Factors Affecting Success In International Collaborative Forestry Research Projects

Anthony Grey BARTLETT

Submitted in fulfilment of the requirements for the degree of

Doctor of Philosophy

of the Australian National University

September 2018

The Fenner School of Environment and Society

The Australian National University, Canberra

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Candidate's Declaration

Statement of originality

This thesis is presented as a collection of linked chapters, with the six substantive chapters having been published in various peer-reviewed, international journals. The research aims to make academic contributions to both evaluation practice and the understanding of factors that influence success in collaborative international forestry research projects.

Of the six journal articles, five are authored by me and one is co-authored with the three members of my academic panel: Assoc. Prof. Lorrae van Kerkhoff, Prof. Peter Kanowski and Dr. Neil Byron. Throughout this research, I instigated, planned and conducted the research, undertook the data analysis and was the primary author of all chapters. My panel provided academic guidance and assistance with editing and revisions, particularly for the most significant aspects of the peer review comments.

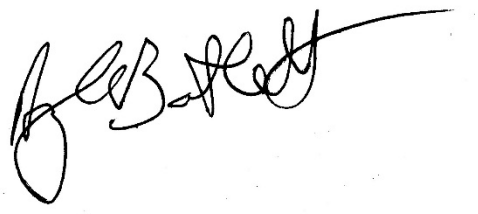
At the time of submission of the final thesis, six articles are now published. The attribution statement for each publication is presented below:

Chapter	Attribution Statement
1	Introduction (unpublished) I wrote this chapter with academic review from my panel.
2	**Bartlett, A.G. (2016) The evolution and impacts of ACIAR's forestry research program over three decades. *Australian Forestry*, 79 (3), 171-188.** I instigated the work, undertook the research and analysis and wrote the article, with review from my panel. © 2016 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.
3	**Bartlett, A.G. (2016) Evaluating relative success of donor-funded collaborative research projects. *Research Evaluation* 25(4): 405-415.** I instigated the work, undertook the research, developed the methodology, undertook the analysis and wrote the article, with academic guidance and review from my panel. © The Author 2016. Published by Oxford University Press.
4	**Bartlett, A. G., Kanowski, P. J., van Kerkhoff, L. and Byron, R. N. (2017) Identifying factors that influence the success of forestry research projects implemented in developing countries: case study results from Vietnam. *Forestry* 90(3): 413-425.** I instigated the work, undertook the research and analysis and drafted the manuscript. The co-authors provided academic guidance on the structure, content and presentation of data and further academic input to revisions following external review. © Institute of Chartered Foresters, 2017.

5	**Bartlett, A. G. (2018) Factors Affecting the Success of Collaborative Forestry Research in Indonesia.** ***The European Journal of Development Research*****. https://doi.org/10.1057/s41287-018-0138-3** I instigated the work, undertook the research and analysis and drafted the manuscript, with academic guidance and review from my panel. Prof. Kanowski provided extensive constructive input to various drafts. © 2018 The Author(s) 0957-8811
6	**Bartlett, A. G. (2018) Factors affecting the success of collaborative forestry research projects in Papua New Guinea.** ***Australian Forestry*** **81(2): 116-128.** I instigated the work, undertook the research and analysis and drafted the manuscript, with academic guidance and review from my panel. © 2018 The Author(s)
7	**Bartlett, A. G. (2018) Understanding and evaluating success in international forestry research projects.** ***International Forest Review*** **20 (3) 274-295** I instigated the work, undertook the research and analysis and drafted the manuscript, with academic guidance and review from my panel.
8	Conclusions (unpublished) I wrote this chapter, with academic review from my panel.

Declaration

I declare that this thesis is my own original work and that it contains no material which has been accepted for the award of any other degree or diploma in any university. To the best of my knowledge, it contains no material previously published or written by another person, except where due reference is made in the text.



Anthony Grey BARTLETT

6 September 2018

Acknowledgements

I am indebted to the three members of my academic panel, Assoc. Prof. Lorrae van Kerkhoff and Prof. Peter Kanowski, from the Australian National University, and Dr. Neil Byron from the University of Canberra, for their ongoing support and guidance over the past six years on both research design and documentation of the findings. I acknowledge their constructive reviews of the many drafts and revisions of journal manuscripts and thesis chapters. I am particularly grateful for their advice when dealing with some rather critical and challenging comments from journal referees, about aspects of the evaluation methodology and its application.

In 2011, Peter Kanowski provided encouragement when I first considered undertaking a PhD and he explained the 'Thesis by Compilation' option, which I found very appealing. He also identified Lorrae van Kerkhoff as an appropriate primary supervisor and Neil Byron as the third member of the panel. Lorrae van Kerkhoff was a wonderful supervisor, she guided me into the literature for qualitative and case study research, regularly reviewed my progress and offered wise counsel when I was faced with various challenges along the way. Peter Kanowski was extremely supportive of my research every step of the way and we would often meet for a discussion. He had endless energy to provide detailed and constructive comments on my written work, and he provided me with additional literature to consider. Neil Byron, who was strongly interested in my research from the start, complemented the other panel members by asking lots of challenging questions. These questions always made me think carefully about how I was approaching an issue, or how others might view, or misinterpret, the way I was expressing a finding.

Undertaking a PhD while working full time is very challenging. This substantial endeavour would not have been possible without the strong support of my employer, the Australian Centre for International Agricultural Research (ACIAR), and in particular the support of ACIAR's previous Chief Executive Officer, Dr. Nick Austin, and the current CEO, Prof. Andrew Campbell. When I first discussed the idea with Dr. Austin, he highlighted the relevance of the topic to ACIAR, as well as his concern about how I would find time to do the necessary study, because of the demands of my ACIAR work. When I commenced the research, he provided me with some assistance to build a database of relevant project records to use in the subsequent research. He then granted me 20 days study leave per year, which was enormously helpful, as it gave me the dedicated blocks of time that I needed to analyse data and write. He allowed me to access and use all the ACIAR project records for the research, and allowed me to conduct the interviews in Vietnam, Indonesia and Papua New Guinea while travelling for work purposes. He encouraged me to present my early findings to the ACIAR Commission (governing body), and also at the 2014 IUFRO World Congress in the USA.

When Prof. Campbell was appointed as ACIAR CEO in 2016, he was equally supportive of my research. He allowed me to continue the study support arrangements agreed to by Dr Austin, and

encouraged me to present the findings to my ACIAR colleagues and at two other national and international conferences. Both of the CEOs offered comments on various chapters in the thesis, which I really appreciated, and attended my review seminars at ANU.

The identification of the project success factors would not have been possible without the generosity and support of the 90 international and Australian forestry scientists who participated in the interview process. The duration of these interviews ranged from 30 minutes to over three hours, and I was continually amazed at, and grateful for, their willingness to provide detailed comments on the research projects used in the case study. Their insights helped me enormously, not only to answer the research question related to success factors, but also to appreciate the subtleties of what makes some projects very successful and other less so.

Throughout my research, I got good feedback and support from many of my colleagues at ACIAR and from some ACIAR project leaders and other international forestry researchers. They were particularly encouraging about the value of the research, the utility of the methodology for evaluating relative success of projects, and for the identification of the success factors. This helped me appreciate that my research would be relevant to other practitioners in the research for development domain. I also appreciated the encouragement to do this postgraduate study that I got from some long-term forestry friends, particularly Dr. Don Gilmour and Mr Gary Morgan, as well as that of some very good friends from my leadership network.

Liz Clarke, then a fellow PhD scholar at the Fenner School of Environment and Society, suggested that I should consider using HyperRESEARCH software to assist with the management and analysis of my interview data. This was helpful advice, as the software was easy to use and quite applicable to the analysis that I needed to do. I am also very grateful for the support that I received from Clive Hilliker, from the Fenner School of Environment and Society, to improve the presentation of some of the figures and tables that were used in the journal articles. I also thank Suzie Gaynor, from ACIAR, who helped me with the task of compiling the thesis from many individual documents.

Finally, I am very grateful for the strong support that I got from my family, Anni, Michael and Roxane, and Ian, over the past six years. Billi, our budgie, would often land on my shoulder, while I sat at the dining table writing, and cheerfully tell me “I’ve got a PhD”. Most importantly, I acknowledge the enormous support that I got from my wife, Anni Bartlett. I thank her for her tolerance and patience during the long hours that I was otherwise engaged on my postgraduate study, and therefore not focussed on domestic matters. She also helped me sort out various challenges that I experienced in using Excel and with preparing graphs and diagrams for use in the thesis. Sadly, neither of my parents, Bruce and Marjorie, nor my sister, Kyra, lived to see this achievement, but I know that all three of them would be very proud of me.

Preface

When I graduated from the University of Melbourne in early 1979, undertaking a PhD was the last thing on my mind and I had virtually no understanding of forestry beyond Australia. In August 1983, while attending the 10th Triennial Conference of the Institute of Foresters of Australia in Melbourne, I was inspired by the keynote address from Jack Westoby. He spoke of the challenges for people and forestry in developing countries, the role that foresters needed to play in addressing these challenges and the need for foresters to take greater account of community views about how forests should be managed. Then in 1984, I was fortunate to be awarded a Russell Grimwade Fellowship, which enabled me to go to Oxford to undertake a Master of Science in Forestry and its Relationship to Land Management. It was during my period of study at the Oxford Forestry Institute, that I began to appreciate the importance of forests globally, the variety of uses of forests in different countries and the significant challenges to be faced. When I returned to Victoria in late 1985, I knew that I wanted to find an opportunity to do some forestry work in developing countries.

In 1989, David Griffin, then the Professor of Forestry at the Australian National University and the Project Director for the Nepal-Australia Forestry Project (NAFP), selected me for a role on the project in Nepal and presented me with a copy of his book "Innocents Abroad in the Forests of Nepal". That was the opportunity I had been looking for, and my entrée to the domain of development forestry. I consider myself very fortunate to have had the opportunity to live in Nepal and contribute to such a globally significant forestry aid project. For two years, as part of the NAFP project team - much of it under the mentorship of Dr. Don Gilmour, I learned about and contributed to the development of community forestry approaches in the Middle Hills of Nepal. I learned a lot from the Australians working on the project, Don Gilmour and Michael Nurse, as well as from the visiting anthropologist, Dr. Bob Fisher. Importantly, I learned how to learn from the locals - the wonderful Nepali project staff, the government forestry officers and rangers, and particularly from the many villagers with whom we collaborated. There was no doubt that those two years were a 'life changing' experience for me and my family.

In 1985 another opportunity came up to work in development forestry, this time in the Pacific Island nation of Vanuatu. For two years I was employed by the Government of Vanuatu as the Principal Forest Utilisation Officer, an in-line position in the Department of Forestry. I worked closely with the ni-Vanuatu Director of Forests, Mr. Aru Mathias, and two other Australian foresters, Mr. David Wood and Mr Ross Andrewartha, who were working on the AusAID funded Vanuatu Sustainable Forest Management Project. Collectively we set about building the local capacity to better manage Vanuatu's tropical forests, all of which were under customary land ownership. This was another wonderful learning opportunity for me, and it particularly focussed my mind on the challenges of implementing

sustainable forestry, in a way that would bring lasting livelihood benefits to rural communities, in a country that had limited technical capacity and poor infrastructure.

From 1997 to 2008, while working in various forestry roles for the Victorian, ACT and Commonwealth governments, I had the privilege of participating in the various United Nations forest policy dialogue processes, including the development of the 2007 UN Non-Legally Binding Instrument on all types of forests. Through these processes, I learned a lot about effective inter-governmental negotiations and the power that comes from collaborative efforts to improve the management of forests and trees in developing countries.

In 2010, I was recruited to the position of Forestry Research Program Manager with the Australian Centre for International Agricultural Research (ACIAR), being only the fourth person in that role since ACIAR commenced in 1982. After I had been at ACIAR for about a year, I asked some of my colleagues whether ACIAR had any guidance documents on how best to ensure that new projects had a good chance of being successful. I was surprised with the response that "you learn this as you go along". Given there were substantial records from about 30 years of completed ACIAR projects, it seemed like a golden opportunity for someone to explore this issue more systematically, to develop a better understanding of what makes some projects more successful than others, and how this might vary across the countries that ACIAR worked in. This then was the genesis of my interest in conducting postgraduate study on the topic "Factors affecting success in international collaborative forestry research projects". Hopefully, the knowledge that I have gained and documented through this postgraduate research will leave a legacy that will benefit both those involved in funding and managing research for development projects, and those people in developing countries for which the findings of such research is intended to benefit.

Abstract

Collaborative research projects are an important component of research for development programs globally, but there is little consensus regarding what constitutes project 'success', and little understanding of factors that contribute to or constrain success. This thesis explores the principle research question: *What constitutes success, and what factors influence it, in forestry research for development projects?* In doing so, it presents a new approach for evaluating the relative success of projects, and applies it to case studies of forestry research for development projects implemented by the Australian Centre for International Agricultural Research (ACIAR) in Vietnam, Indonesia and Papua New Guinea (PNG).

While ACIAR evaluates individual projects regularly, it has no methodology to compare levels of success across large numbers of projects. The first part of the thesis reviews ACIAR's forestry program and evaluation methodologies, and presents a new methodology for evaluating the relative success of research projects using existing project records. It places projects into four categories of success based on scores for achievements and impacts, which aids understanding of differential success between projects.

In the second part of the thesis, this methodology is applied to country-based case studies in Vietnam, Indonesia and PNG. Ten completed ACIAR forestry projects were evaluated in each country to identify relative success. There was considerable variation in the relative success of the projects, in terms of both achievements and impacts. Interviews with Australian and partner country project participants were then used to investigate the factors that affected project success. The number of project success factors identified varied, with 22, 30, and 37 factors identified in Vietnam, Indonesia and PNG respectively. In each country the frequency of identification of these factors and their apparent relationships with the relative success evaluation scores of selected projects was investigated.

The third part of the thesis synthesised results from the three country case studies, and considered how this knowledge could be used by ACIAR and other international development agencies. Overall, ACIAR's forestry programs in Vietnam and Indonesia have been more successful than its program in PNG. Project success had little relation to research theme, and successor projects were not necessarily more successful than their precursors. Of the 37 success factors identified, seven were considered to be beyond the control of a project, and a further 15 factors would only apply in some situations. The remaining 15 factors, which relate to aspects of project design and implementation, and for which there appear to be relationships with the evaluated level of project success, are therefore considered to be 'key success factors'.

This research has made two key contributions to understanding how to improve research for development projects. The first is a low-cost method for evaluating relative success between projects. The second is the identification of 15 widely applicable success factors that are subject to decisions made by research program managers and project teams. These insights will help inform research for development funders and managers about factors influencing, and strategies for enhancing, project success.

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1. Introduction

This chapter introduces the rationale and focus of this research, including outlining its aims and the chosen research questions. While providing a brief review of some of the relevant literature, it does not include a comprehensive literature review, as that is undertaken in Chapter 2, for the ACIAR forestry literature, and in Chapter 3, for the international development evaluation literature. It briefly describes the focus of the research within the broader domain of understanding what contributes to success in projects, as well as summarising the overarching approach and the methods used to conduct the research. Finally, it presents the connecting logic and the structure of the thesis.

1. Introduction

1.1. Research need, opportunity and focus

Following the development of the United Nations Charter in 1945, the global community began to implement measures, including Official Development Assistance (ODA) programs, to support development in underdeveloped countries (Koehler, 2015). There has long been a recognised need for effective research in the agriculture, fisheries and forestry sectors (Zethner, 1973; Westoby, 1987), and for adequate resourcing of such research (Sachs, 1999), to address agricultural and environmental development-related challenges in developing countries (Ryan, 1987; Tribe, 1994). Over the past six decades, much of this research has been funded under ODA programs and it forms part of what has become known as research for development (R4D) (senso lato Høgh-Jensen *et al.*, 2010).

The context for R4D projects has some differences to that of other development projects. The two major differences are that R4D projects are conducting research, rather than development, activities which involve many unknowns; and they typically focus on developing 'proof of concept' innovations and systems rather than their wide-scale adoption. The nature of the research varies considerably, but can include fundamental research - for which the outcome is unknown; applied research - where existing knowledge is applied and adapted; and systems or social research - including understandings that facilitate or constrain adoption of research innovations. In addition, very often a single R4D project will not be sufficient to resolve the underlying research question, and consequently successive related projects will form a longer-term program (see Figure 1.1). Because of these differences, the nature, extent and timing of impacts from R4D projects will generally be quite different to those from development projects.

International agricultural and forestry research programs facilitate the generation of knowledge and technologies to address national and global development goals related to increasing food security, reducing poverty and ensuring sustainable management of natural resources (CGIAR, 2005). Such international research programs have been shown to increase crop yields and lower food prices (Evenson and Gollin, 2003), and to generate impressive economic benefits collectively but not always individually (Raitzer, 2003; Lindner *et al.*, 2013; Maredia and Raitzer, 2012). The poor performance and mixed success of many individual ODA and R4D projects has also long been a concern (Yalegama *et al.*, 2016; Ika *et al.*, 2012; CGIAR Standing Panel on Impact Assessment, 2006; Raitzer and Lindner, 2005).

Evaluation of ODA-funded programs, including R4D projects, provides information on development policy and implementation to facilitate learning, increase accountability and ultimately to enhance the effectiveness of development cooperation (Liverani and Lundgren, 2007). The literature on various approaches used to evaluate ODA programs and projects is reviewed in detail in Chapter 3. Despite

the extensive literature on approaches to and findings from evaluation studies of ODA programs and projects, it is difficult to compare the results from large numbers of projects, and there are very significant gaps in our understanding of what approaches work or don't work, and where and why this is the case. Very few studies have attempted to identify conceptual sets of (critical) success factors in international development (Diallo and Thuillier, 2004; Yalegama *et al.*, 2016), and even fewer have attempted to explore the relationships between success factors and project success (Ika *et al.*, 2012). Furthermore, the ability to improve project success is constrained by an inadequate understanding of why development projects will achieve success in one setting yet not in others (Ika and Donnelly, 2017).

There are few studies that report project-level factors contributing to the success of ODA-funded projects, particularly those that relate to agriculture, fisheries or forestry research. There is a wealth of literature related to organisational management and behaviour, leadership, and effective teamwork: see (Schein, 2004; Koontz *et al.*, 1984; Yang *et al.*, 2011) as examples. Likewise, there is considerable literature on factors affecting effective research collaboration (Ulnicane, 2015), as well as on inter- and trans-disciplinary research (Buizer *et al.*, 2015; Woolley *et al.*, 2015) and team science Bozeman and Youtie (2017). However, much of this literature focusses on the developed world, and generally does not explore the specific research operating environments of ODA-funded agricultural or forestry research projects. There are some exceptions, which are reviewed in Chapter 4: in 2010, the Australian Centre for International Agricultural Research (ACIAR) surveyed 30 of its project leaders, research program managers and country managers, to investigate factors supporting success in its agricultural, fisheries and forestry research projects, to identify 14 factors that contributed to successful project outcomes (Pearce, 2010). Earlier, Miles (1998) identified four factors that contributed to success of ODA-funded construction projects in seven countries.

Given the length of time that collaborative agricultural and forestry R4D projects have now been supported by ODA funding and the apparent variability in success, there is an important need to improve the understanding of which factors affect R4D project success in different contexts. While most ODA and international organisations conduct evaluations of their projects, much of this important material exists as grey literature, for example (Global Environment Facility, 2018), and the methodologies used are often organisation-specific, making it difficult to systematically compare the results from different evaluations. This research therefore seeks to enhance the understanding both of how the success of forestry research projects differs in different developing country contexts, and what factors contribute towards greater or lesser success in such projects. Given the apparent knowledge gaps about these factors, this research will focus primarily on identifying factors that might be influenced by those responsible for designing and implementing collaborative agricultural and forestry research projects that are implemented in developing countries.

Australia has more than 35 years of experience in supporting international agricultural and forestry research through the Australian Centre for International Agricultural Research (ACIAR). ACIAR commissions collaborative R4D projects, involving Australian and international scientists working together with scientists and other stakeholders from partner countries, to address a priority research need identified by the partner country. ACIAR's work not only supports research collaboration but emphasizes human capital building and private sector-led development, targeted at improved livelihoods in the agriculture, forestry and fisheries sectors. It is also a learning organisation, with a strong commitment to distil, learn and share the lessons from its research portfolio (ACIAR, 2017). ACIAR's activities are organised into disciplinary research programs, of which forestry is one.

In 2012, when this research commenced, ACIAR's forestry program had been implementing forestry projects for about 30 years, and had completed about 100 projects. In recent years, the program has involved 20 to 25 active projects, representing an annual investment of about $10 million. ACIAR monitors the performance of its research investments by conducting adoption and impact assessment studies (ACIAR, 2017). Its impact assessment studies demonstrate substantial economic benefits arising from some of the completed forestry projects, but limited impact from other projects (Lindner, 2011; Fisher, 2011). The commitment from governments of developed and developing countries to increase aid effectiveness (OECD, 2005), together with ACIAR's lesson-learning culture and its commissioning of new projects annually, provide a justification for more research on ways to improve the effectiveness of these projects.

Throughout the period of this research, which was undertaken on a part-time basis, I was also managing ACIAR's forestry program and had access to ACIAR's internal records of the completed projects. The extent, variability and ongoing level of investment in the ACIAR forestry program, together with the availability of extensive data on completed projects, provided a good basis for conducting detailed research to improve understanding of what factors had affected their variable success. After discussions with ACIAR's chief executive and several scientists who were involved in ACIAR forestry projects, I identified an opportunity to undertake postgraduate research on this topic. I was particularly interested to understand what could be learned from the completed projects that could help those responsible for designing and implementing projects to improve their success.

1.2. Research aims and questions

This postgraduate research had three aims, all related to improving the understanding of success of R4D programs and projects. They were:

1. improving the understanding of what factors contribute to success in collaborative research projects that are implemented in developing countries;
2. developing an evaluation method to enable the relative success of large numbers of R4D projects to be systematically evaluated in a cost-effective manner; and

3. distilling the resulting lessons in a manner that would help those who are either responsible for funding and managing research programs, or for implementing projects under these programs, to collectively achieve better results from these investments.

When I commenced the research, I had only identified the first and third of these aims. I added the second aim, when it became apparent that, to achieve the other two aims, I needed to address a gap in evaluation methods which constrained evaluations of the relative success of large numbers of R4D projects in a cost-effective manner. For organisations like ACIAR that fund a lot of R4D projects, addressing different research priorities and implemented in different locations, systematic comparisons of the achievements and impacts of large numbers of the projects are rarely, if ever, undertaken. Research program managers and project scientists, who have been involved in multiple projects, often have subjective impressions about the differential success of projects, but these comparisons are limited to the projects that they know well and they cannot be quantified in any way. This limits the ability of research mangers to systematically identify lessons related to project success, or to compare the effectiveness of different research project investments over time. Having a simple, cost-effective, but consistent methodology for evaluating the relative success of multiple projects would help overcome these limitations.

The research therefore seeks to make academic contributions to both evaluation methodologies R4D projects and the understanding of factors that influence project success; as well as practical contributions that could assist development agencies, such as ACIAR and its R4D counterparts worldwide, to improve the design and implementation of their research project investments.

The thesis explores the principal research question: What constitutes success, and what factors influence it, in forestry research for development projects? This is addressed through application of case study research involving ACIAR's forestry program. The research activities examined eight research sub-questions, grouped into four themes of research:

Research context

1. What is ACIAR's approach to development research and how has its forestry program evolved over three decades?
2. What constitutes "success" in ACIAR's forestry research projects?

Independent evaluation of relative success

3. How can the relative success of multiple research projects be systematically evaluated in a cost effective manner?
4. How does relative success of forestry research projects vary within and between countries?

Consultative identification of project success factors

5. What are the factors that affect the relative success of ACIAR's forestry research projects and which factors are considered to be most important?

6. Are there causal relationships between the identified success factors and the evaluated relative success of individual projects?

Synthesizing the lessons

7. What are the common and the country-specific lessons about project success and what role does context play in understanding project success?
8. How could the improved understanding of project success be utilised by research for development programs?

1.3. Research approach

> *I may not have gone where I intended to go, but I think I ended up where I intended to be.*
>
> Douglas Adams – The Long Dark Tea-Time of the Soul (1988)

The approach I took, which evolved as the research progressed, was through conducting empirically-based, practically oriented research, drawing on elements of approaches used in action research, formative research and case study research, and applying them to development evaluation. This mixed methods design used both quantitative and qualitative methods. A significant proportion of the research was done in a qualitative manner, by engaging 90 scientists who had worked on ACIAR forestry projects.

From the beginning of this research, I was inspired by the writings of Michael Quinn Patton, an American specialist in the art and science of utilisation-focused evaluation (Patton, 1996) and developmental evaluation (Patton, 1994), particularly his evaluation books (Patton, 2011; Patton, 2014; Patton, 2012a). Patton's insightful writings were very useful for a forestry practitioner like myself who was entering the evaluation domain in the latter part of my career. These writings improved my understanding of the differences between summative and formative approaches to evaluation and helped me realise that there was some 'middle ground' that developmental evaluation occupies. Developmental evaluation, in which evaluators are involved in program development, centres on situational sensitivity, responsiveness, and adaptation, and is an approach to evaluation especially appropriate for situations of high complexity and uncertainty where what may and does emerge is relatively unpredictable and uncontrollable (Patton, 2011). With this new knowledge, I was able to find the space where I wanted to operate when evaluating projects for this research.

An important element of the research approach was to try to ensure that the methods and findings are practical and relevant to those responsible for designing and implementing research for development projects. While I was familiar with the way that ACIAR operated I also researched evaluation and learning approaches used by other similar organisations, especially those of Canada's International

Development Research Centre. This introduced me to the concept of evaluative thinking (Carden and Earl, 2007) and the importance of thinking about how a project contributes to the system or society as a whole (Carden, 2013). Throughout the research, I made regular efforts to discuss the research with my ACIAR colleagues and to share the preliminary findings widely, as they emerged, including through presentations at national and international conferences. This facilitated very helpful two-way exchanges on how the research could be approached, what the findings meant, and how they might be applied practically in R4D organisations. Early on, I decided to progressively publish the research findings in order to make early contributions to the somewhat limited body of literature, and to achieve appropriate peer review of the methods and findings.

The research commenced with a review of literature, focussing on exploring the literature on evaluation of ODA-funded programs and projects and of project management in general, including methodologies, identification of project success factors and studies that contributed to improved understanding of project success. A summary of the various evaluation methodologies and some issues relevant to their application in this research is included in Chapter 3. This review provided me with a good understanding of the domain of evaluation, particularly its application within international development. While the evaluation literature is very extensive, only a small proportion of it relates to R4D projects or to forestry development projects. Significantly, no published journal articles were found that explained what ACIAR does or its approach to designing and implementing its projects, and only one published report (Pearce, 2010) was found that identified factors contributing to success in R4D projects.

At the end of the literature review, the three key knowledge gaps relevant to the principal research question were identified:

1. No existing cost-effective evaluation methodology for comparing the success of large numbers of projects;
2. Very limited literature on factors that influence success in R4D projects; and
3. Limited understanding of how and why success of development projects varies between countries.

In parallel to the literature review, I undertook a review of ACIAR's internal records from the forestry program to understand the nature of the projects that had been implemented over the previous 30 years. A journal manuscript was prepared from this review, which is presented here as Chapter 2. During this process, I also gained insights into what existing information existed in the ACIAR records that might be useful for the planned research.

While developing the research proposal, I established that the research methods needed to do the following:

- Establish what is meant by success in research for development projects and how success can be evaluated;
- Identify which projects could be considered to be more successful or less successful;
- Understand the view of scientists who had worked on ACIAR projects on what factors they considered had enhanced or diminished project success; and
- Establish whether there is any evidence of causal relationships between the identified success factors and the evaluated level of relative success of a project.

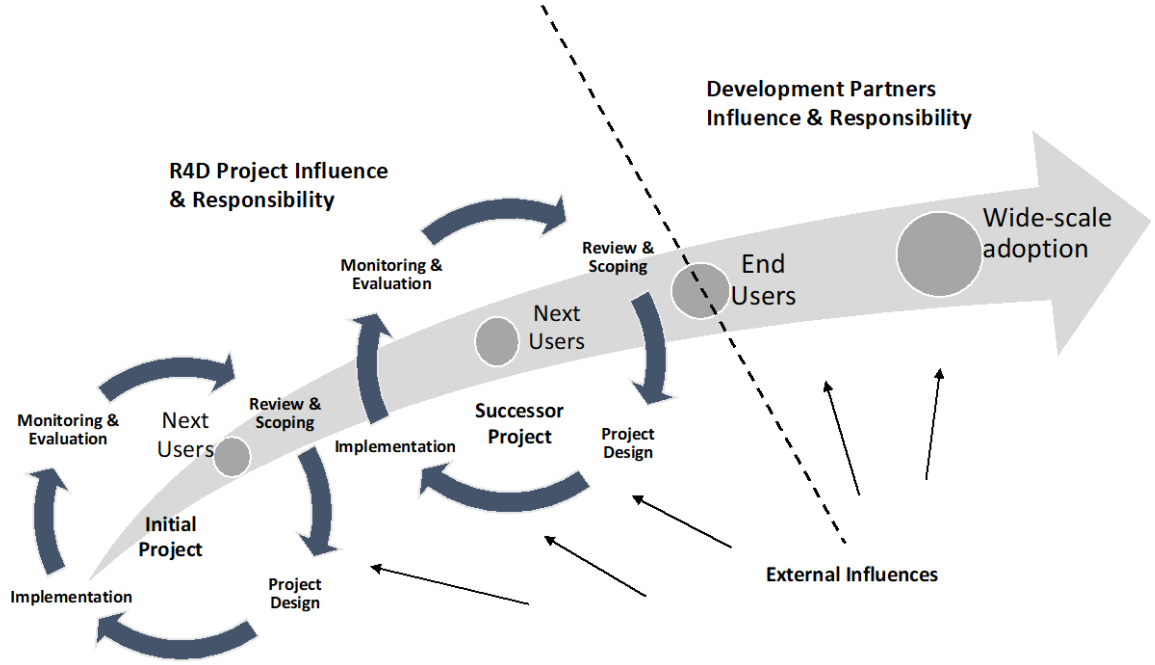

Figure 1.1: Influence and responsibilities in the R4D project impact pathway

During the literature review, I found that defining what is meant by success in R4D projects was quite challenging. Within the general project management literature, there is no consensus on a definition of project success or a means of assessing it (Ika, 2009) and as a result it is often contested and controversial (McLeod *et al.*, 2012). Within the domain of R4D programs, there is very limited literature and no consensus on how research quality and impact should be considered in defining success. Likewise, there is considerable variation in the literature on how both outcomes and impacts of development interventions are defined (Belcher and Palenberg, 2018). Furthermore, the nature and extent of impacts generated by individual R4D projects partly depend on the nature of the project and also on where it is situated within the research to development continuum (see Figure 1.1). This is further complicated by the long and complex causal chains that link research activities and outputs to development results for the intended beneficiaries (Mayne and Stern, 2013) and the challenges of attributing observed impacts to the research intervention alone (Alston and Pardey, 2001).

For simplicity and clarity, I adopted the approach already established by ACIAR in its impact assessment studies. In this research, the concept of success of a forestry research project follows the logic articulated by Pearce (2010), with two primary dimensions: the extent to which planned research outputs are achieved and adopted ("achievements"); and the extent of the impacts resulting from wider adoption, typically outside of the project and beyond its life ("impacts"). As success can mean different things to different people and wanting to test the validity of the ACIAR approach, I asked all the researchers that I interviewed during this research to describe what success, in an ACIAR forestry project, meant to them. While the central purpose of the research was to identify 'success factors' – the factors that contribute to enhanced or diminished success in R4D projects – I did not specify a priori how I defined 'success factors' when conducting interviews. My aim was to explore the breadth of opinion amongst the researchers about what they thought constituted 'success', and what factors they thought affected project success. This approach enabled me to reflect the variety of ideas when I distilled the inputs into lists of project 'success factors'. However, it also means that, amongst the large number of identified 'success factors', there may be considerable variation in the significance of each for a project's success.

The development evaluation domain is plagued by terminological inconsistency, with definitions of key concepts, such as outputs, outcomes and impacts, constantly changing as thinking and practice evolve (Mayne and Stern, 2013; Befani and Mayne, 2014). While the Organization for Economic Co-operation and Development (OECD) has a glossary of relevant evaluation terms (OECD, 2002) these have not been used in the ACIAR literature, which draws principally on the definitions presented in two ACIAR Impact Assessment Series reports (Davis *et al.*, 2008; Mayne and Stern, 2013). Pearce (Pearce, 2010) uses these three terms, without further discussion of them, when describing what constitutes success in an ACIAR project. In this research, recognising that the evaluation component relied primarily on existing grey and published literature from ACIAR forestry projects over some 20 years, the approach I took was to use the terminology used in this literature rather than attempting to retrofit the findings to consistent definitions. The definitions of the terms output, outcome and impact, as used in the ACIAR Impact Assessment Series reports are shown in Table 1.1.

Source	Output	Outcome	Impact
Davis et al. 2008	results of the R&D that can be adopted or are inputs into further R&D; these may be intended or unintended and can be a by-product of the process of undertaking R&D	changes in practices, products or policy that result from adoption of the outputs by initial, next and final users—final outcomes are the changes experienced by the final users as a result of their adoption of the output	changes in markets (prices, input and output costs, quantities) and in the state of common resources (ecosystem health and biodiversity) and communities (livelihood opportunities, health, security, equity)
Mayne and Stern 2013	the first-level results from an intervention, the information, goods or services delivered by the intervention that research partners are provided with or expected to respond to. Outputs are under the sphere of control of the intervention.	the effects and changes that occur outside the intervention, often labelled as immediate and intermediate; the effects and the consequences of the actions taken by the research partners due to responding to the outputs, frequently focused on behaviour changes manifest as changes in practice, institutions, policy and capacity. Outcomes are largely expected to be in the sphere of influence of the intervention.	the positive and negative, primary and secondary, intended and unintended, long-term effects on beneficiaries that result from a development intervention, and are in the sphere of interest of the intervention.

Table 1.1. Definitions of key evaluation terms used in ACIAR reports

The final aspect of the research approach involved determining the appropriate evaluation methodology to use in the research. In order to understand what factors have enhanced or diminished project success, it is necessary to have a method that enables the assessor to objectively determine which projects had good success and which ones had poor success. For this type of research, such a methodology needed to be equally applicable to projects that concluded recently or that concluded many years ago. The methodology needed to be cheap to implement, if large numbers of projects were to be evaluated, and practical for me to implement alone, as a postgraduate research-scale task. At the beginning of this research, I had intended to either utilise an existing evaluation methodology, or to adapt one to suit the needs of this research. Unfortunately, despite extensive searches of the literature, no existing methodology suitable for this research could be found. Therefore, I had to develop a new methodology for use in evaluations of the relative success of multiple research projects.

1.4. Research methods

Development of a methodology for the independent evaluation of relative success

The new methodology for evaluating relative success is described in Chapter 3. In developing the methodology, I gained some inspiration from a recently published score-card methodology used to evaluate international public health projects (Guinea *et al.*, 2015). I also drew on my experience as the ACIAR forestry program manager, including knowledge of data available in the ACIAR project records that could inform evaluations of relative success. The methodology incorporates consideration of two dimensions that reflect 'success' in the terms described previously: achievement of the intended research activities, and evidence of the apparent impacts. It utilises eight criteria, four for each of the two dimensions, and involves the evaluator(s) assessing project records to assign scores for each criterion. Further information on the rationale for these eight criteria and the scoring system are presented in Table 1 of Chapter 3.

I tested the new methodology on ten completed ACIAR forestry research projects from Vietnam, finding that it was practical to apply and able to identify differential success of projects. A manuscript on this component of the research, presented here as Chapter 3, was published in the journal "Research Evaluation", following substantial revision to address the extensive and critical reviewer comments. The editor noted that it addressed an important gap in existing evaluation methods.

Case study research

Case study methods (Yin, 2009) are particularly appropriate for social research, including evaluations of complex initiatives such as international development projects (Yin and Davis, 2007), and have the ability to address the complexity and contextual conditions of different projects (Stufflebeam and Shinkfield, 2007). From the review of the ACIAR forestry program, I identified that the greatest number of completed projects were in Indonesia, Vietnam and Papua New Guinea, so I selected them as the case study countries. In each case study, ten completed projects, representing about half of the forestry projects that ACIAR had completed in each country between 1987 and 2016 were studied.

In conducting the three case studies, I used a mix of qualitative and quantitative methods, involving three phases: identification of success factors; evaluation of relative success of projects; and exploration of relationships between the identified success factors and the evaluated relative success of projects. Chapter 4, which was accepted for publication in the international journal "Forestry", describes the methods used and presents the logic and flow of tasks within the three phases as Figure 1.1. The research protocol covering the case studies was approved by the Australian National University Human Ethics Committee (Protocol No. 2014/051).

Consultative identification of project success factors:

To identify the project success factors, I conducted interviews with Australian, partner country and international scientists who had participated in projects from each case study. The interviews were undertaken sequentially by case study, with interviews conducted in the three countries and in Australia between 2014 and 2017. For the Vietnam study, 24 researchers were interviewed, and for each of the Indonesia and PNG studies, 33 researchers were interviewed. When researchers had participated in multiple projects, there were asked the same interview questions for each of these projects. Chapter 4 includes the standard questions used in each interview as supplementary information. The full set of interview protocols are provided in Appendix 1.

In each case study, I conducted thematic analyses of the interview data, using HyperRESEARCH1 qualitative data analysis software, and prepared two lists of the factors: factors that enhanced success; and factors that diminished success. During the first case study, I found that most often the researchers identified that the one factors could either enhance or diminish project success depending on how it had been addressed. Therefore, I identified the complementary expressions of the same factor from the two lists, and prepared concisely-worded statements that best represented researchers' perspectives on what these success factors were. I also recorded data on the frequency with which each success factor had been identified. In each case study I analysed the frequency data to determine the most important success factors, which I considered to be the most frequently identified factors whose combined identification frequencies represented 75% of the data.

Independent evaluations of relative success:

I conducted evaluations of relative success of the projects in each case study using the new evaluation methodology (as presented in Chapter 3), drawing in information from internal ACIAR project records. The evaluation questions and evidence guidance that I used when conducing these evaluations are detailed in Table 2 of Chapter 3. When conducting these evaluations, a degree of data source triangulation occurred through reviewing a range of reports and other records, which collectively presented information and the perspectives of research program managers, project participants, and those of external reviewers of projects.

During the conduct of the first case study, I thought about how best to portray the results of the two evaluation scores to provide a useful way to compare project success. Given the variable nature of the individual research projects, both in research theme and their position in the research for development continuum, I considered it inappropriate to aggregate the scores for research achievements and research impacts. Hence, I developed a classification approach with four potential categories of project success which are represented diagrammatically in Figure 1.2.

[1] Researchware, Inc. – [http://www.researchware.com/ accessed 13/06/2014]

Figure 1.2. The four categories of relative success in R4D projects.

Patton (2012b) highlights the importance of maintaining the focus of utilisation-focused evaluation on the intended users, including all those who will use the outcomes to improve program delivery. For this reason, I considered it important to explore whether I could establish causal relationships between identified success factors and the evaluated success of individual projects. While the ability to identify causal explanations in qualitative research is perhaps more challenging than in quantitative research, Maxwell (2004) presented a comprehensive justification for its use.

In each case study, I selected a sub-set of the projects, drawn from different success categories, for a more detailed analysis to investigate whether or not evidence existed of causal relationships between the identified success factors and the evaluated level of relative success for a project. The methods used to analyse data from the interview records and the relevant ACIAR project records are detailed in Chapter 4. The results were displayed in a table to show, for each project, which success factors demonstrated an apparent causal relationship with the evaluated relative success of the project.

1.5. Structure of the thesis

The thesis is presented as a series of six journal articles, 'book-ended' by an introduction and conclusions and organised into three parts. The details of chapters and publication status of the six journal articles are shown in Table 1.2.

Chapter	
1	**Introduction** (unpublished)
	Part 1: Understanding the research context and evaluation methods
2	**The evolution and impacts of ACIAR's forestry research program over three decades.** This article was submitted to the journal *Australian Forestry* in July 2015 and accepted for publication in April 2016. The full citation is: Bartlett, A.G. (2016) The evolution and impacts of ACIAR's forestry research program over three decades. *Australian Forestry*, 79 (3), 171-188.
3	**Evaluating relative success of donor-funded collaborative research projects.** This article was submitted to the journal *Research Evaluation* in October 2015 and accepted for publication in March 2016. The full citation is: Bartlett, A.G. (2016) Evaluating relative success of donor-funded collaborative research projects. *Research Evaluation* **25**(4): 405-415.
	Part 2: The case studies
4	**Identifying factors that influence the success of forestry research projects implemented in developing countries: case study results from Vietnam.** This article was submitted to the journal *Forestry* in May 2016 and accepted for publication in January 2017. The full citation is: Bartlett, A. G., Kanowski, P. J., van Kerkhoff, L. and Byron, R. N. (2017) Identifying factors that influence the success of forestry research projects implemented in developing countries: case study results from Vietnam. *Forestry* **90**(3): 413-425.
5	**Factors affecting the success of collaborative forestry research in Indonesia.** The manuscript was submitted to the journal *The European Journal of Development Research* in July 2017, revised following peer review and accepted for publication on 2/2/2018. The full citation is Bartlett, A. G. (2018a) Factors Affecting the Success of Collaborative Forestry Research in Indonesia. *The European Journal of Development Research*. https://doi.org/10.1057/s41287-018-0138-3 .
6	**Factors affecting the success of collaborative forestry research projects in Papua New Guinea.** The manuscript was submitted to the journal *Australian Forestry* in September 2017, revised following peer review and accepted for publication on 16/2/2018. The full citation is Bartlett, A. G. (2018b) Factors affecting the success of collaborative forestry research projects in Papua New Guinea. *Australian Forestry* 81(2): 116-128.
	Part 3: Presenting and using new knowledge
7	**Understanding and evaluating success in international forestry research projects: experience from ACIAR projects in Vietnam, Indonesia and Papua New Guinea.** The manuscript was submitted to the journal *International Forest Review* in January 2018 and was substantially revised following peer review. It was accepted for publication in July 2018 and the final thesis has been updated to include the published article. The full citation is Bartlett, A. G. (2018c) Understanding and evaluating success in international forestry research projects: experience from ACIAR projects in Vietnam, Indonesia and Papua New Guinea. *International Forestry Review* **20** (3) 274-295
8	**Conclusions** (unpublished)

Table 1.2. Structure of thesis chapters and journal publication status

The thesis logic is presented in Figure 1.3, showing how each of the eight research sub-questions are linked to the chapters of the thesis. In accord with the empirical and formative research approaches used in this research, the knowledge needed to answer many of the research questions is developed in

an iterative manner throughout the whole research period. Only some of the sub-questions have a direct one-on-one relationship with a chapter, most sub-questions are relevant to multiple chapters; for example, the three case study chapters each address the same four sub-questions.

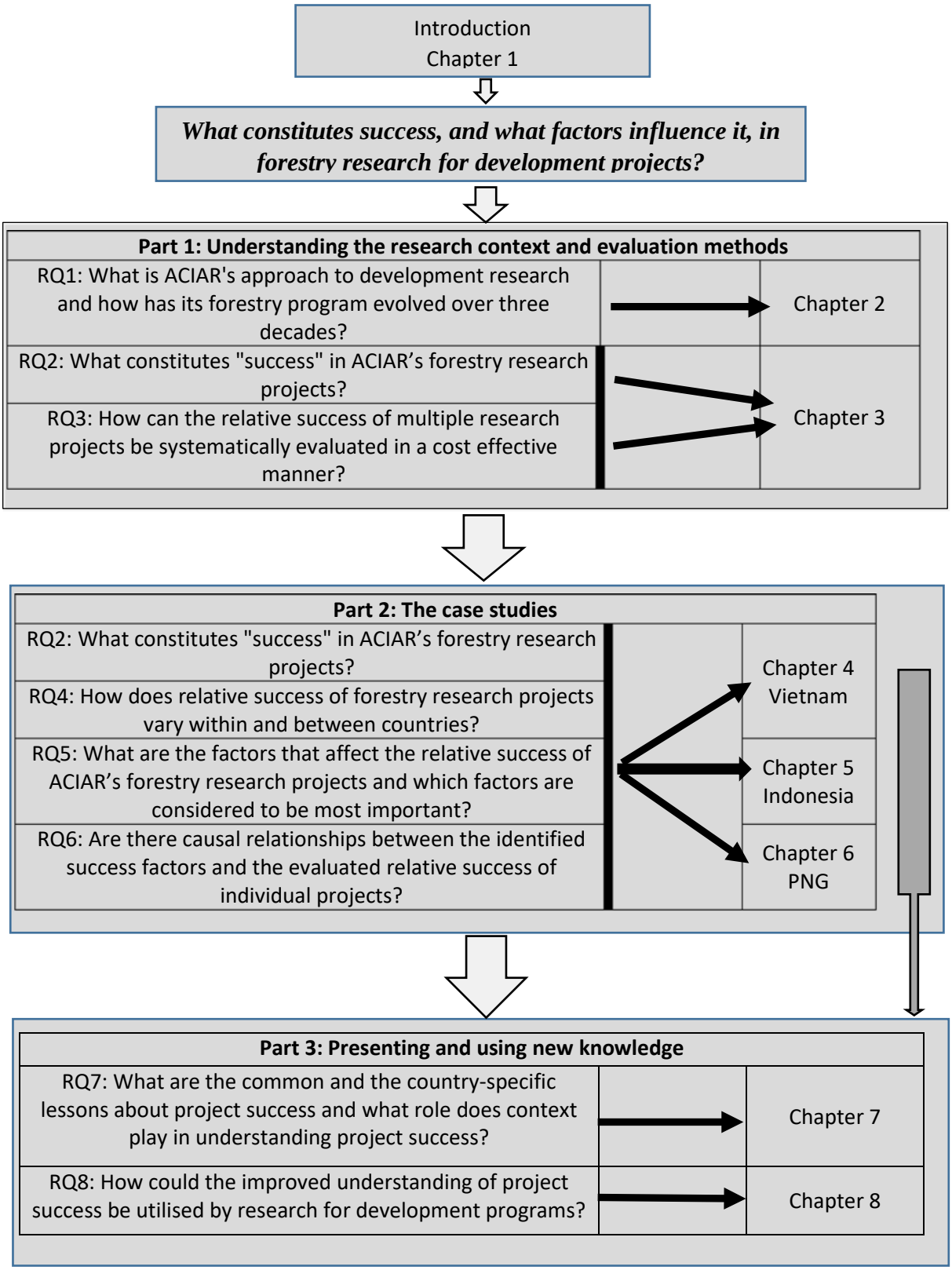

Figure 1.3. Thesis logic diagram

An outline of the content presented in each part of the thesis is presented below:

Part 1: Understanding the research context and evaluation methods

Part 1 of the thesis contains two chapters, designed to present the background about ACIAR's forestry program and the evaluation approaches used in international development programs. Chapter 2 "The evolution and impacts of ACIAR's forestry research program over three decades" examines what ACIAR does and the approach it uses to facilitate research for development projects, and then presents a review of the ACIAR forestry program over three decades. The information contained in this chapter provides the logic for the selection of the three countries for the case studies. Chapter 3 "Evaluating relative success of donor-funded collaborative research projects" explores the definition of success in ACIAR projects, reviews approaches used to evaluate ODA programs and projects, and presents a new evaluation methodology is useful for identifying the relative success of research projects. This evaluation methodology is then used in each of the three case studies.

Part 2: The case studies

Part 2 of the thesis contains three chapters, each presenting the findings from individual case studies based on 10 completed ACIAR forestry projects implemented in one country. Chapter 4 "Identifying factors that influence the success of forestry research projects implemented in developing countries: case study results from Vietnam" presents a detailed explanation of the methods that were used in each of the case studies and then documents the findings of the relative success evaluations and the qualitative participative research on identifying project success factors. In this study 22 success factors were identified.

Chapter 5 "Factors affecting the relative success of collaborative forestry research projects in Indonesia" presents the findings from the Indonesian case study on the relative success evaluations and the qualitative participative research on identifying project success factors. In this study 30 success factors were identified. It also makes some comparisons with the findings from the Vietnam case study, as presented in Chapter 4. In Chapter 6 "Factors affecting the success of collaborative forestry research in Papua New Guinea" the findings from the PNG case study are presented in a manner similar to that used in Chapters 4 and 5. This study identified 37 success factors and found that, in comparison with the studies from Vietnam and Indonesia, ACIAR's PNG forestry projects are less successful, in terms of their achievements and their impacts.

Part 3: Presenting and using new knowledge

Part 3 of the thesis contains two chapters which focus on distilling the new knowledge arising from this research and offering perspectives on how it might be used to improve the effectiveness of future R4D projects. Chapter 7 "Understanding and evaluating success in international forestry research projects" synthesizes the results from the three case studies. It explains the differences found in

relative success of projects, between and within countries, and identifies 15 success factors as being generally applicable to all research for development projects. The interplay between relative success, the success factors and context at the national, local and project levels is also explained. The academic contributions include: demonstration that the new evaluation methodology provides an efficient means of comparing success of projects within and between countries; presentation of evidence that programs of forestry research projects in PNG have been less than those in Vietnam or Indonesia; and broadening the existing knowledge of factors that affect project success and demonstrating apparent causal relationships between a project's success and many of the identified success factors.

Chapter 8 "Conclusions" is unpublished and presents a short synopsis of this body of work and its academic significance. It also presents some personal reflections from this research, identifies further research needs, including further application and refinement of the evaluation methodology. Finally, it discusses how the improved understanding of project success could be utilised by those responsible for research for development programs and projects to improve project success.

1.6. References (for Chapter 1 only)

ACIAR, 2017. *ACIAR Corporate Plan 2017-21*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/files/aciar_corporate_report_2017_final_web.pdf

Alston, J. M. and Pardey, P. G., 2001. Attribution and other problems in assessing the returns to agricultural R&D, *Agricultural Economics,* **25**(2-3): 141-152. Available at: 10.1111/j.1574-0862.2001.tb00195.x

Befani, B. and Mayne, J., 2014. Process Tracing and Contribution Analysis: A Combined Approach to Generative Causal Inference for Impact Evaluation, *IDS Bulletin,* **45**(6): 17-36. Available at: 10.1111/1759-5436.12110

Belcher, B. and Palenberg, M., 2018. Outcomes and Impacts of Development Interventions: Toward Conceptual Clarity, *American Journal of Evaluation*: 1098214018765698. Available at: 10.1177/1098214018765698 (accessed 2018/08/30).

Bozeman, B. and Youtie, J., 2017. *The Strength in Numbers: The New Science of Team Science*, Princetown University Press, Princetown, New Jersey.

Buizer, M., Ruthrof, K., Moore, S. A., Veneklaas, E. J., Hardy, G. and Baudains, C., 2015. A Critical Evaluation of Interventions to Progress Transdisciplinary Research, *Society & Natural Resources,* **28**(6): 670-681. Available at: 10.1080/08941920.2014.945058

Carden, F., 2013. Evaluation, Not Development Evaluation, *American Journal of Evaluation,* **34**(4): 576-579. Available at: 10.1177/1098214013495706

Carden, F. and Earl, S., 2007. Infusing evaluative thinking as process use: The case of the International Development Research Centre (IDRC), *New Directions for Evaluation,* **2007**(116): 61-73. Available at: 10.1002/ev.243

CGIAR, 2005. *Science for agricultural development: Changing contexts, new opportunities*, CGIAR Science Council Secretariat, Rome, Italy. Available at: https://cgspace.cgiar.org/bitstream/handle/10947/3893/agm05_stake_science_agdev_execsum.pdf?sequence=1&isAllowed=y

CGIAR Standing Panel on Impact Assessment, 2006. *Natural resources management research impacts: evidence from the CGIAR.* , Consultative Group on International Agricultural Research, Rome. Available at: https://cgspace.cgiar.org/handle/10947/4200

Davis, J., Gordon, J., Pearce, D. and Templeton, D., 2008. *Guidelines for assessing the impacts of ACIAR's research activities* Australian Centre for International Agricultural Research, Canberra, Australia. Available at: http://aciar.gov.au/files/node/10103/ias58_pdf_20268.pdf

Diallo, A. and Thuillier, D., 2004. The success dimensions of international development projects: the perceptions of African project coordinators, *International Journal of Project Management,* **22**(1): 19-31. Available at: https://doi.org/10.1016/S0263-7863(03)00008-5

Evenson, R. E. and Gollin, D., 2003. Assessing the impact of the green revolution, 1960 to 2000 *Science,* **300**(5620): 758-762. Available at: Retrieved from https://search-proquest-com.virtual.anu.edu.au/docview/213596303?accountid=8330

Fisher, H., 2011. *Forestry in Papua New Guinea: a review of ACIAR's program*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/publication/ias073

Global Environment Facility, 2018. *Annual Performance Report 2017*, Global Environment Facility, Washington DC, USA. Available at: https://www.thegef.org/council-meeting-documents/annual-performance-report-2017

Guinea, J., Sela, E., Gómez-Núñez, A. J., Mangwende, T., Ambali, A., Ngum, N., Jaramillo, H., Gallego, J. M., Patiño, A., Latorre, C., Srivanichakorn, S. and Thepthien, B., 2015. Impact oriented monitoring: A new methodology for monitoring and evaluation of international public health research projects, *Research Evaluation,* **24**(2): 131-145. Available at: 10.1093/reseval/rvu034

Høgh-Jensen, H., Oelofse, M. and Egelyng, H., 2010. New Challenges in Underprivileged Regions Call for People-Centered Research for Development, *Society & Natural Resources,* **23**(9): 908-915. Available at: 10.1080/08941921003671502 (accessed 2015/05/25).

Ika, L. A., 2009. Project success as a topic in project management journals, *Project Management Journal,* **40**(4): 6-19. Available at: 10.1002/pmj.20137

Ika, L. A., Diallo, A. and Thuillier, D., 2012. Critical success factors for World Bank projects: An empirical investigation, *International Journal of Project Management,* **30**(1): 105-116. Available at: https://doi.org/10.1016/j.ijproman.2011.03.005

Ika, L. A. and Donnelly, J., 2017. Success conditions for international development capacity building projects, *International Journal of Project Management,* **35**(1): 44-63. Available at: https://doi.org/10.1016/j.ijproman.2016.10.005

Koehler, G., 2015. Seven Decades of 'Development', and Now What?, *Journal of International Development,* **27**(6): 733-751. Available at: 10.1002/jid.3108

Koontz, H., O'Donnell, C. and Weihrich, H., 1984. *Management: Eighth Edition*, McGraw-Hill Book Company, Tokyo, Japan.

Lindner, R., 2011. *The economic impact in Indonesia and Australia of investment in plantation forestry research, 1987–2009*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/publication/ias071

Lindner, R., McLeod, P. and Mullen, J., 2013. *Returns to ACIAR's investment in bilateral agricultural research*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/publication/IAS086

Liverani, A. and Lundgren, H. E., 2007. Evaluation Systems in Development Aid Agencies: An Analysis of DAC Peer Reviews 1996—2004, *Evaluation,* **13**(2): 241-256. Available at: 10.1177/1356389007075226

Maredia, M. K. and Raitzer, D. A., 2012. Review and analysis of documented patterns of agricultural research impacts in Southeast Asia, *Agricultural Systems,* **106**(1): 46-58. Available at: http://dx.doi.org/10.1016/j.agsy.2011.10.011

Maxwell, J. A., 2004. Using Qualitative Methods for Causal Explanation, *Field Methods,* **16**(3): 243-264. Available at: 10.1177/1525822x04266831

Mayne, J. and Stern, E., 2013. *Impact evaluation of natural resource management research programs: a broader view*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/files/ias84.pdf

McLeod, L., Doolin, B. and MacDonell, S. G., 2012. A Perspective-Based Understanding of Project Success, *Project Management Journal,* **43**(5): 68-86. Available at: 10.1002/pmj.21290

Miles, D. W. J., 1998. Evaluating International Development Projects: Lessons from the Construction Sector, *Evaluation,* **4**(4): 469-482. Available at: 10.1177/13563899822208734

OECD, 2002. *Glossary of Key Terms in Evaluation and Results Based Management*, OECD, Paris. Available at: http://www.oecd.org/development/peer-reviews/2754804.pdf

OECD, 2005. *Paris Declaration on Aid Effectiveness*, Organisation for Economic Cooperation and Development, Paris. Available at: http://www.oecd.org/dac/aideffectiveness/43911948.pdf (accessed 16/09/2012).

Patton, M. Q., 1994. Developmental Evaluation, *Evaluation Practice,* **15**(3): 311-319. Available at: 10.1177/109821409401500312

Patton, M. Q., 1996. A World Larger than Formative and Summative, *Evaluation Practice,* **17**(2): 131-144. Available at: 10.1177/109821409601700205

Patton, M. Q., 2011. *Developmental Evaluation: applying complexity concepts to enhance innovation and use*, The Guildford Press, New York, USA.

Patton, M. Q., 2012a. *Essentials of utilisation-focussed evaluation (4th ed.)*, Sage Publications Thousand Oaks, USA.

Patton, M. Q., 2012b. A utilization-focused approach to contribution analysis, *Evaluation,* **18**(3): 364-377. Available at: 10.1177/1356389012449523

Patton, M. Q., 2014. *Qualatative Research and Evaluation Methods 4th ed*, Sage Publications, Los Angeles.

Pearce, D., 2010. *Lessons learned from past ACIAR impact assessments, adoption studies and experience*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/files/node/13202/lessons_learned_from_past_aciar_impact_assessments_87432.pdf (accessed 16/09/2012).

Raitzer, D. A., 2003. *Benefit-cost meta-analysis of investment in Intenational Agricultural Research Centres of the CGIAR*, Food and Agricultural Organisation of the United Nations, Rome. Available at: https://ispc.cgiar.org/benefit-cost-meta-analysis-investment-international-agricultural-research-centres-cgiar

Raitzer, D. A. and Lindner, R., 2005. *Review of the returns to ACIAR's bilateral R & D investments*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/publication/ias035

Ryan, J. G. e., 1987. *Building on success: agricultural research, technology, and policy for development*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/publication/tr007

Sachs, J., 1999. Sachs on development: Helping the world's poorest *The Economist* **352**: 17-20. Available at: Retrieved from https://search-proquest-com.virtual.anu.edu.au/docview/224067222?accountid=8330

Schein, E. H., 2004. *Oganisational Culture and Leadership*, John Wiley & Sons, San Francisco, California.

Stufflebeam, D. L. and Shinkfield, A. J., 2007. *Evaluation Theory, Models, and Applications.*, Jossey-Bass, San Francisco, CA.

Tribe, D. E., 1994. *Feeding and Greening the World: the role of international agricultural research*, CAB International, Wallingford, UK.

Ulnicane, I., 2015. Why do international research collaborations last? Virtuous circle of feedback loops, continuity and renewal, *Science and Public Policy,* **42**(4): 433-447. Available at: 10.1093/scipol/scu060

Westoby, J. C., 1987. *The Purpose of Forests*, Basil Blackwell Ltd, Oxford, UK.

Woolley, R., Sánchez-Barrioluengo, M., Turpin, T. and Marceau, J., 2015. Research collaboration in the social sciences: What factors are associated with disciplinary and interdisciplinary collaboration?, *Science and Public Policy,* **42**(4): 567-582. Available at: 10.1093/scipol/scu074

Yalegama, S., Chileshe, N. and Ma, T., 2016. Critical success factors for community-driven development projects: A Sri Lankan community perspective, *International Journal of Project Management,* **34**(4): 643-659. Available at: https://doi.org/10.1016/j.ijproman.2016.02.006

Yang, L.-R., Huang, C.-F. and Wu, K.-S., 2011. The association among project manager's leadership style, teamwork and project success, *International Journal of Project Management,* **29**(3): 258-267. Available at: https://doi.org/10.1016/j.ijproman.2010.03.006

Yin, R. K., 2009. *Case Study Research: Design and Methods 4th ed*, Sage Publications, Los Angeles.

Yin, R. K. and Davis, D., 2007. Adding new dimensions to case study evaluations: The case of evaluating comprehensive reforms, *New Directions for Evaluation,* **2007**(113): 75-93. Available at: 10.1002/ev.216

Zethner, O., 1973. Assistance to agricultural scientists in the third world: a neglected field, *World Development,* **1**(12): 53-55. Available at: http://dx.doi.org/10.1016/0305-750X(73)90112-5

PART 1: UNDERSTANDING THE RESEARCH CONTEXT AND EVALUATION METHODS

Chapter 2. The evolution and impacts of ACIAR's forestry program over three decades.

This chapter reports the results of the review that I undertook of the ACIAR forestry program in order to understand the overall context for my research and to assist with the identification of suitable case study countries and projects. It also explains what ACIAR is and how it operates, as this have not previously been reported in the literature. I was particularly interested to learn how the program had changed over the years, in which countries the projects had been implemented and what was known about variation in impacts from these projects.

This article was published in the journal *Australian Forestry* in April 2016. The full citation is: Bartlett, A.G. (2016) The evolution and impacts of ACIAR's forestry research program over three decades. *Australian Forestry*, 79 (3), 171-188.

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The evolution and impacts of ACIAR's forestry research program over three decades

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ABSTRACT

The Australian Centre for International Agricultural Research (ACIAR) commissions collaborative agriculture, fisheries and forestry research projects in developing countries. Over a 30-year period, ACIAR has invested over AUD 100 million to fund 150 forestry projects and activities in 29 countries, with most of these projects implemented in Indonesia, Vietnam and Papua New Guinea. This article describes the approach that ACIAR uses to develop and implement projects, and reviews the nature of the ACIAR Forestry Program and its achievements during each decade of its existence. About three-quarters of the research projects have focused on aspects of smallholder and community forestry systems. The findings from a series of independent impact assessment studies, which demonstrate generally high returns on the forestry research investment, are reviewed and some examples of different categories of impacts from the research projects are discussed.

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Introduction

Agricultural and forestry research have an important role in addressing international development goals related to enhancing food security, reducing poverty and achieving sustainable management of natural resources. Since the 1960s, science for agricultural development has delivered real benefits to farmers, processors and consumers, but many significant challenges remain in developing countries (CGIAR 2005). Australia has more than 30 years of experience in supporting international agricultural and forestry research through the Australian Centre for International Agricultural Research (ACIAR). This presents an important opportunity to examine how ACIAR's forestry research program has contributed to international research for development and how it has changed over the years. This study is not a comprehensive history of all of ACIAR's forestry research activities and achievements nor of its important non-research activities, such as facilitating the establishment of the Center for International Forestry Research (CIFOR).

Until the late 1970s, international rural development programs were focused primarily on increasing agricultural production. Forestry was of interest only if it were thought possible to promote wood production for export or the establishment of domestic industries, or where forests were necessary for water supply or to control erosion (FAO 1981). Assistance to agricultural research scientists in developing countries, including those working on forestry, was neglected (Zethner 1973) compared with other areas of development funding.

In 1975 a group of Australian scientists, businessmen and government officers met to consider whether Australia's aid to developing countries in science and technology would be more effective if it were managed through an independent body. Subsequently the distinguished public servant and vice-chancellor, Sir John Crawford, chaired a committee that assessed the significance of research assistance to development and identified administrative options for Australia's response to this need (ADAB 1981). It concluded that research assistance was one of the most effective ways of helping developing countries achieve economic and social progress and that Australia could do more to assist, especially in South-East Asia and the Pacific. It recommended that the Australian Government should establish an independent agency funded from its aid budget for this purpose.

In late 1977, the Minister for Foreign Affairs established the Consultative Committee on Research for Development to provide advice to the Australian Development Assistance Bureau (ADAB). This committee recognised the role that Australia's network of successful agricultural research organisations and scientific expertise could play in international agriculture. In early 1981, the following deficiencies in Australia's arrangements to assist international agricultural research were identified (ADAB 1981):

- lack of an effective mechanism for systematically identifying agricultural problems of developing countries and the areas of research that warrant Australia's support
- lack of a mechanism for marshalling the collective expertise of Australian research organisations to assist in solving the identified problems
- lack of suitable arrangements to provide training for developing country researchers in practical, problem solving approaches to agricultural research.

After consideration of this advice, the Australian Government decided to establish a statutory authority to commission international agricultural research.

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The Australian Centre for International Agricultural Research

In 1982, the Australian Government passed legislation (Commonwealth of Australia 1982) to establish the Australian Centre for International Agricultural Research. ACIAR's mission is to achieve more productive and sustainable agricultural systems for the benefit of both developing countries and Australia through international agricultural research partnerships (ACIAR 2014a). As part of Australia's Official Development Assistance (ODA), ACIAR uses Australia's agricultural innovation system to enhance food security, reduce poverty and contribute to the long-term economic prosperity of developing countries (ACIAR 2014a). In this context, agricultural research includes fisheries and forestry, as well as agricultural disciplines. In accordance with its legislation (Commonwealth of Australia 1982) the functions of ACIAR are to:

- formulate programs and policies with respect to agricultural research for identifying agricultural problems of developing countries and finding solutions to those problems
- commission agricultural research by persons or institutions in accordance with such programs and policies
- communicate to persons and institutions the results of such agricultural research
- establish and fund training schemes related to the research programs
- conduct and fund development activities related to the research programs
- fund international agricultural research centres.

In 1991–92, the Australian Parliament's Joint Committee on Foreign Affairs, Defence and Trade reviewed the effectiveness of ACIAR as an element of Australia's ODA and the desirability of it continuing beyond 1994. The Joint Committee made 21 recommendations including that: ACIAR continue as a statutory authority; that it be responsible for providing Australian funding to the Consultative Group for International Agricultural Research (CGIAR); that projects not be limited to 3 years; and that it be able to undertake pilot programs to extend project results (Parliament of Australia 1992).

Like many other ODA agencies and the CGIAR centres, ACIAR supports Research for Development (R4D) (*sensu lato* Høgh-Jensen *et al*. 2010) that incorporates, where relevant, an understanding of farming systems to ensure that technologies developed meet the needs of farmers (Chambers and Ghildyal 1985). ACIAR projects seek to generate knowledge, technologies and capacity to achieve better decision-making and change agricultural practices and policies that, in turn, generate positive scientific, economic, social or environmental impacts (ACIAR 2014a). In ACIAR terminology, projects generate outputs which, if adopted, lead to outcomes and impacts. Outputs are defined as the products of the research, including technologies, knowledge, enhanced capacity and policy options, that can be adopted or used as inputs for further research; outcomes are changes in practice, products or policies consequent on the adoption of outputs; and impacts are changes in markets, the state of common resources and to individuals or communities that can be attributed to the adoption of the research outputs by the end users of the research (Davis *et al*. 2008).

ACIAR now has over 30 years of experience in implementing agricultural research projects in a wide range of countries and contexts, predominantly from the Asia–Pacific region, but also to a lesser extent in Africa and the Middle East (ACIAR 2014a). In 2014–15, ACIAR received a budget of AUD 123 million, of which AUD 84.4 million was allocated for bilateral and multilateral research projects in 40 countries and AUD 18.9 million was provided as Australia's contribution towards implementation of the 16 CGIAR Research Programs (ACIAR 2014b).

Some defining features, which distinguish ACIAR from many other agricultural and rural development organisations, are:

- its mandate specifically relates to agricultural research rather than to broader areas of international development research
- it commissions research projects as collaborative partnerships between Australian or international scientists and scientists in the partner country and seeks contributions, of time, resources and money, from partners to the project
- projects are formulated to address research priorities identified by the partner country
- projects are designed by research teams with input from the relevant ACIAR Research Program Manager and from three stages of internal and external review
- projects focus predominantly at the research end of the Research for Development continuum, on the expectation that research innovations will be promulgated through national and donor-funded extension and development programs
- many projects have components with the potential to deliver benefits to Australia
- capacity building of research partners is supported in parallel with research activities.

In relation to its capacity-building activities, ACIAR funds postgraduate study and research management training in Australia as well as specific capacity-building activities in each research project. The John Allwright Fellowship scheme, which had 110 active fellowships in 2014–15, supports postgraduate study in Australia for partner country scientists associated with ACIAR projects (ACIAR 2014b). The John Dillon Fellowship program funds short-term research management training (ACIAR 2014a).

ACIAR's approach towards international agricultural research

ACIAR's approach is to identify priorities for research with partner country stakeholders, as the basis for commissioning collaborative research projects (ACIAR 2008). At least 70% of its research activities are implemented through bilateral projects, of three-to-five years duration, commissioned between Australian research institutions and the appropriate national government ministry. The balance are undertaken through multilateral activities of the CGIAR International Agricultural Research Centres (ACIAR 2014a). These research projects can be implemented either in one country or with multiple partner countries and some projects have research activities implemented in Australia. ACIAR also commissions small

research activities, each worth less than AUD 150 000. These are generally conducted over shorter time frames than the research projects and are either activities to support the design of new projects, for example scoping of research relevant to teak value chains in Laos (Midgley *et al*. 2012), or stand-alone research studies, for example research on the sustainability of plantation forestry in South-East Asia (Harwood and Nambiar 2014).

The strategic components of ACIAR's approach[1] include:

- focusing on regions and countries in accordance with Australia's overall priorities for ODA
- employing research program managers with a strong technical knowledge and experienced in research management and international development
- conducting periodic consultations with partner countries to identify priorities for future research and identifying those in which Australia has a comparative advantage
- commissioning Australian and international research organisations to implement projects of three-to-five years duration with research partners in developing countries
- conducting technical, social and policy research, but limiting extension activities to those related to proof of concept or understanding of adoption processes
- building capacity of partner country scientists and institutions through joint research activities and postgraduate training in Australia
- communicating the results of ACIAR's research to partners, the scientific community and interested domestic and international stakeholders
- conducting adoption studies and impact assessments of projects and programs several years after completion to establish achievements, lessons learned and the impacts.

ACIAR manages its research activities through discipline-specific research programs, each of which is managed by a research program manager (ACIAR 2014b). The research program managers foster existing relationships, and develop new relationships between research providers, partner government institutions and development agencies. Their expertise is used to identify research priorities and appropriate research partners, develop and manage research projects, and to assess all new research proposals through an internal ('in-house') review process (ACIAR 2008).

While the number and nature of research programs has changed over the years, there has been a Forestry Program since 1982. Analysis of ACIAR's records indicates that the Forestry Program has had relatively stable management over the past 30 years with four forestry scientists[2] occupying the role of the research program manager.

The operational components of ACIAR's approach[3] include:

- employing methods to achieve high quality project design, including scoping studies, internal peer review of preliminary proposals and external review of full proposals
- identifying clear research questions and objectives linked to research activities, articulating the impact pathways and conducting an ex-ante impact assessment
- requiring financial and in-kind contributions from Australian and developing country partner organisations and supporting regular in-country collaborative research rather than full-time technical assistance
- allowing flexibility in project implementation, with project leaders managing within the broad design, and supporting activity variations to improve outcomes
- minimising reporting requirements to annual and final reports
- maintaining professional dialogue between the research program manager and project leaders and conducting mid-term and external end-of-project reviews to facilitate learning and provide accountability.

Once a concept for a new research project is agreed to by ACIAR, the project is designed by partner scientists with input from the research program manager under a two-phase process. This includes consideration of the preliminary proposal business case through the in-house review process, followed by external review and further internal review during the development of the full project proposal.[4] In each project proposal, the objectives, activities and methodology are described together with the expected impacts from the research. ACIAR manages its projects with a 'light touch' relative to many development agencies, monitoring progress through annual reports, occasional visits and mid-term reviews. It also encourages documentation and sharing of lessons to improve future program and project delivery.

ACIAR's approach to conducting international agricultural research, as outlined above, has remained relatively constant throughout its 30-year history. This approach has been the subject of external reviews on four occasions, including in 1992 (Parliament of Australia 1992) and 2013 (Farmer *et al*. 2013). Each external review has noted the effectiveness of ACIAR's approach and recommended that it should continue.

ACIAR has a long history of identifying the impacts of the research it funds, via adoption studies and impact assessments (Davis *et al*. 2008; ACIAR 2014b) and in particular to quantify the economic returns from its bilateral research (Lindner *et al*. 2013). In the lead up to the 1992 Joint Committee review of ACIAR, economic assessments were undertaken on 20 completed projects covering 12 research areas (Davis and Lubulwa 1995). By 2012, ACIAR had published a total of 65 impact assessments, which covered a little less than 10% of ACIAR's investments in bilateral research projects, and was allocating about 0.6% of its budget to impact assessment (Lindner *et al*. 2013).

Adoption studies are undertaken by the project leader on a sample of past projects usually 3 years after completion (Davis *et al*. 2008). These studies identify the level of uptake of project outputs and the extent of the legacy (Pearce *et al*. 2013), through documentation of outcomes at the scientific and community levels in the partner countries and in Australia. The results of these studies are published annually as ACIAR Adoption Series reports and provide a greater understanding of the adoption pathways.

Impact assessments are carried out by independent external consultants once the project results have been taken up by the end users and the results are published as ACIAR

Impact Assessment Series reports (ACIAR 2014b). They provide quantitative estimates of the economic returns from the research investment as well as some qualitative assessments of the project's social and environmental impacts. They provide accountability to stakeholders, a measure of the returns from ACIAR's investments and valuable lessons in the selection, design and delivery of projects (Davis *et al*. 2008). 'Almost all of ACIAR's impact assessments have been ex-post economic cost-benefit evaluations', using a consistent methodology that documents the research undertaken and its costs, the realised and expected take-up of outputs, and quantifies realised and expected benefits (Lindner *et al*. 2013).

Early focus of the ACIAR Forestry Program (1984–1994)

Following the 8th World Forestry Congress in 1978, there was a more widespread recognition of rural communities' dependence on forest goods and services (FAO 1978) and of the potential for forestry to complement agriculture, especially in regards to small farmers (FAO 1981). In the early 1980s, the largest use of forests in most developing countries was for gathering fuelwood (FAO 1981), many people suffered from acute fuelwood scarcity and many forest resources were being overcut (Westoby 1989). Far too little research was being undertaken on the role of trees in agricultural settings (FAO 1978) and it was recognised that forestry interventions should be based on examination of the local context, involvement of local people and the development of new knowledge and skills (FAO 1985). By the late 1980s, scientists were arguing for consideration of sustainability of agricultural systems, both at the local and landscape levels, including impacts on common resources such as forests (Lynam and Herdt 1989).

Australian scientists recognised that there were likely to be many Australian trees and shrubs suitable for community plantings in developing countries to deliver multi-purpose benefits in rural agricultural areas (Boland and Turnbull 1989). Since 1962, the Australian Tree Seed Centre of the Commonwealth Scientific and Industrial Research Organisation (CSIRO) had provided seed from Australian trees to many countries around the world, but some of this seed had not been used effectively due to a lack of expertise in implementing species testing trials in the recipient countries (Boland and Turnbull 1989).

In the early years, the ACIAR Forestry Program had four components (Shepherd 1985):

(1) collecting representative seed samples of potentially useful Australian trees
(2) evaluating the growth of these species in developing countries
(3) researching the propagation and management of these tree species
(4) facilitating adoption of these trees in developing countries.

In selecting partner countries, ACIAR took account of the prevailing foreign aid policy and applied the following criteria (Boland and Turnbull 1989):

- the research must be a high national priority
- the collaborating institution must be of sufficient standard and have the capacity to provide and effective partnership
- the local environment(s) should be sufficiently representative of the region to enable considerable spillover of results to neighbouring countries.

Following 18 months of establishing networks, identifying priorities and then designing projects, ACIAR's first two forestry projects (FST/1983/057 and FST/1983/031) began in late 1984. Both projects were commissioned through CSIRO and involved the growing of Australian trees for fuelwood and nitrogen fixation, with activities in Thailand, Zimbabwe and Kenya. In 1985 ACIAR initiated two forestry projects (FST/1984/058 and FST/1984/057) in China, involving research on wattle tannins and establishing species and provenance trials for promising species of eucalypts, acacias and casuarinas. Subsequently, other forestry projects were developed in China, Thailand, Indonesia, Malaysia, Pakistan and Philippines, and by 1988 the Forestry Program had an annual budget of AUD 1.3 million (Boland and Turnbull 1989). ACIAR's records show that the first forestry project in the Pacific commenced in 1992 and that it focused on nutrition and mycorrhizal requirements of tropical trees in Papua New Guinea, Solomon Islands and Vanuatu.

The first decade of the ACIAR Forestry Program was a period in which some successful long-term collaborative relationships between Australian forestry scientists and partners in South-East Asia, Southern and Eastern Africa and the Pacific were established. Analysis of the ACIAR records shows that during this decade a nominal investment of AUD 21.26 million was made in the Forestry Program. ACIAR worked in close collaboration with CSIRO's Australian Tree Seed Centre, which provided the Australian tree seed to partner countries.

In line with the prevailing global forestry development policies, the research aimed at providing communities with options to address fuelwood and timber shortages under a range of climatic and soil conditions. The projects commissioned focused predominantly on domestication, improvement and silviculture of Australian trees, with a few projects focused on domestication of other trees, agroforestry systems and preservation treatment. The projects did not promote Australian species to the exclusion of local native species, but sought to provide a wide range of multi-purpose species to meet local requirements, including agroforestry, fuelwood production and potential commercial purposes (Boland and Turnbull 1989). Some projects included broader environmental objectives, such as the use of farm trees to assist with rehabilitation of salt-affected sites (Khanzada *et al*. 1998). The research on lesser-known Australian tropical trees produced scientific information on the growing of multi-purpose trees (Boland 1989) and the environmental requirements, cultivation, potential uses and pests and diseases for 166 Australian trees suitable for plantings in the tropics (Doran and Turnbull 1997). It also helped to identify the commercial potential of species such as *Acacia crassicarpa* (Turnbull *et al*. 1988b) and *Eucalyptus pellita* (Hardiyanto 2003) as well at the value of dry-zone acacias such as *A. colei* and *A. difficilis* (Harwood *et al*. 1988).

The research on establishment and management of sandalwood and fuelwood species in northern Australia and Eastern Indonesia (under projects FST/1986/013 and FST/

1990/043), contrasted with the rest of the program, because it included research on non-Australian trees and also led to dramatically different economic impacts in Australia and Indonesia. These projects developed new knowledge on the biology and establishment of *Santalam album* (Harisetijono and Suriamihardja 1991) and the propagation and performance of a range of multi-purpose tree species in Nusa Tenggara Timur. However, 15 years after the completion of the projects, no evidence could be found of the utilisation of any of this knowledge in Indonesia and all the project-funded species and provenance trials were either not maintained or destroyed by fire and weeds (Lindner 2011). In Australia, the research laid the basis for the development of the Ord River sandalwood industry (Henderson and Braidotti 2013), which is predicted to provide benefits with a present value of AUD 766 million to Australia from a combined research investment of AUD 7.5 million (Lindner 2011).

The second decade of the ACIAR Forestry Program (1994–2004)

Around the 1992 United Nations Conference on Environment and Development (UNCED), there was an increase in global policy dialogue about the contribution of forests to global and national development and conservation objectives (Humphreys 2001). Although there was disagreement between developed and developing countries on the substance of an international forest regime, they agreed on the concept of sustainable forest management (Humphreys 1999) and that scientific research should be strengthened through international cooperation (United Nations 1992). During this period, community forestry gained more focus in international forestry development (Gilmour *et al*. 1990; Bartlett 1992) and it was considered that international forestry research required an inter-disciplinary approach involving social, economic and ecological disciplines (FAO-IUFRO-CIFOR 1997).

Analysis of the records shows that during this decade ACIAR made a nominal investment of AUD 27.0 million in the Forestry Program. The program continued research on the development of eucalypts and acacias for plantation forestry in the Asia–Pacific region, but broadened to include research on the utilisation of these species as well as management of their pests and diseases. Research topics on domestication of indigenous trees, impacts of forest and land management practices, and sustainable forest management were introduced.

In 1997 the key priorities for the Forestry Program[5] included:

- development of Australian tree genetic resources to meet community needs for reforestation and agroforestry
- sustainable management practices for tropical plantations of Australian species, particularly soil and water relations, pests and diseases, silviculture and harvesting and processing
- research on forest policy development.

The second decade of the Forestry Program saw an increased number and a considerable broadening of the focus of the research projects commissioned. The inclusion of research on sustainable forest management (SFM) and policy instruments, such as SFM criteria and indicators, partially reflected the broadened focus of global forestry policy and research dialogue. The program continued to focus substantially on technical research associated with the growing, protection and utilisation of trees by smallholders and private companies. There was no research undertaken on community forestry, nor did the nature of the projects designed change to include more inter-disciplinary teams especially with social science skills.

Nevertheless, the focus of the program during the second decade resulted in some very substantial outcomes and impacts from a range of projects. The ongoing collaboration with the Forest Science Institute of Vietnam (under projects FST/1993/118 and FST/1998/096) enabled widespread dissemination of improved *Acacia* and *Eucalyptus* germplasm (Turnbull *et al*. 1988a) resulting in an estimated AUD 129 million of benefits to tree growers and wood fibre product consumers (Fisher and Gordon 2007a). Other substantive outputs included improved understanding of how to better manage soil, water and nutrients to improve the sustainability of tropical plantations (Nambiar and Brown 1997) and on identifying and minimising the impacts of diseases of *Acacia* (Old *et al*. 2000) *and Eucalyptus* (Old *et al*. 2003) in South-East Asia.

According to the impact assessment studies, some projects from this decade have not generated any apparent outcomes or impacts. Research and capacity building on the application of molecular marker technologies for genetic improvement of tropical *Acacia* trees in Indonesia (under project FST/2000/122) generated no apparent impacts (Lindner 2011). Likewise, there were no apparent outcomes or impacts from research and capacity building (under project FST/1998/118) on planning methods for sustainable management of timber from PNG's native forests (Fisher 2011). Whether these findings are true or an artefact of the difficulty of quantifying impacts from capacity building and some scientific and policy research is less clear, because the Indonesian molecular laboratory supported by the ACIAR project is still in operation in 2015.[6]

The third decade of the ACIAR Forestry Program (2004–2014)

During this period, the Non-Legally Binding Instrument on All Types of Forests (United Nations 2007) was negotiated through the United Nations Forum on Forests. It recognises the need to promote the development and application of scientific and technological innovations and to strengthen the contribution of science and research in advancing sustainable forest management. In 2005, the concept of 'Reducing Emissions from Deforestation and Forest Degradation' (REDD+) emerged under the United Nations Framework Convention on Climate Change negotiation forums (Pistorius 2012), generating new forestry research needs.

In the mid-2000s, global deforestation was continuing at a rate of 13 million hectares per annum, although this was partially offset by reforestation and landscape restoration of 5.7 million hectares per annum (FAO 2005b). The contribution of non-wood forest products to the economic benefits derived from forests was recognised, with the global trade in these products increasing 150% over the previous decade. In order to capture the full economic benefits from wood

production it was considered necessary to create efficient markets, combat illegal logging and to add value to wood products (FAO 2005a). To meet the multifaceted global expectations on the supply of services and products from planted and natural forests, enhanced multi-disciplinary research was needed, but there was a general lack of interest from ODA for such programs (Bevege 2005).

At the beginning of this period, the Forestry Program was primarily focused on collaborations with countries in the Asia–Pacific region, but by 2013 it included a project in East Africa and one in South Asia. To enhance the contribution that forests make to rural livelihoods the program addressed four themes (Haines 2005):

- silvicultural methods for promising high-value and multi-purpose species
- value-added processing of wood and non-timber forest products
- development of agroforestry systems
- socio-economic impediments to forestry's contributions to rural development.

In 2013 ACIAR updated the strategies for each research program, taking account of priorities identified through recent country consultation processes. The Forestry Program included four strategic themes, each having multiple priority research areas (ACIAR 2013). The four strategic themes were tree growing, sustainable forest management, efficient and sustainable forest industries, and climate change mitigation and adaption.

Analysis of the records shows that during the third decade, ACIAR made a nominal investment of AUD 55.2 million in the Forestry Program and in the 2011–12 financial year, it accounted for 9.2% of ACIAR's investments in bilateral research projects (Lindner *et al*. 2013). During this ten-year period, the individual budgets for the forestry projects were generally in the range of AUD 0.4–2.5 million, with one large regional project covering four African countries having a budget of AUD 5.6 million.

The third decade of the Forestry Program was characterised by a shift towards research on agroforestry and community forestry systems, including improvement and silviculture of high-value species. High-value species include teak, acacias, eucalypts, sandalwood and indigenous trees from the Pacific Islands. A long-term program of value-added wood processing projects in Vietnam, Laos, Papua New Guinea, Indonesia and Fiji aimed at improving the processing and manufacturing of furniture and engineered wood products using small-diameter logs grown by smallholders. The approach of supporting a range of research themes continued with some alignment with global trends, such as the development of REDD+ projects and enhancing economic benefits through value adding of forest products. However, consistent with the approach in the first two decades, most projects related to smallholder and community-based forestry systems.

During this period significant achievements continued to be made on improving the management of *Acacia* plantations in Indonesia (Mendham and Hardiyanto 2011) and on broadening the basis of clonal forestry using the *A. mangium* × *auriculiformis* hybrid (Harwood *et al*. 2015). The research on teak-based agroforestry systems in Indonesia (Roshetko *et al*. 2013) and Laos (Dieters *et al*. 2014) created knowledge on how the existing systems could generate enhanced livelihoods. In the Pacific, good progress was made on developing small-scale agroforestry systems suitable for archipelago nations like Solomon Islands (Blumfield *et al*. 2013) and Vanuatu (Glencross *et al*. 2012; Grant *et al*. 2012; Viranamangga *et al*. 2012).

As with the previous two decades, some of the research showed different achievements in different countries. Research related to the wooden-furniture industries in Central Java (under project FST/2007/119) generated positive economic benefits for the small and medium enterprises that collaborated with the project (Melati *et al*. 2013; Purnomo *et al*. 2014). In contrast, research related to enhancing value-added wood processing in Papua New Guinea (under project FST/2006/120) did not achieve any apparent adoption of project outputs by the private sector (Fisher 2011).

The evolving nature of the Forestry Program over 30 years

The program's investments and major Australian partners

Analysis of the records indicates that ACIAR has invested a nominal AUD 103.46 million over 30 years to commission 150 forestry-related projects. This includes 101 forestry research projects, with a nominal value of AUD 98.93 million, and 49 small research activities. The details of these investments by decade are shown in Table 1, bearing in mind that the financial values have not been adjusted to a common year. Between the first and third decades, the number of research projects commissioned doubled and small research activities had become an important feature.

ACIAR commissions all of its projects through either Australian or international research organisations. While many projects have multiple research organisations involved in the partnership, the commissioned organisation provides the leadership and undertakes the largest proportion of project activities. The analysis of the numbers of projects commissioned through different research organisations in each 10 year period is shown in Table 2.

Over the 30 year period, 17 Australian research organisations and two CGIAR research centres have led ACIAR forestry research projects, with more than one-third of the projects led by CSIRO. During the first decade, there were only four organisations leading projects and 75% of the projects were commissioned through CSIRO. In the second decade, there were 11 commissioned organisations, 45% of the projects were commissioned through CSIRO and collaborations commenced through the CGIAR centres, CIFOR and the World Agroforestry Centre (ICRAF). In the third decade, the number of commissioned

Table 1. ACIAR's investments in forestry research projects and activities.

Decade	Forestry research projects	Nominal investment (AUD million)	Small research activities	Nominal investment (AUD million)	Total nominal investment (AUD million)
1984–94	24	21.13	1	0.13	21.26
1994–04	29	24.76	22	2.24	27.00
2004–14	48	53.04	26	2.16	55.20
Totals	101	98.93	49	4.53	103.46

Table 2. Number of projects commissioned with partner organisations by 10 year period.

Decade	CSIRO	AG BRS	WA CALM	VIC Forestry	QLD Forestry	NSW Forestry	NTU/ CDU	Univ of Qld	ANU	Southern Cross	Univ of Tas	James Cook	Sunshine Coast	Griffith	Charles Sturt	Univ of Melb	Univ of Adelaide	ICRAF	CIFOR
1	18		2		3		1												
2	13	1		1	3		1	2	2	1	2							2	1
3	5				3	1	1	3	6	2	4	5	3	2	1	5	2	3	2
Σ	36	1	2	1	9	1	3	5	8	3	6	5	3	2	1	5	2	5	3

organisations increased to 16, CSIRO's involvement declined and universities such as the Australian National University, James Cook and Melbourne each led five or more projects. The forestry-related CGIAR centres together led five projects, located in countries where they had a presence.

Decisions about the commissioned organisation are made by the Research Program Manager, taking account of factors such as experience in leading projects in developing countries, availability and strength of scientific disciplines needed for the project, value for money and effectiveness of the existing partnership arrangement (for follow-on projects). Over the 30-year period, the number of projects commissioned through CSIRO and state forestry research organisations declined substantially, with the exception of Queensland, reflecting governments' disinvestment in the conduct of forestry research. The increase in number of commissioned organisations reflects the growth in both the number of projects commissioned and the disciplines involved, a conscious effort to seek out new partners, and the need to manage declining availability of Australian forestry scientists.

Countries in which projects have been implemented

Most ACIAR forestry research projects are implemented in one country, although in each decade some projects have involved collaborations with several countries. The selection of countries in which the Forestry Program works is influenced by Australian aid policies, ACIAR policy on the number of countries a program can work in, availability of funding (including government-initiative funding), and the appropriateness of and interest in inter-country collaboration on a research topic. Analysis of the ACIAR records indicates that forestry research projects have been implemented in 29 countries and that the countries have changed over time. The distribution of projects—including projects that have had activities in multiple countries—is shown in Table 3 by country and decade.

The countries that have had the most projects are Indonesia (23), Vietnam (20), Papua New Guinea (19) and Thailand (18). During the first decade there were projects in 15 countries, with the most projects implemented in China, Thailand, Zimbabwe and Kenya. In the second decade there were projects in 17 countries, with the most projects implemented in Indonesia, Vietnam, Thailand and Papua New Guinea. In the third decade projects were implemented in 16 countries, with Indonesia, Papua New Guinea, Vietnam and Laos having most projects.

The program's forestry research themes

In developing projects ACIAR responds to priorities developed collaboratively with partner countries, rather than setting its own priorities. The topics of the 101 completed research projects can be grouped into ten research themes (Table 4).

Analysis of the ACIAR records shows that there have been considerable changes in the nature of the investments over the three decades, including the number of research themes covered and the numbers of projects under a particular research theme, as shown in Figure 1.

Table 3. Number of ACIAR forestry research projects in each partner country by decade.

	East Asia								South Asia						
Decade	Indonesia	China	Vietnam	Laos	Myanmar	Thailand	Cambodia	Malaysia	Philippines	Sri Lanka	India	Bangladesh	Pakistan	Nepal
1	3	9	4	1	1	9		1	2	1	1		2	
2	8	3	8	4		7	1	3	5	1	3	1	1	
3	12	2	8	7		2	1							1
Σ	23	14	20	12	1	18	2	4	7	1	4	1	3	1

	Africa							Pacific						
Decade	Ethiopia	Rwanda	Uganda	Burundi	Ghana	Kenya	Zimbabwe	South Africa	Papua New Guinea	Vanuatu	Solomon Islands	Fiji	Samoa	Pacific Islands	Brazil
1						5	6		1					2	
2					1			1	6					2	1
3	1	1	1	1					12	6	5	3	2		
Σ	1	1	1	1	1	5	6	1	19	6	5	3	2	4	1

Table 4. Themes of ACIAR forestry research undertaken between 1984 and 2014.

No.	Research theme	Comments
T1	Domestication and improvement of Australian trees	Includes domestication and tree improvement principally for *Eucalyptus* and *Acacia*
T2	Silviculture for Australian trees	Includes research on establishment, spacing, site management, growth monitoring and thinning
T3	Domestication and silviculture of non-Australian trees	Includes supply of quality germplasm for native and exotic trees as well as silvicultural systems
T4	Forest health and biosecurity	Includes pests, diseases and forest health systems
T5	Value added processing, timber manufacturing and treatment of wood	Includes wood science, wood processing and manufacturing, furniture and composite products
T6	Agroforestry and community forestry	Improving benefits from agroforestry systems and approaches to community forestry
T7	Non timber forest products	Includes research on growing, processing and adding value to non-timber forest products
T8	Native forest management	Includes yield modelling and improved management systems for native forests
T9	Fire management	Includes use and impacts of fire on land management and systems for managing fire
T10	Forestry and environment policies	Development of policy options, global forestry documents, criteria and indicators and REDD+

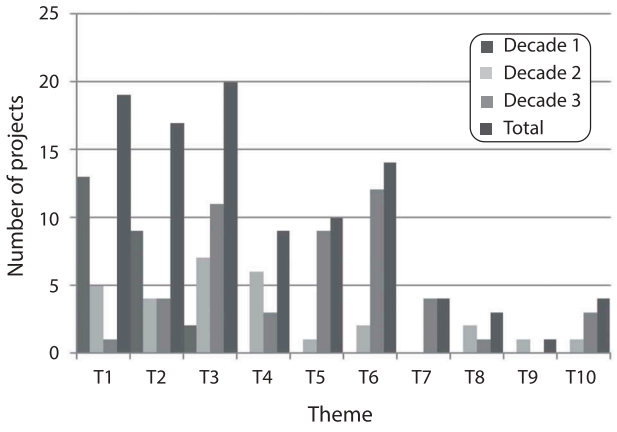

Figure 1. Numbers of research projects by research theme and decade.

In the first decade, there were only three themes covered and 22 of the projects focused on two themes (T1 and T2), which related to domestication, improvement and silviculture of Australian tree species. In each of the subsequent two decades, projects covered nine of the ten research themes. In the second decade, nine projects related to the two Australian tree themes, seven projects related to domestication and silviculture of non-Australian trees (T3), and six projects focused on forest health (T4). In the third decade, the focus shifted significantly towards the research themes related to agroforestry, community forestry (T6), silviculture of non-Australian trees (T3) and value-added processing (T5). In general terms, these thematic shifts parallel the changes in global forestry priorities as outlined in the descriptions of the Forestry Program by decade. Moreover, they reflect the priorities requested by partner countries as well as the perspectives of the

incumbent research program manager on the needs, opportunities and best use of the funding provided to the program.

Looking at the program over 30 years, 26% of the research projects have focused on domestication, improvement and silviculture of Australian trees, 20% have focused on domestication and silviculture of non-Australian trees, 14% have focused on agroforestry and community forestry, 10% have focused on value-added processing and 9% have focused on forest health and biosecurity. Almost three-quarters of the research effort by project number has been focused on smallholder and community-based commercial forestry systems (through T1, T2, T3, T6 and T7 themes). This reflects the areas where the program best contributes to ACIAR's aims to enhance food security, reduce poverty and contribute to the long-term economic prosperity of developing countries.

Economic impacts from the Forestry Program

ACIAR puts significant effort into identifying the impacts of the research it funds, particularly through independent impact assessment studies. Analysis of ACIAR's records indicates that there have been ten impact assessment studies undertaken on components of the Forestry Program, nine of which have been published as Impact Assessment Series reports (Lindner *et al*. 2013), and one as an Economic Evaluation Unit Working Paper (Davis and Lubulwa 1995). In aggregate, these impact assessments cover 48 projects, which is nearly half of the completed forestry research projects. For 30% of the completed projects quantitative economic impact assessments have been undertaken. This body of work provides an indication of the overall economic impacts from the Forestry Program and some indication of the differential impacts from various projects.

The results of the impact assessments are summarised in Table 5. They show that the research programs related to the development of plantation forestry systems, based on Australian tree germplasm in Indonesia, Vietnam and China, have all yielded high economic benefits, and therefore have impressive cost-benefit ratios. In each case, the result is strongly influenced by the scale of plantings that have occurred in the three countries. They also indicate that research on tree diseases and non-timber forest products can generate substantial economic benefits. The research on tree planting to facilitate environmental remediation generated positive but low economic benefits, due to the slow growth on these sites.

Table 5. Results from impact assessment studies of ACIAR forestry projects.

Impact assessment study	Research costs (AUD million)	NPV of benefits (AUD million)	Benefit-cost ratio	Internal rate of return (%)
Australian trees in China[a]	2.30	122.30	53:1	35.0
Acacia hybrids in Vietnam[b]	1.04	152.00	145:1	N/A
Australian trees in China[c]	18.60	1300.00	57:1	40.0
Australian trees in Vietnam[d]	1.50	129.00	79:1	32.0
Fungal diseases of eucalypts[e]	1.90	65.00	30:1	23.0
Trees on saline land[f]	20.80	23.20	1.12:1	N/A
Plantation forestry in Indonesia and Australia[g]	37.00	11 914.00	322:1	54.4
Galip nuts in Papua New Guinea[h]	7.20	163.00	22.6:1	20.4

[a]ACIAR Impact Assessment Study No. 8 (McKenney 1998).
[b]ACIAR Impact Assessment Study No. 27 (van Bueren 2004a).
[c]ACIAR Impact Assessment Study No. 30 (van Bueren 2004b).
[d]ACIAR Impact Assessment Study No. 47 (Fisher and Gordon 2007a).
[e]ACIAR Impact Assessment Study No. 49 (Fisher and Gordon 2007b).
[f]ACIAR Impact Assessment Study No. 51 (Corbishley and Pearce 2007).
[g]ACIAR Impact Assessment Study No. 71 (Lindner 2011).
[h]ACIAR Impact Assessment Study No. 73 (Fisher 2011), estimates relate to combined program funded by ACIAR, EU and PNG Government.

Australian trees in China

Over a 20-year period—from 1985 to 2004—ACIAR invested AUD 11.8 million on seven forestry projects that primarily addressed the development of high-yielding eucalypt plantations in China. The ACIAR projects included selection trials for 100 eucalypt species, tree improvement for tropical, subtropical and cold-tolerant eucalypts, as well as research on site cultivation techniques, nutrient management, the introduction of mycorrhizal fungi and the water requirements of planted eucalypts (van Bueren 2004b).

ACIAR has conducted two impact assessments on these projects. The first study involved two projects that tested germplasm of *Eucalyptus, Acacia* and *Casuarina* species over an eight-year period and predicted economic benefits worth AUD 122.3 million (McKenney 1998). The second study involved all seven projects, most of which supported research on improving productivity from *Eucalyptus* plantations. It predicted economic benefits worth AUD 1.3 billion, due to both the substantial increase in area of *Eucalyptus* plantations and the tripling of growth rates over 16 years as a result of the research (van Bueren 2004b). It was subsequently recognised that the achievement of such benefits was possible only through the collaboration and coordination of a wide range of research and development activities (Turnbull 2007).

Improving Acacias in Vietnam

Australian tropical *Acacia* species were introduced to Vietnam between 1960 and the late 1980s (Kha and Nghia 1991), but ACIAR's collaboration with Vietnam did not begin until 1993. ACIAR has conducted two impact assessments on *Acacia* tree improvement research in Vietnam (van Bueren 2004a; Fisher and Gordon 2007a).

Between 1988 and 1992, ACIAR funded research (FST/1986/030) into hybridisation and vegetative propagation of tropical acacia species in Malaysia. A scientist from the Forest Science Institute of Vietnam attended the project's final workshop. Access to the knowledge on clonal selection techniques and propagation methods enabled Vietnamese scientists to speed up the development of hybrid *A. mangium* × *auriculiformis* clones for commercial

release. The first study found that access to this knowledge generated benefits worth AUD 152 million for Vietnam (van Bueren 2004a). It is an example of spill-over benefits, whereby research conducted in one country benefited another country.

During the period 1993–2004, ACIAR funded two global forestry projects (FST/1993/118 and FST/1998/096) related to the provision and domestication of Australian tree germplasm and which included collaboration between CSIRO and the Forest Science Institute of Vietnam. Seed of various *Eucalyptus, Acacia* and *Melaleuca* trees potentially suitable for Vietnam was provided. The projects involved capacity building in tree breeding and supported the establishment of seed production areas, seedling seed orchards and clonal seed orchards for ten Australian tree species (Fisher and Gordon 2007a). The second study calculated benefits worth AUD 129 million from the projects, from greater access to improved germplasm of commercial timber species, increased plantation productivity and reduced wood production costs (Fisher and Gordon 2007a). This study estimated that about two-thirds of these benefits flow to consumers via lower prices, with the rest flowing to the producers, including large numbers of smallholder farmers, who have planted the better quality Australian trees.

Reducing the impacts of fungal diseases in eucalypt plantations

Pests and diseases are a growing threat to the productivity of eucalypt plantation species (Wingfield *et al*. 2008). Following the widespread planting of eucalypts in Asia, damaging foliar and stem diseases, particularly leaf and shoot blight pathogens, began to appear (Old and Mohammed 2003). From the mid-1990s, the ACIAR Forestry Program began to include projects on management of pests and diseases in eucalypt plantations.

During the period 1996–2000, ACIAR funded a project (FST/1994/041) aimed at minimising disease impacts in eucalypt plantings in Vietnam and Thailand. An impact assessment study calculated benefits worth AUD 65 million to the smallholders and plantation companies growing *Eucalyptus* through the identification and dissemination of planting material with enhanced disease resistance (Fisher and Gordon 2007b). The study demonstrated that research to improve the productivity of plantations can have significant benefits despite the often long lag times required to realise the benefits.

Growing trees on salt-affected land

Soil salinity is an increasing problem impacting negatively on agricultural productivity in many of ACIAR's partner countries as well as in Australia. From 1994 to 1997, ACIAR funded a research project (FST/1993/016) that increased the range of trees and shrubs suitable for saline sites in Pakistan, Thailand and Australia and developed appropriate establishment techniques for these species.

An impact assessment study predicted benefits worth AUD 23.2 million from research and development activities to treat 7000 hectares of saline sites in Pakistan and 5000 hectares in Thailand (Corbishley and Pearce 2007). This study demonstrated that long-term environmental remediation programs, where tree growth is slow and farmers have little incentive to adopt the technologies without subsidies, generate a relatively low rate of return to the investment.

Plantation forestry research in Indonesia and Australia

Between 1987 and 2006, ACIAR invested in 12 forestry projects with the aim of improving plantation forestry in both Indonesia and Australia. These projects focused on the domestication and silviculture of Australian trees and other multi-purpose trees such as sandalwood. They also undertook research on genetic improvement of plantation trees, control of fungal diseases and insect pests and on policy instruments for sustainable plantation management. Because the nature of these projects varied considerably, the impact assessment (Lindner 2011) grouped related projects into four clusters, but found evidence of impact for only two of the clusters. It could not determine any economic impact from either the pest and diseases or policy research.

For the agroforestry and multi-purpose trees cluster, the study found evidence of impact only in Australia, related to the development of the Ord River sandalwood plantation industry. For the Australian trees cluster, evidence of impact was found only in Indonesia, associated with the expansion and improved productivity of *Acacia* and *Eucalyptus* industrial pulpwood plantations. The study calculated benefits worth AUD 11 914 million from the 12 projects, including AUD 766.48 million in benefits to Australia from two sandalwood projects (Lindner 2011).

Forestry in Papua New Guinea

Papua New Guinea has been an important partner country for the Forestry Program. Collaborations began in 1992 and about 15% of the program budget is spent on projects in Papua New Guinea (ACIAR 2013). In 2011, ACIAR published a thematic impact assessment study that examined 12 Papua New Guinea forestry projects, including two scoping studies (Fisher 2011). These projects were grouped into four clusters: project-scoping studies, sustainable forest management, agroforestry, and processing of timber and non-timber forest products. The study identified the key outputs, outcomes and impacts from each project and estimated economic impacts from three projects supporting development of a new industry based on growing and processing nuts from the indigenous galip tree (*Canarium indicum*).

The study found that adoption of project outputs has been mixed and appeared to have been greatest in projects aimed at local communities and least in the policy-related projects. From the ten research projects, there were no apparent outcomes or impacts from four projects; five projects had generated outcomes but no apparent impacts; and only one agroforestry project demonstrated outcomes and impacts at the time of the study (Fisher 2011). The study concluded that achieving adoption of research and development outputs is a significant challenge in Papua New Guinea. Even with projects aimed at local communities, there are various barriers to adoption, including weak governance, resistance to change, lack of extension services and infrastructure, inadequate supply of tree germplasm and the long time frames to receive benefits. It also found that ACIAR's delivery model is not well suited to addressing governance issues and, for research

on downstream processing, commitment to long-term funding and to support marketing activities is needed (Fisher 2011).

The study estimated the expected impacts from three projects related to galip nuts, taking account of investment in related development activities from the European Union and 10 years of further investment in research, development and marketing activities. It calculated projected benefits worth AUD 163 million, of which AUD 51 million was attributed to the three ACIAR forestry projects (Fisher 2011).

Contribution of forestry to the returns to ACIAR's investments

ACIAR has commissioned two reviews of the returns to its investment in bilateral agricultural research: the first reviewing returns from 53 projects in 29 impact assessment studies, which represented 7.8% of ACIAR's total investment in bilateral research over 23 years (Raitzer and Lindner 2005); and the second reviewing returns from 103 projects in 27 studies (Lindner *et al*. 2013). To account for variability in methods applied and the certainty of benefit estimates, these reviews included evaluations of the confidence of the reported estimates of benefits. The first review used five criteria and ten indicators to construct three scenarios of benefit aggregation: potential benefits, plausible benefits and substantially demonstrated benefits (Raitzer and Lindner 2005). The second review developed a set of 14 criteria and a three-level rating score, which, when combined, enabled each assessed benefit stream to be classified as conceivable, plausible or convincing (Lindner *et al*. 2013).

The results from the first review indicated a benefit-cost ratio of 1.33 for the substantially demonstrated benefits and that these benefits arose from projects that represented only 3.0% of ACIAR's total investment in bilateral research over the 23-year period (Raitzer and Lindner 2005). This review included three impact assessment studies (McKenney 1998; van Bueren 2004a, 2004b) that assessed eight forestry projects implemented in China and Vietnam on the domestication and improvement of *Eucalyptus* and *Acacia*. It found that the forestry projects produced the highest economic returns in two of the benefit aggregation scenarios—plausible benefits and substantially demonstrated benefits—and that they contributed 47% of the substantially demonstrated benefits (Raitzer and Lindner 2005).

The results from the second review, which were from projects that represented only 3.9% of ACIAR's total investment in bilateral research over 30 years, indicated a much greater benefit-cost ratio of 51.4 for the almost AUD 23 billion worth of benefits assessed as convincing (Lindner *et al*. 2013). This review included five impact assessment studies (Corbishley and Pearce 2007; Fisher and Gordon 2007a, 2007b; Fisher 2011; Lindner 2011) that assessed 28 forestry projects implemented in Indonesia, Pakistan, Papua New Guinea, Thailand and Vietnam. It found that the Indonesia and Vietnam forestry projects contributed 63% of the substantially demonstrated benefits and that the Indonesian plantation forestry projects achieved the highest benefit-cost ratio (323.9) of any of ACIAR's published impact assessments to date (Lindner *et al*. 2013).

These two reviews demonstrate that the Forestry Program, and particularly the subset of plantation forestry research projects, has made a significant contribution to the overall economic returns from ACIAR's research investments. The calculated economic benefits from the plantation forestry research projects to Indonesia and Australia were AUD 11 148 million and AUD 766.48 million respectively (Lindner 2011). These benefit streams far exceed ACIAR's total nominal investment of AUD 103.46 million in the 150 completed forestry research projects. The estimated economic benefit, to either Indonesia or Australia, from just four of the forestry projects, far exceeds the cost of all the ACIAR forestry projects.

Other impacts from the Forestry Program

While economic impacts resulting from research are important they are not the only impacts that ACIAR projects seek to achieve. Other important impact categories include scientific, capacity building, social and environmental impacts. These impacts are harder to assess than economic impacts but they are equally important for research projects. In addition, the type of impacts that can be achieved will vary depending on the nature of the research undertaken by a project, the existing capacity of partners and the positioning of the project activities in a longer-term program of research and development. For each impact category, some examples of the impacts achieved by ACIAR forestry research projects are described below.

Scientific impacts

Unsurprisingly, there have been a considerable number of impacts arising from the scientific outputs from the 101 completed forestry research projects, including the wide dissemination of this knowledge in scientific journals and the publications of ACIAR and partner organisations, such as CIFOR and ICRAF. Some of these impacts include:

- use of information about the environmental requirements, cultivation, potential uses and pests and diseases for 166 Australian trees (Doran and Turnbull 1997) by scientists to guide tree planting programs in their countries
- sharing of knowledge on the domestication and improvement of tropical acacias (Turnbull *et al*. 1988a; Kha and Nghia 1991; Turnbull 1991) between scientists which led to the development of large areas of fast-growing acacia plantations in Vietnam and Indonesia
- sharing current state of knowledge on the role of eucalypts in Asia including socioeconomics, genetics, nutrition, pest and diseases, environmental impacts and utilisation issues (Turnbull 2003)
- knowledge on the essential oils derived from *Melaleuca, Asteromyrtus* and *Callistemon* (Brophy and Doran 1996) used to facilitate production of essential oils in Papua New Guinea and Indonesia
- research on identifying diseases of *Acacia* (Old *et al*. 2000) and *Eucalyptus* (Old *et al*. 2003) in South-East Asia and minimising their impacts, that led to the availability of more disease-resistant plants (Fisher and Gordon 2007b)
- publication of procedures for working with mycorrhizal fungi (Brundrett *et al*. 1995, 1996) enabled researchers, nursery and plantation managers to introduce them

and then establish plantations of Australian trees on nutrient impoverished soils
- development of polyploid varieties of *Acacia mangium* and the discovery that the tetraploids have significantly longer and wider fibres (Griffin *et al*. 2015), offers potential benefits for paper making
- an analysis of the largest global markets for teak timber in India, China, Vietnam and Thailand, together with information on Solomon Islands' under-utilised teak resource (Midgley *et al*. 2015), assists with development of markets for this timber through global timber traders.

Capacity-building impacts

Skills of research scientists and other stakeholders, including farmers and employees of forestry companies and processing industries, have been enhanced by working directly with the international scientists engaged in the forestry projects. An example of this is the enhanced knowledge of appropriate silviculture for teak growing (Pramono *et al*. 2011). At the completion of the project, 50% of the farmers were adopting the silvicultural practices on their farms, 30% were disseminating this knowledge to other farmers. In neighbouring regions 20% of farmers were adopting the recommended silvicultural practices and 15% were sharing this information with other farmers (Rohadi *et al*. 2012).

Perhaps the most important capacity-building impact from the Forestry Program is the substantial legacy of enhanced scientific capacity in partner countries arising from postgraduate studies under ACIAR's John Allwright Fellowship scheme. By mid-2015, ACIAR had supported 293 developing country scientists to complete postgraduate degrees in Australia. Forty-five scientists associated with ACIAR forestry projects, including 33 male and 12 female scientists, have completed 24 PhDs and 21 Masters degrees. These scientists have come from 12 partner countries as shown in Figure 2, with many of them subsequently contributing substantially to forestry in their countries or globally.

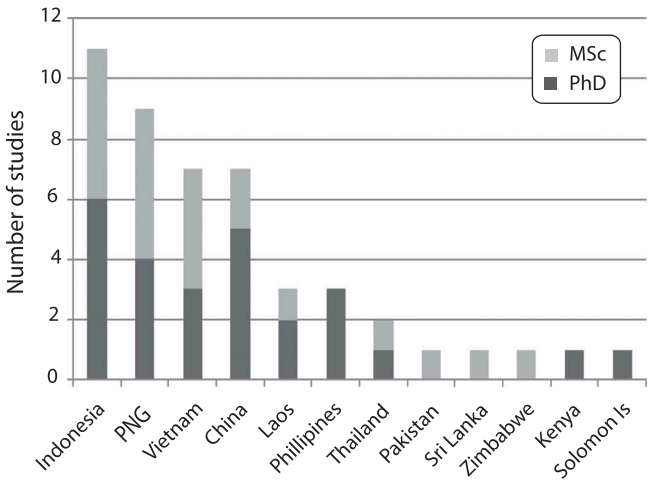

Figure 2. Numbers of forestry-related PhD and MSc studies completed by country.

Social impacts

Enhancing the use of trees and forests in rural development requires consideration of both social and biophysical sciences and often good technical forestry innovations will not succeed without appropriate understanding of the social factors that affect its adoption. While this approach became a significant component of ACIAR forestry projects only in the most recent decade, research under various projects has resulted in a number of important social impacts:

- engagement of farmers and the private sector in research on improving *Eucalyptus* plantation productivity in India facilitated widespread adoption of research outputs which led to 120 000 more jobs in log harvesting and delivery (Mendham 2010)
- knowledge of landholders' attitudes to growing trees and the constraints to them participating in commercial tree growing in Papua New Guinea (Kanowski *et al*. 2014) enabled a more targeted approach to promotion of agroforestry
- understanding of the livelihood assets of different household groups in communities (Oktalina 2015) enabled more effective interventions to foster community-based commercial forestry in Indonesia
- knowledge of how land ownership and labour availability affect different households' ability to integrate tree growing into their farming system, manage the woodlots effectively and maintain plantation ownership until maturity (Newby *et al*. 2014), influenced the design of teak agroforestry systems in northern Laos
- recognition of the importance of decentralised political and administrative structures and existing capacity in the design of REDD+ schemes, enabled local decision-makers to address deforestation causes but increased the risk of leakage (Irawan and Tacconi 2009)
- understanding by donors and policy actors that Nepal's community forestry initiatives have evolved to include governance regimes beyond the local level, with civil society groups engaged in the politics of resource governance has influenced the livelihood and conservation outcomes (Ojha 2014).

Environmental impacts

The expansion of planted forests and the improvement of forest management systems can provide many environmental benefits, but these are often difficult to attribute to research projects. It is also possible that the expansion of planted forests can result in negative environmental outcomes. In Indonesia, about half of the plantations that were established before 2001 were on land that had natural closed forest cleared in the past 20 years (Cossalter and Pye-Smith 2003). Some of the positive environmental impacts from the Forestry Program include:

- research on water use by plantations in China (Lane *et al*. 2004; Morris *et al*. 2004) enabled scientists and plantation managers to predict the impact of new plantations on water availability on different soil

types and suggested options for modifying tree spacing to reduce water use
- information on the recovery of secondary forests following logging (Fox and Keenan 2011) enabled scientists in Papua New Guinea to predict the recovery of merchantable timber volumes and carbon stocks (Fox *et al*. 2011)
- knowledge from a review the sustainability of fast-grown *Eucalyptus* and *Acacia* plantation forestry in five countries in South-East Asia (Harwood and Nambiar 2014) encourages local scientists to develop integrated, science-based operational management systems to improve plantation sustainability
- research on different impacts and alternatives to slash and burn practices in Eastern Indonesia (Russell-Smith *et al*. 2000) provided village communities with skills in strategic burning to protect their agroforestry plots and gardens, which were still being used 7 years after the project finished (Myers *et al*. 2014).

Discussion

Forestry research involves complex systems with biophysical and social elements and requires long timeframes to produce the desired products and, hence, impacts (Henderson 2000). It is apparent from ACIAR's research reports and impact assessment studies that a wide range of positive scientific, capacity, economic, social and environmental impacts have been achieved across the portfolio of completed projects. This highlights the importance of considering the non-economic impacts from research projects when evaluating a program of research projects. It is also apparent that many research projects do not deliver the expected level of impact. What is not so clear, however, is why this occurs and what factors contribute to greater or lesser success of projects in different situations.

Economic impacts differ depending on the theme of the research, the country in which it is undertaken and other factors. In Indonesia, where forestry is important to the economy and comparatively good research capacity exists, very high impacts have arisen from research on domestication and improvement of Australian trees, but only limited impacts from research on control of plantation diseases (Lindner 2011). In Papua New Guinea, where forestry is also important economically but comparatively weaker research capacity exists, it has been difficult to deliver successful research projects across a range of research themes, including tree domestication and improvement (Fisher 2011). While the Western Australian sandalwood industry could not have been developed without the enabling research outputs, the level of plantation expansion was assisted by an enabling tax policy that allowed favourable treatment for forestry Managed Investment Schemes (Lindner 2011).

The focus on smallholder and community forestry

A consistent feature of the ACIAR Forestry Program over the 30 years has been its focus on smallholder and community forestry, particularly research related to enhanced livelihoods from commercial forestry activities, including timber and non-wood forest products. About three-quarters (74%) of the research projects (T1, T2, T3, T4 and T7 from Table 4) related to smallholder and community forestry. This research focus, which includes both technical and social science activities, has supported development of both plantation and agroforestry systems, based on eucalypts, acacias and other trees that produce high-value products.

The arguments for and against fast-growing plantations have been reviewed against published science (Cossalter and Pye-Smith 2003) to conclude that in some situations this form of forestry is undesirable, while in other situations it can yield benefits not just for the economy, but for the environment and local communities. The situation with benefits from smaller-scale agroforestry systems is also complex. The level of adoption of the agroforestry technologies by farmers and the benefits from the particular systems are variable and context-dependent (Mercer 2004; Viranamangga *et al*. 2012; Coe *et al*. 2014).

The ACIAR impact assessment studies clearly show that there have been some substantial economic impacts from this ongoing research focus. This is particularly the case for plantation forestry systems, in situations where there has been a large scale of plantation development and good markets for products. However, these same studies also show that the economic impacts from this smallholder-focused research are not uniformly displayed in all countries, or between projects within countries (Lindner 2011; Fisher 2011). Sustained research on species selection, tree breeding and site management has improved the productivity and profitability of plantations by between 70% and 200% in China (van Bueren 2004b; Turnbull 2007), Vietnam (Fisher and Gordon 2007a; Harwood *et al*. 2015) and Indonesia (Mendham and Hardiyanto 2011).

When two countries collaborate in the same ACIAR projects the outcomes can be very different and these are difficult to predict when the research commences. Vietnam now has 1.1 million hectares of *Acacia* plantations managed for wood production on five-to-ten year rotations, nearly half of which is managed by an estimated 250 000 smallholder growers with woodlots of one to five hectares in size (Nambiar *et al*. 2014). In contrast, in Laos only a small proportion of the estimated 200 000 hectares of plantations consists of *Eucalyptus* and *Acacia* trees and most of this is in concession areas developed by multi-national companies with limited benefit to local communities (Phimmavong *et al*. 2009). Yet both countries collaborated between 1994 and 2004 in two ACIAR forestry projects (FST/1993/118 and FST/1998/096) on domestication and improvement of Australian trees. In Vietnam, the policy settings supported smallholder engagement in forestry, there were very good mechanisms for the production and dissemination of high quality germplasm and strong markets developed for the wood products (Nambiar *et al*. 2014).

Having good forestry technology available to farmers is important, but not sufficient to ensure widespread adoption. Farmers also need secure access to land and rights to the tree products, confidence that their trees can be protected from fire, pests and diseases, as well as a market for the products that is attractive to them (Byron 2001). The level of adoption within a region, where all farmers have access to knowledge and germplasm for an agroforestry system, can also vary. In northern Laos, the degree to which households can participate in growing teak woodlots varies within and between villages, depending on factors such as a household's history of settlement in an area, the age and educational background of the household head, the level of off-farm income and access to enough paddy land to achieve self-sufficiency in rice production (Newby *et al*. 2012).

The situation in Indonesia is complex and depends on the location and nature of the commercial forestry operations.

By 2007 there were an estimated 799 000 hectares of industrial pulpwood plantations based on *Acacia* and *Eucalyptus* species, with most of the economic benefits from these plantations flowing to the plantation companies, but with rural communities benefiting from increased employment opportunities (Lindner 2011). On Java, 1.5 million smallholders manage 444 000 hectares of teak and mahogany-based agroforestry systems. Timber from these systems provides 12% of the average farming household income, with the trees acting as a living savings account (Roshetko *et al*. 2013). In another part of Central Java, where farmers are planting fast-growing *Albizia* trees and collect various non-timber forest products, community forestry contributes an average of 25–32% (USD 590–1200 annually) of household income (Irawanti *et al*. 2014). In Eastern Indonesia, the financial returns to communities engaged in commercial forestry varies considerably, depending on the nature of the system and intercropping outputs, the distribution of costs borne by stakeholders, and the nature of policy settings and government support for community forestry (Nawir 2013).

To date the outputs of ACIAR's smallholder forestry research in Papua New Guinea have not generated the substantial economic benefits for smallholders that have been achieved in South-East Asia. However, there are promising signs from the research about what could be achieved. Financial analysis of five high-value smallholder agroforestry systems showed benefit-cost ratios of between 1.58 and 3.11, with the highest return being for a teak sawlog system (Kanowski *et al*. 2014). Likewise, the estimated net present value from growing galip (*Canarium*) as shade trees in a cocoa agroforestry system was estimated at PGK 10 931 per ha (AUD 4900 per ha), with farmers receiving income from galip nuts after 5 years (Fisher 2011). The achievement of these potential benefits depends on the expansion of processing facilities and development of new markets for the value-added products, which a new ACIAR project that commenced in 2015 will try to address.

An important lesson from this research focus is that to achieve the desired impacts from new forestry technologies, research is also required on value-added processing and pest and disease management. The value chain and wood processing research undertaken in the Jepara region of Indonesia, where there are 12 000 furniture manufacturing businesses and 120 000 workers, has facilitated formation of an industry association and generated additional markets for their furniture products (Purnomo *et al*. 2014). In recent years, fungal diseases, such as *Ganoderma* and *Ceratocystis*, have caused significant death in tropical *Acacia* plantations in Indonesia. Recent research has enabled rapid screening of planting stock for variations in tolerance and/or susceptibility to *G. philippi* (Gafur *et al*. 2015), while preliminary trials on resistance and tolerance to *Ceratocystis* has indicated that the development of resistant breeds will be challenging (Brawner *et al*. 2015).

Challenges of achieving adoption and impact from research projects

ACIAR's 30 years of experience in implementing forestry research projects has shown that there are many challenges in achieving adoption of research outputs and these often have a bearing on the scale of impacts achieved by different projects. An example of the challenges of achieving adoption of research findings for small-scale forestry systems is shown in Box 1.

These adoption challenges are not limited to developing country situations, as is evidenced by the case study described in Box 2. Achieving positive impacts from forestry

Box 1. Challenges for adoption of agroforestry technologies in Vanuatu.

Whitewood (*Endospermum medulosum*), a fast growing high-value native tree of Vanuatu, is highly suited to planting by farmers in small woodlots or agroforestry systems and capable of producing sawlogs in 15 years (Viranamangga *et al*. 2012). Research has shown that in order to control branch size and thereby improve wood quality and value, whitewood stands need to be planted at 800 stems per hectare and then thinned at age 4 years to 400 stems per hectare to maximise individual tree growth (Glencross *et al*. 2012). There has been only limited adoption of this silvicultural knowledge to date, mainly due to the fact that the landowners are unwilling to thin the poorer trees to waste.

Participatory social science research involving 139 landowners on the island of Espiritu Santo, who had collectively established 63 hectares of whitewood plantations, found that almost all of them supported planting whitewood to provide future income. However, only 51% of the landowners were willing to plant additional whitewood, partly due to the lack of reliable markets for the wood products (Aru *et al*. 2012).

Box 2. Challenges for adoption of forest biosecurity research in Australia.

Puccinia psidii (eucalypt rust and, in Australia, also known as myrtle rust) is an exotic rust fungus of South American origin. In the early 2000s, an ACIAR project (FST/1996/206) investigated the susceptibility to eucalypt rust of 129 species of *Eucalyptus* and other Myrtaceae family plants. At the time, this rust was confined to Florida, the Caribbean islands and South America, but was considered a serious threat to eucalypt plantations worldwide and to many natural ecosystems in Australia (Booth *et al*. 2000).

The project found that the impact of rust disease was variable but widespread in the species tested and, of the 58 Australian species tested, 52 had some degree of susceptibility (Glen *et al*. 2007). It developed sensitive detection tests for the rust spores (Langrell *et al*. 2008) and a model to identify potentially high risk areas for *P. psidii* globally and in Australia. The most at-risk areas in Australia encompassed the coastal region from near Sydney northwards to Cape York Peninsula (Booth *et al*. 2000).

Following the completion of the ACIAR project, the project scientists worked with the relevant biosecurity authorities to develop a contingency response plan for an incursion (Carnegie *et al*. 2010). A disease risk assessment method and map for *P. psidii* were produced for the Chief Plant Protection Officer and these were used in a ministerial briefing and a workshop in May 2006 to identify appropriate responses to disease incursion scenarios (Booth and Jovanovic 2012).

An exotic myrtaceous rust was first detected in Australia in April 2010 on the New South Wales Central Coast. It was initially described as *Uredo rangelii*—myrtle rust (Carnegie *et al*. 2010), but later regarded to be *P. psidii* (Booth and Jovanovic 2012). Unfortunately, the contingency response plan was not activated by Australia's biosecurity officials at the time of the incursion and the rust spread rapidly. By late 2011 the rust had spread southwards to Batemans Bay in New South Wales and northwards to Bundaberg in Queensland, with outlier records from plant nurseries in Kingaroy, Chinchilla, Townsville and Cairns. The locations of the 201 sites known to be infected with *P. psidii* in Australia corresponded well with the predicted high disease hazard areas that had been identified following the completion of the ACIAR project (Booth and Jovanovic 2012).

research projects is likely to depend on multiple factors, some of which are likely to be outside the control of a research project. These factors may vary between countries and projects within a country and also could change over time as the local research capacity and policy and development contexts change.

Conclusions

ACIAR has been investing in forestry research in developing countries for over 30 years. Its investment of more than AUD 100 million in 101 forestry research projects, covering ten research themes, and 49 small research activities has resulted in an impressive array of scientific outputs and diverse range of impacts. A total of 29 countries have benefited from these collaborative research projects, most notably Indonesia, Vietnam and Papua New Guinea. In many cases, the projects have led to substantial economic benefits being generated for smallholders, communities and plantation companies.

The strategic and operational components of ACIAR's approach have remained relatively constant over the 30 years, but project designs have incorporated lessons learned from project evaluations to increase the prospects for greater scientific achievements and impacts. The nature of the Forestry Program has evolved and broadened over the three decades. These changes have generally been in line with international forestry research priorities, but it has always maintained its primary focus on research related to enhancing smallholder and community forestry systems. In each decade the number of countries in the program operated was between 15 and 17, but there has been variation in which countries were included in ACIAR projects. The number of partner organisations through which projects are commissioned has grown from four in the first decade to 16 in the third decade.

Over the years there have been many and varied benefits for the partner countries involved in ACIAR forestry projects as well as some significant benefits for Australia. There is now a significant body of knowledge about the growth and management of Australian tree species in tropical and subtropical areas, together with substantial genetic improvement in a number of high-value tree species and enhanced knowledge and capacity to improve the quality and value of timber products from these plantations. Large numbers of smallholders and rural households have had their livelihoods improved by the use of genetic material and silvicultural management practices generated from these projects. Communities have also benefited from employment in the wood processing and manufacturing industries, many of which have also benefited from ACIAR's wood science and processing projects.

Australia too has benefited from this sustained research program. There is improved knowledge of the performance of various Australian trees under different environmental conditions and reliable techniques for growing sandalwood plantations have been developed. The enhanced networks that exist with collaborating partner country scientists facilitate ongoing exchange of scientific information and in the case of forest biosecurity they can assist Australia to monitor the spread of new threats to Australian forestry.

The independent impact assessments conducted on nearly half of the completed projects demonstrate substantial economic benefits from this research investment. They also provide some insights into the variability of outcomes and impacts from individual projects and some of the factors that influence this. These factors include the nature of the research theme and topic, the country where the research is undertaken, the mechanisms that exist to disseminate the research outputs and the linkages that exist to markets for the products and services.

The ACIAR Forestry Program has achieved greater impacts in South-East Asian countries, such as Indonesia and Vietnam, than it has in Pacific countries, such as Papua New Guinea. But clearly, when this 30-year program of forestry research is considered as a whole, it is not clear why one project on a given topic apparently achieves substantially different outcomes and impacts from a similar project in a different location.

Notes

1. Documented by Bartlett 2015 on basis of 5 years of experience as an ACIAR Research Program Manager.
2. Dr John Turnbull, from early 1984 to September 1994; Dr John Fryer, from January 1995 to February 2003; Dr Russell Haines, from September 2004 to June 2010; and Mr Tony Bartlett, from July 2010.
3. Documented by Bartlett 2015 on basis of 5 years of experience as an ACIAR Research Program Manager.
4. The current project development process is described at: http://aciar.gov.au/project_dev
5. Unpublished internal report: ACIAR Forestry Program Strategic Plan 1997–2001.
6. Bartlett, personal observation in June 2015.

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References

ACIAR. (2008) *ACIAR Corporate Plan 2008–12*. Australian Centre for International Agricultural Research, Canberra.

ACIAR. (2013) *Forestry Research Program Strategy*. Australian Centre for International Agricultural Research, Canberra.

ACIAR. (2014a) *ACIAR Strategic Plan 2014–18*. Australian Centre for International Agricultural Research, Canberra.

ACIAR. (2014b) *ACIAR Annual Operational Plan 2014–15*. Australian Centre for International Agricultural Research, Canberra.

ADAB. (1981) *Australian Centre for International Agricultural Research*, Occasional Papers on Development Assistance No. 24. Australian Development Assistance Bureau, Canberra.

Aru, R., Nichols, J.D., Grant, J.C., Leys, A.J., Glencross, K., Sethy, M., Convery, K. and Viranamangga, R. (2012) Constraints to whitewood (*Endospermum medullosum*) plantation development on Santo Island, Vanuatu. *International Forestry Review* **14**, 414–423. doi:10.1505/146554812804715928

Bartlett, A.G. (1992) A review of community forestry advances in Nepal. *Commonwealth Forestry Review* **71**, 95–100.

Bevege, I. (2005) Supplying forest services from natural forests and plantations: can we meet the challenge? In: *Forests, Wood and Livelihoods - Finding a Future for All: Conference Conducted by the ATSE Crawford Fund on* 16 August *2005*. ATSE Crawford Fund, Parliament House, Canberra, pp. 30–43.

Blumfield, T., Bacon, G., Lyons, K., Walters, P., Tutua, S. and Moveni, R. (2013) *Improving Silvicultural and Economic Outcomes for Community Timber Plantations in Solomon Islands by Interplanting with* Flueggea flexuosa *and other Pacific Agroforestry Species*, ACIAR Projects Final Reports No. FR2013-09. Australian Centre for International Agricultural Research, Canberra.

Boland, D.J. (1989) *Trees for the Tropics: Growing Australian Multipurpose Trees and Shrubs in Developing Countries*, ACIAR Monograph No. 10. Australian Centre for International Agricultural Research, Canberra.

Boland, D.J. and Turnbull, J.W. (1989) Australian tree species for fuelwood and agroforestry in China, Kenya, Thailand and Zimbabwe. In: Boland, D.J. (ed.) *Trees for the Tropics: growing Australian Multipurpose Trees and Shrubs in Developing Countries*. Australian Centre for International Agricultural Research, Canberra.

Booth, T.H. and Jovanovic, T. (2012) Assessing vulnerable areas for *Puccinia psidii* (eucalyptus rust) in Australia. *Australasian Plant Pathology* **41**, 425–429. doi:10.1007/s13313-012-0130-x

Booth, T.H., Old, K.M. and Jovanovic, T. (2000) A preliminary assessment of high risk areas for Puccinia psidii (Eucalyptus rust) in the Neotropics and Australia. *Agriculture, Ecosystems & Environment* **82**, 295–301. doi:10.1016/S0167-8809(00)00233-4

Brawner, J., Japarudin, Y., Lapammu, M., Rauf, R., Boden, D. and Wingfield, M.J. (2015) Evaluating the inheritance of Ceratocystis acaciivora symptom expression in a diverse Acacia mangium breeding population. *Southern Forests: A Journal of Forest Science* **77**, 83–90. doi:10.2989/20702620.2015.1007412

Brophy, J.J. and Doran, J.C. (1996) *Essential oils of tropical Asteromyrtus, Callistemon and Melaleuca species*, ACIAR Monograph No 40. Australian Centre for International Agricultural Research, Canberra.

Brundrett, M., Bougher, N., Dell, B., Grove, T. and Malajczuk, N. (1996) *Working with Mycorrhizas in Forestry and Agriculture*, ACIAR Monograph No 32. Australian Centre for International Agricultural Research, Canberra.

Brundrett, M., Dell, B., Malajczuk, N. and Gong, M. (1995) *Mycorrhizal research for forestry in Asia*, Proceedings No. 62. Australian Centre for International Agricultural Research, Canberra.

Byron, N. (2001) Keys to smallholder forestry. *Forests, Trees and Livelihoods* **11**, 279–294. doi:10.1080/14728028.2001.9752396

Carnegie, A.J., Lidbetter, J.R., Walker, J., Horwood, M.A., Tesoriero, L., Glen, M. and Priest, M.J. (2010) Uredo rangelii, a taxon in the guava rust complex, newly recorded on Myrtaceae in Australia. *Australasian Plant Pathology* **39**, 463–466. doi:10.1071/AP10102

CGIAR. (2005) *Science for Agricultural Development: changing Contexts, New Opportunities*. CGIAR Science Council Secretariat, Rome, Italy.

Chambers, R. and Ghildyal, B.P. (1985) Agricultural research for resource-poor farmers: the farmer-first-and-last model. *Agricultural Administration* **20**, 1–30. doi:10.1016/0309-586X(85)90063-9

Coe, R., Sinclair, F. and Barrios, E. (2014) Scaling up agroforestry requires research 'in' rather than 'for' development. *Current Opinion in Environmental Sustainability* **6**, 73–77. doi:10.1016/j.cosust.2013.10.013

Commonwealth of Australia. (1982) *Australian Centre for International Agricultural Research Act, 1982*. Commonwealth of Australia, Australia.

Corbishley, J. and Pearce, D. (2007) *Growing Trees on Salt-Affected Land*, ACIAR Impact Assessment Series Report No. 51. Australian Centre for International Agricultural Research, Canberra.

Cossalter, C. and Pye-Smith, C. (2003) *Fast-Wood Forestry: Myths and Realities*. Forest Perspectives. Center for International Forestry Research, Bogor, Indonesia.

Davis, J., Gordon, J., Pearce, D. and Templeton, D. (2008) *Guidelines for Assessing the Impacts of ACIAR's Research Activities*, ACIAR Impact Assessment Series Report No. 58. Australian Centre for International Agricultural Research, Canberra.

Davis, J. and Lubulwa, G. (1995) *An Overview of ACIAR's Economic Evaluation Activities with a Forestry Program Focus*, Economic Evauation Unit Working Paper No. 18. Australian Centre for International Agricultural Research, Canberra.

Dieters, M., Newby, J., Cramb, R., Sexton, G., McNamara, S. and Johnson, M. (2014) *Enhancing on-Farm Incomes through Improved Silvicultural Management of Teak in Luang Prabang Province of Lao PDR*, ACIAR Final Reports No. 2014-08. Australian Centre for International Agricultural Research, Canberra.

Doran, J.C. and Turnbull, J.W. (1997) *Australian Trees and Shrubs: species for Land Rehabilitation and Farm Planting in the Tropics*. Australian Centre for International Agricultural Research, Canberra.

FAO. (1978) *Forestry for Local Community Development*. Food and Agriculture Organisation of the United Nations, Rome.

FAO. (1981) *Forestry and Rural Development*, FAO Forestry Paper No. 26. Food and Agricultural Organization of the United Nations, Rome.

FAO. (1985) *Tree Growing by Rural People*, FAO Forestry Paper No. 64. Food and Agricultural Organisation of the United Nations, Rome.

FAO. (2005a) *State of the World's Forests 2005*. Food and Agriculture Organization of the United Nations, Rome, Italy.

FAO. (2005b) *Global Forest Resources Assessment 2005*. Food and Agriculture Organization of the United Nations, Rome, Italy.

FAO-IUFRO-CIFOR. (1997) *New arrangements for forest science*, Discussion paper prepared for the Intergovernmental Panel on Forests, fourth session, New York, Feb 97.

Farmer, B., Duncan, R., Enright, T. and Jarvie, W. (2013) *Independent Review of the Australian Centre for International Agricultural Research (ACIAR)*, ACIAR Corporate Reports No. CP025. Australian Centre for International Agricultural Research, Canberra.

Fisher, H. (2011) *Forestry in Papua New Guinea: A Review of ACIAR's program*, ACIAR Impact Assessment Series Report No. 73. Australian Centre for International Agricultural Research, Canberra.

Fisher, H. and Gordon, J. (2007a) *Improved Australian Tree Species for Vietnam*, ACIAR Impact Assessment Series Report No. 47. Australian Centre for International Agricultural Research, Canberra.

Fisher, H. and Gordon, J. (2007b) *Minimising Impacts of Fungal Disease of Eucalypts in South-East Asia*, ACIAR Impact Assessment Series Report No. 49. Australian Centre for International Agricultural Research, Canberra.

Fox, J. and Keenan, R. (2011) *Assessment, Management and Marketing of Goods and Services from Cutover Native Forests in Papua New Guinea*, ACIAR Final Reports No. FR2011-10. Australian Centre for International Agricultural Research, Canberra.

Fox, J.C., Keenan, R.J., Brack, C.L. and Saulei, S. (2011) *Native Forest Management in Papua New Guinea: Advances* in Assessment, Modelling *and Decision-Making*, ACIAR Proceedings No. 135. Australian Centre for International Agricultural Research, Canberra.

Gafur, A., Nasution, A., Yuliarto, M., Yong, W.C. and Sharma, M. (2015) A new screening method for *Ganoderma philippii* tolerance in tropical *Acacia* species. *Southern Forests: a Journal of Forest Science* **77**, 75–81. doi:10.2989/20702620.2014.999304

Gilmour, D.A., King, G.C., Applegate, G.B. and Mohns, B. (1990) Silviculture of plantation forest in central Nepal to maximise community benefits. *Forest Ecology and Management* **32**, 173–186. doi:10.1016/0378-1127(90)90169-C

Glen, M., Alfenas, A.C., Zauza, E.A.V., Wingfield, M.J. and Mohammed, C. (2007) *Puccinia psidii*: a threat to the Australian environment and economy —a review. *Australasian Plant Pathology* **36**, 1–16. doi:10.1071/AP06088

Glencross, K., Nichols, J.D., Grant, J.C., Sethy, M. and Smith, R.G.B. (2012) Spacing affects stem form, early growth and branching in young whitewood (*Endospermum medullosum*) plantations in Vanuatu. *International Forestry Review* **14**, 442–451. doi:10.1505/146554812804715865

Grant, J.C., Glencross, K., Nichols, J.D., Palmer, G., Sethy, M. and Vanclay, J.K. (2012) Silvicultural implications arising from a simple simulation model for *Endospermum medullosum* in Vanuatu. *International Forestry Review* **14**, 452–462. doi:10.1505/146554812804715874

Griffin, A.R., Chi, N.Q., Harbard, J.L., Son, D.H., Harwood, C.E., Price, A., Vuong, T.D., Koutoulis, A. and Thinh, H.H. (2015) Breeding polyploid varieties of tropical acacias: progress and prospects. *Southern Forests: A Journal of Forest Science* **77**, 41–50. doi:10.2989/20702620.2014.999303

Haines, R. (2005) The contribution of Australian and international forestry research. In: *Forests, Wood and Livelihoods – Finding a Future for All: Conference Conducted by the ATSE Crawford Fund on* 16 August *2005*. ATSE Crawford Fund, Parliament House, Canberra, pp. 74–79.

Hardiyanto, E. (2003) Growth and genetic improvement of *Eucalyptus pellita* in south Sumatra, Indonesia. In: Turnbull, J.W. (ed.) *Eucalypts in*

Asia. ACIAR Proceedings No. 111. Australian Centre for International Agricultural Research, Canberra.

Harisetijono, and Suriamihardja, S. (1991) Sandalwood in Nusa Tenggara Timur. In: McKinnell, F.H. (ed.) *Sandalwood in the Pacific Region*. Proceedings of a Symposium Held on 2 June 1991. Australian Centre for International Agricultural Research, Honolulu, Hawaii, pp. 39–43.

Harwood, C.E., Hardiyanto, E.B. and Yong, W.C. (2015) Genetic improvement of tropical acacias: achievements and challenges. *Southern Forests: a Journal of Forest Science* **77**, 11–18. doi:10.2989/20702620.2014.999302

Harwood, C.E., Kha, L.D., Dien, P.Q. and Thang, L.V. (1988) Performance of Australian dry-zone *Acacia* species on white sandy soil in dry, south-eastern Vietnam. In: Turnbull, J.W., Crompton, H.R. and Pinyopusarerk, K. (eds.) *Recent Developments in Acacia Planting*. ACIAR Proceedings No. 82. Australian Centre for International Agricultural Research, Canberra.

Harwood, C.E. and Nambiar, E.K.S. (2014) *Sustainable Plantation Forestry in South-East Asia*, ACIAR Technical Reports No. 84. Australian Centre for International Agricultural Research, Canberra.

Henderson, J.S. (2000) Evaluating the impact of forestry research for development. *International Forestry Review* **2**, 191–199.

Henderson, W. and Braidotti, G. (2013) *Innovation and entrepreneurs*, Partners, November 2013, 18–19. Australian Centre for International Agricultural Research, Canberra.

Høgh-Jensen, H., Oelofse, M. and Egelyng, H. (2010) New challenges in underprivileged regions call for people-centered research for development. *Society & Natural Resources* **23**, 908–915. doi:10.1080/08941921003671502

Humphreys, D. (1999) The evolving forests regime. *Global Environmental Change* **9**, 251–254. doi:10.1016/S0959-3780(99)00005-9

Humphreys, D. (2001) Forest negotiations at the United Nations: explaining cooperation and discord. *Forest Policy and Economics* **3**, 125–135. doi:10.1016/S1389-9341(01)00039-9

Irawan, S. and Tacconi, L. (2009) Reducing emissions from deforestation and forest degradation (REDD) and decentralized forest management. *International Forestry Review* **11**, 427–438. doi:10.1505/ifor.11.4.427

Irawanti, S., Ginoga, K., Prawestisuka, A. and Race, D. (2014) Commercialising community forestry in Indonesia: lessons about the barriers and opportunities in central Java. *Small-Scale Forestry* **13**, 515–526. doi:10.1007/s11842-014-9268-4

Kanowski, P., Blyth, M., Essacu, F., Holzknecht, H., Jenkin, B., Kuniata, L., Mulung, K. and Rollinson, S. (2014) *Value-Adding to Papua New Guinea Agroforestry Systems*, ACIAR Final Reports No. FR2014-10. Australian Centre for International Agricultural Research, Canberra.

Kha, L.D. and Nghia, N.H. (1991) Growth of some *Acacia* species in Vietnam. In: Turnbull, J.W. (ed.) *Advances in Tropical Acacia Research*. Australian Centre for International Agricultural Research, Canberra.

Khanzada, A.N., Morris, J.D., Ansari, R., Slavich, P.G. and Collopy, J.J. (1998) Groundwater uptake and sustainability of *Acacia* and *Prosopis* plantations in southern Pakistan. *Agricultural Water Management* **36**, 121–139. doi:10.1016/S0378-3774(98)00030-4

Lane, P.N.J., Morris, J., Ningnan, Z., Guangyi, Z., Guoyi, Z. and Daping, X. (2004) Water balance of tropical eucalypt plantations in south-eastern China. *Agricultural and Forest Meteorology* **124**, 253–267. doi:10.1016/j.agrformet.2004.01.015

Langrell, S.R.H., Glen, M. and Alfenas, A.C. (2008) Molecular diagnosis of *Puccinia psidii* (guava rust) – a quarantine threat to Australian eucalypt and Myrtaceae biodiversity. *Plant Pathology* **57**, 687–701. doi:10.1111/ppa.2008.57.issue-4

Lindner, R. (2011) *The Economic Impact in Indonesia and Australia of Investment in* Plantation Forestry Research, *1987–2009*, ACIAR Impact Assessment Series Report No. 71. Australian Centre for International Agricultural Research, Canberra.

Lindner, R., McLeod, P. and Mullen, J. (2013) *Returns to ACIAR's Investment in Bilateral Agricultural Research*, ACIAR Impact Assessment Series No. 86. Australian Centre for International Agricultural Research, Canberra.

Lynam, J.K. and Herdt, R.W. (1989) Sense and sustainability: sustainability as an objective in international agricultural research. *Agricultural Economics* **3**, 381–398. doi:10.1016/0169-5150(89)90010-8

McKenney, D.W. (1998) *Australian Tree Species Selection in China*, ACIAR Impact Assessment Series No. 8. Australian Centre for International Agricultural Research, Canberra.

Melati, Purnomo, H. and Shantiko, B. (2013) *Making Research Work for Small-Scale Furniture Makers: action Research in the Jepara Furniture Industry, Indonesia*, Center for International Forestry Research (CIFOR), Bogor, Indonesia.

Mendham, D. (2010) Adoption study for ACIAR project FST/1995/106. In: Pearce, D. and Templeton, D. (eds.) *Adoption of ACIAR Project Outputs - Studies of Projects Completed in 2005–06*. Australian Centre for International Agricultural Research, Canberra.

Mendham, D. and Hardiyanto, E. (2011) *Realising Genetic Gains in Indonesia and Australian Plantations through Water and Nutrient Management*, ACIAR Final Reports No. FR2011-07. Australian Centre for International Agricultural Research, Canberra.

Mercer, D.E. (2004) Adoption of agroforestry innovations in the tropics: a review. *Agroforestry Systems* **61–62**, 311–328.

Midgley, S., Bennett, J., Samontry, X., Stevens, P., Mounlamai, K., Midgley, D. and Brown, A. (2012) *Enhancing Livelihoods in Lao PDR through* Environmental Services *and Planted-Timber Products*, ACIAR Technical Reports No. 81. Australian Centre for International Agricultural Research, Canberra.

Midgley, S., Somaiya, R.T., Stevens, P.R., Brown, A., Nguyen, D.K. and Laity, R. (2015) *Planted Teak: Global Production and Markets, with Reference to Solomon Islands*, ACIAR Technical Reports No. 85. Australian Centre for International Agricultural Research, Canberra.

Morris, J., Ningnan, Z., Zengjiang, Y., Collopy, J. and Daping, X. (2004) Water use by fast-growing *Eucalyptus urophylla* plantations in southern China. *Tree Physiology* **24**, 1035–1044. doi:10.1093/treephys/24.9.1035

Myers, B., Fisher, R., Pickering, S. and Garnett, S. (2014) Post-project evaluation of the sustainability of development project outcomes: a case study in eastern Indonesia. *Development in Practice* **24**, 379–389. doi:10.1080/09614524.2014.899320

Nambiar, E.K.S. and Brown, A.G. (1997) *Management of Soil, Nutrients and Water in Tropical Plantation Forests*, ACIAR Monograph No. 43. Australian Centre for International Agricultural Research, Canberra.

Nambiar, E.K.S., Harwood, C.E. and Kien, N.D. (2014) Acacia plantations in Vietnam: research and knowledge application to secure a sustainable future. *Southern Forests: A Journal of Forest Science* **77**, 1–10. doi:10.2989/20702620.2014.999301

Nawir, A.A. (2013) Commercial community tree-growing inside state forests: an economic perspective from eastern Indonesia. *International Forestry Review* **15**, 200–217. doi:10.1505/146554813806948558

Newby, J., Cramb, R. and Sakanphet, S. (2014) Forest transitions and rural livelihoods: multiple pathways of smallholder teak expansion in northern Laos. *Land* **3**, 482–503. doi:10.3390/land3020482

Newby, J., Cramb, R.A., Sakanphet, S. and Mcnamara, S. (2012) Smallholder teak and agrarian change in northern Laos. *Small-Scale Forestry* **11**, 27–46. doi:10.1007/s11842-011-9167-x

Ojha, H.R. (2014) Beyond the 'local community': the evolution of multi-scale politics in Nepal's community forestry regimes. *International Forestry Review* **16**, 339–353. doi:10.1505/146554814812572520

Oktalina, S.N. (2015) *Forestry Livelihood Framework: unpublished Report for ACIAR Project FST/2008/030 'Overcoming Constraints to Community-Based Commercial Forestry in Indonesia'*. University of Gadjah Mada, Yogyakarta, Indonesia.

Old, K.M. and Mohammed, C. (2003) Managing diseases of eucalypts in southeast Asia. In: Turnbull, J.W. (ed.) *Eucalypts in Asia*. Proceedings of an International Conference held in Zhanjiang, China. 7–11 April 2003. Australian Centre for International Agricultural Research, Canberra.

Old, K.M., See, L.S., Sharma, J.K. and Yuan, Z.Q. (2000) *A Manual of Diseases of Tropical Acacias in Australia, South-East Asia and India*. CIFOR, Bogor, Indonesia.

Old, K.M., Wingfield, M.J. and Yuan, Z.Q. (2003) *A Manual of Diseases of Eucalyptus in South-East Asia*. CIFOR, Bogor, Indonesia.

Parliament of Australia. (1992) *Review of the Australian Centre for International Agricultural Research: a report of the Joint Committee on Foreign Affairs, Defence and Trade*. Australian Government Publishing Service, Canberra.

Pearce, D., Jilani, A. and Templeton, D. (2013) *Adoption of ACIAR Project Outputs 2013*, ACIAR Adoption Studies No. AS010. Australian Centre for International Agricultural Research, Canberra.

Phimmavong, S., Ozarska, B., Midgley, S. and Keenan, R. (2009) Forest and plantation development in Laos: history, development and impact for rural communities. *International Forestry Review* **11**, 501–513. doi:10.1505/ifor.11.4.501

Pistorius, T. (2012) From RED to REDD+: the evolution of a forest-based mitigation approach for developing countries. *Current Opinion in Environmental Sustainability* **4**, 638–645. doi:10.1016/j.cosust.2012.07.002

Pramono, A.A., Fauzi, M.A., Widyani, N., Heriansyah, I. and Roshetko, J.M. (2011) *Managing Smallholder Teak Plantations: field Guide for Farmers*. Center for International Forestry Research (CIFOR), Bogor, Indonesia.

Purnomo, H., Achdiawan, R., Melati, Irawati, R.H., Sulthon, Shantiko, B. and Wardell, A. (2014) Value-chain dynamics: strengthening the institution of small-scale furniture producers to improve their value addition. *Forests, Trees and Livelihoods* **23**, 87–101. doi:10.1080/14728028.2013.875279

Raitzer, D.A. and Lindner, D. (2005) *Review of the Returns to ACIAR's Bilateral R and D Investments*, ACIAR Impact Assessment Series Report No. 35. Australian Centre for International Agricultural Research, Canberra.

Rohadi, D., Roshetko, J., Perdana, A., Blyth, M., Nuryartono, N., Kusumowardani, N., Pramono, A., Widyani, N. and Fauzan, A. (2012) *Improving Economic Outcomes for Smallholders Growing Teak in Agroforestry Systems in Indonesia*, ACIAR Final Reports No. FR2012-11. Australian Centre for International Agricultural Research, Canberra.

Roshetko, J.M., Rohadi, D., Perdana, A., Sabastian, G., Nuryartono, N., Pramono, A.A., Widyani, N., Manalu, P., Fauzi, M.A., Sumardamto, P. and Kusumowardhani, N. (2013) Teak agroforestry systems for livelihood enhancement, industrial timber production, and environmental rehabilitation. *Forests, Trees and Livelihoods* **22**, 241–256. doi:10.1080/14728028.2013.855150

Russell-Smith, J., Hill, G., Djoeroemana, S. and Myers, B. (2000) Fire and sustainable agricultural and forestry development in Eastern Indonesia and Northern Australia. In: *Proceedings of an International Workshop Held at Northern Territory University, Darwin, Australia*, 13–15 April 1999. ACIAR Proceedings No. 91. Australian Centre for International Agricultural Research, Canberra.

Shepherd, K.R. (1985) Forestry research within the Australian centre for international agricultural research. *Australian Forestry* **48**, 77–78. doi:10.1080/00049158.1985.10674426

Turnbull, J.W. (ed.) (1991) Advances in tropical Acacia research. In: *Proceedings of a Workshop Held in Bangkok, Thailand*, 11–15 February 1991. ACIAR Proceedings No. 35. Australian Centre for International Agricultural Research, Canberra, pp. 234.

Turnbull, J.W. (2003) Eucalypts in Asia. In: *Proceedings of an International Conference Held in Zhanjiang, People's Republic of China*, 7–11 April 2003. Australian Centre for International Agricultural Research, Canberra.

Turnbull, J.W. (2007) *Development of Sustainable Forestry Plantations in China*: A *Review*, ACIAR Impact Assessment Series Report No. 45. Australian Centre for International Agriculture, Canberra.

Turnbull, J.W., Crompton, H.R. and Pinyopusarerk, K. (1988a) Recent developments in Acacia planting. In: *Proceedings of an International Workshop Held in Hanoi, Vietnam*, 27–30 October 1997. ACIAR Proceedings No. 82, Australian Centre for International Agricultural Research, Canberra.

Turnbull, J.W., Midgley, S.J. and Cossalter, C. (1988b). Tropical acacias planted in Asia: an overview. In: Turnbull, J.W., Crompton, H.R. and Pinyopusarerk, K. (eds.) *Recent Developments in Acacia Planting*. ACIAR Proceedings No. 82. Australian Centre for International Agricultural Research, Canberra.

United Nations (1992) *Non-Legally Binding Authoritative Statement of Principles for a Global Consensus on the Management, Conservation and Sustainable Development of All Types of Forests*. United Nations, New York.

United Nations. (2007) *Non-Legally Binding Instrument on All Types of Forests*. United Nations General Assembly, New York.

van Bueren, M. (2004a) *Acacia Hybrids in Vietnam*, ACIAR Impact Assessment Series Report No. 27. Australian Centre for International Agricultural Research, Canberra.

van Bueren, M. (2004b) *Eucalypt Tree Improvement in China*, ACIAR Impact Assessment Series Report No. 30. Australian Centre for International Agricultural Research, Canberra.

Viranamangga, R., Palmer, G. and Glencross, K. (2012) Plantation-grown whitewood timber in Vanuatu: challenges and opportunities for export and domestic use. *International Forestry Review* **14**, 486–491. doi:10.1505/146554812804715847

Westoby, J.C. (1989) *Introduction to World Forestry*. Basil Blackwell, Oxford, UK.

Wingfield, M.J., Slippers, B., Hurley, B.P., Coutinho, T.A., Wingfield, B.D. and Roux, J. (2008) Eucalypt pests and diseases: growing threats to plantation productivity. *Southern Forests: a Journal of Forest Science* **70**, 139–144. doi:10.2989/SOUTH.FOR.2008.70.2.9.537

Zethner, O. (1973) Assistance to agricultural scientists in the third world: a neglected field. *World Development* **1**, 53–55. doi:10.1016/0305-750X(73)90112-5

PART 1: UNDERSTANDING THE RESEARCH CONTEXT AND EVALUATION METHODS

Chapter 3. Evaluating relative success of donor-funded collaborative research projects.

This chapter reports the results of the literature review that I undertook of methodologies used to evaluate Official Development Assistance programs and projects, considers their utility for lessons learned, and presents the new methodology for evaluating the relative success of multiple research projects that I developed during this research. In approaching this task, I was particularly interested in the 'lessons learned' purpose of evaluation rather than the 'accountability' purpose. I was also looking for ways of efficiently comparing evaluation results from multiple projects, in order to help me find subsets of 'more successful' and 'less successful' projects to use in the research.

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Evaluating relative success of donor-funded collaborative research projects

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Abstract

This article reviews approaches commonly used to evaluate official development assistance programmes and projects, considers their utility for lessons learned, and proposes a simple methodology for evaluating the relative success of research projects. While current approaches each have appropriate uses, they do not readily provide a way of systematically evaluating the relative success of multiple projects without the need for complex reviews and analyses. This is a constraint for research managers in donor organizations, such as the Australian Centre for International Agricultural Research (ACIAR), in facilitating organizational learnings, including factors that contribute to project success. The proposed evaluation methodology assesses two dimensions of project success: achievements of the research project, and the impacts arising from the research. Four assessment criteria are identified for each dimension, and are scored largely by reviewing existing project records. The methodology includes suggested evaluation questions and evidence requirements, and generates a scoring matrix. The methodology allows assessors to vary the weighting assigned in scoring, and to interpret outcomes, in terms most relevant to the purpose and context of particular evaluations. It was tested by application to 10 collaborative forestry research projects funded by ACIAR and implemented in Vietnam. The results indicate that the evaluation methodology is useful in identifying the relative success of research projects, particularly for the research achievements dimension. Its usefulness for the research impacts dimension depends on the nature of the research project and its impacts, the timing of the assessment after project completion, and how well the impacts have been documented.

Key words: forestry; research; evaluation; methodology.

1. Introduction

The international community and individual nations fund agricultural and natural resource management research in developing countries through bilateral and multilateral official development assistance (ODA) programmes. These programmes facilitate the generation of knowledge and technologies to address national and global development goals related to increasing food security, reducing poverty, and ensuring sustainable management of natural resources (CGIAR 2005). This research plays an important role in enhancing the effectiveness of agricultural and natural resource management development initiatives (Ross 1988). The resulting knowledge and technologies have been shown to generate significant benefits to farmers and rural communities (Maredia and Raitzer 2010; Raitzer 2003).

Agricultural development, whereby new technologies are adopted by farmers, is fundamentally a complex social process with a high degree of non-linearity (Douthwaite et al. 2003). The conventional approach, whereby researchers develop technologies and extension workers disseminate them to farmers, is more suited to resource-rich farmers than to resource-poor farmers in developing countries (Chambers and Jiggins 1987a). An alternative approach, whereby farmers articulate their research needs to researchers and on farm trials focus more on dissemination potential than scientific rigour, may be better suited to resource-poor farmers (Chambers and Jiggins 1987b). Linking research-based knowledge with action for development is a difficult task that involves an understanding of tensions generated through engagement of multiple actors as well as

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of the power relationships that exist between these actors (van Kerkhoff and Lebel 2006).

The Australian Centre for International Agricultural Research (ACIAR) has a mission to achieve more productive and sustainable agricultural systems for the benefit of developing countries and Australia through international agricultural research partnerships (ACIAR 2014). Since 1982, ACIAR has been commissioning collaborative agricultural, fisheries, and forestry research projects using a relatively consistent approach to designing and implementing its projects (Bartlett Forthcoming). These projects seek to generate knowledge, technologies, and capacity to achieve better decision-making and changed agricultural practices and policies that, in turn, generate positive scientific, economic, social, or environmental impacts (ACIAR 2014).

Evaluation of ODA-funded programmes provides information on development policy and implementation to facilitate learning, to increase accountability, and, ultimately, to enhance the effectiveness of development cooperation (Liverani and Lundgren 2007). Approaches to evaluation of ODA-funded research projects are well-established and, although a diverse range of approaches are used, these were relatively static until the end of the past century (Rebien 1997). Since the development of the United Nations Millennium Development Goals in 2000, evaluation approaches have undergone substantial refinement (Conlin and Stirrat 2008; Millstone, Van Zwanenberg and Marshall 2010), including a greater emphasis on understanding what works, when, why, and for whom (Pawson and Tilley 1997; Liverani and Lundgren 2007; Pawson 2013), and on engaging stakeholders in evaluation of people-centred development projects (Armytage 2011). While donor agencies recognize the importance of evaluation, there are challenges in implementation: for example, the purpose of evaluation varies; multiple evaluation methodologies exist, many of which require specialist evaluation or economic analysis skills; and the conduct of comprehensive evaluations is costly.

ACIAR has a commitment to evaluating the effectiveness and benefits of its ODA-funded projects. It has a robust and independent system of impact evaluation (ACIAR 2014), principally involving the use of economic impact assessment tools. The economic returns to ACIAR's investment in bilateral research have been found to be high on average, but a small number of highly successful projects are responsible for most of the estimated benefit streams (Lindner, McLeod and Mullen 2013). ACIAR has documented the lessons learned from its impact assessments (Pearce 2010), but—like most development assistance agencies—it does not have a standard approach for identifying and comparing the achievements of every project. This limits ACIAR's ability to systematically study factors that contribute to the greater or lesser success of projects to improve its understanding of what works when, why, and for whom. As ACIAR has funded over 100 forestry research projects, which show varying documented levels of economic impact (Bartlett Forthcoming), these offer both an opportunity and case study material to further examine this topic.

In this article, the success of an 'agricultural' (including forestry) research project is considered to have two primary dimensions (Pearce 2010): the first is the extent to which planned research outputs are achieved and adopted by the participating scientists, known in ACIAR assessment terminology as 'next users' (Davis et al. 2008); the second is the extent of the impacts resulting from wider adoption by 'end users' (Pearce 2010), such as smallholder tree growers, typically outside of the project and beyond its life. The factors that influence success under the first dimension are likely to be largely within the control of a project team, whereas those under the second dimension are likely generally to be outside the control of a project team. On this basis, it is possible to have a research project that is successful in terms of the conception, design, and conduct of the research, but that does not lead to significant post-project adoption of new knowledge or technology. For example, a project testing for genetic resistance to pest insect predation within a tree species may develop and apply research methods successfully, but find that all provenances are equally susceptible to the pest. A contrasting example might be that of the adoption of improved agroforestry practices developed by a research project, which may depend on information reaching farmers through extension services, which may themselves be ineffective.

This study seeks to identify a simple method for determining the relative success of a series of ODA-funded research projects in the agriculture and natural resources domain, as an aide to identifying factors that contribute to greater or lesser success. The article reviews the main approaches to evaluation in a development context, particularly in relation to agricultural and forestry research projects; presents a methodology for evaluating the relative success of collaborative research projects; and tests the methodology by applying it to 10 of ACIAR's forestry research projects implemented in Vietnam. These projects provide good case study material for reasons discussed subsequently.

2. The purposes of evaluation in international development

Development evaluation is defined as an assessment, as systematic and objective as possible, of an ongoing or completed project, programme, or policy, its design, implementation, and results, to determine the relevance and fulfilment of objectives, developmental efficiency (inputs to outputs), effectiveness, impact, and sustainability (OECD 1991). Development evaluation ascribes special emphasis on two additional criteria: sustainability and impact, because development interventions take place in rapidly evolving operating environments (Picciotto 2013), and need to demonstrate their effectiveness in achieving development goals (Conlin and Stirrat 2008). Outputs are defined as the products, capital goods, and services resulting from a development intervention; outcomes are the likely or achieved short-term and medium-term effects of an intervention's outputs; and impacts are positive and negative, long-term effects produced by the intervention directly or indirectly, intended or unintended (OECD 2002).

Evaluation is generally considered to have two main purposes in the international development context: to improve future policies, programmes, and projects through lessons learned, and to provide a basis for accountability (OECD 1991). However, in practice, it is recognized that it is difficult to address both the programme improvement and accountability purposes in a single evaluation (Horton and Mackay 2003), and that different evaluation methodologies are fit for different purposes (Stern et al. 2012).

Some commentators (Rebien 1997; Raitzer and Norton 2009; IDRC 2010; Lucas and Longhurst 2010) consider that there are distinct purposes that may be given priority in development evaluation methodologies:

- for informing and justifying policy, strategy, and resource allocation processes;

- to provide accountability to donor constituents and beneficiaries on the programme's effectiveness and efficiency;
- to improve performance of ongoing programmes and their management;
- to provide knowledge of what works in what circumstances to be used in the design of future activities;
- to identify impacts and understand how research contributes to solving development problems; and
- to facilitate empowerment and capacity-building of institutions and programme stakeholders.

This multiplicity of purposes creates methodological challenges and complexity in the design of evaluation programmes. In practice, much of the evaluation effort is directed towards the accountability purpose, and there is comparatively less literature from evaluations on either the broader lessons for ODA-funded programmes or the specific lessons for specific projects.

3. A review of approaches to evaluation in the development context

The evolution of approaches to development evaluation is well-documented (Conlin and Stirrat 2008; Cracknell 1988; Armytage 2011), and it is characterized by a great variety of approaches (Rebien 1997), which include the use of quantitative, qualitative, and mixed methods. Evaluations should seek to understand what works, what does not work, and why, so that policy-makers can draw on these lessons to replicate, generalize, and scale up the results from development interventions (Stern et al. 2012). In some situations, randomized controlled trials are used to establish causal inference in development economics (Deaton 2010a) and social science research (Cartwright 2010). However, the routine use of such methods for project evaluation is often uninformative about why the results are what they are, and in such cases, nothing is learned about mechanisms that can be applied elsewhere (Deaton 2010b).

While different methods support different evaluation purposes, there is debate about the appropriateness of different methods (Stame 2010; White 2010). These include challenges to the validity of using randomized experimental approaches with community programmes (Pawson and Tilley 1998) or of using data from research station trials to estimate economic benefits to adopters (de Janvry, Dunstan and Sadoulet 2011). The most commonly used evaluation approaches, and some issues affecting their use for evaluating relative success of ODA-funded research projects, are summarized below.

3.1 The OECD evaluation criteria

The Organisation for Economic Cooperation and Development (OECD), through its Development Assistance Committee, has identified five evaluation criteria (OECD 2010) that are now used widely in the evaluation of ODA-funded programmes and projects:

- *Relevance*: the extent to which the aid activity is suited to the priorities and policies of the target group, recipient and donor.
- *Effectiveness*: a measure of the extent to which an aid activity attains its objectives.
- *Efficiency*: measures the outputs—qualitative and quantitative—in relation to the inputs.
- *Impact*: the positive and negative changes produced by a development intervention, directly or indirectly, intended or unintended.
- *Sustainability*: measuring whether the benefits of an activity are likely to continue after the donor funding has been withdrawn.

The five OECD evaluation criteria provide a framework for ODA evaluations, but they do not prescribe the methods by which a programme or project can be evaluated against each criteria. These criteria are most relevant for evaluating aid accountability and, depending on the nature of the methodology, they may or may not generate information that assists understanding of why one research project is more successful than another.

3.2 The Logical Framework

The Logical Framework, commonly referred to as 'Logframe', is a conceptual framework or an analytical tool that has been used by many ODA organizations to guide the design, implementation, and evaluation of projects (Jacobs, Barnett and Ponsford 2010). It is based on development of a matrix that enables project designers to list on one axis the planned project objectives, outputs, and activities, often with the expected outcomes and impacts, and then on the other axis to identify relevant objectively verifiable indicators of progress, the means of verification, and important assumptions or risks (Cracknell 1996). The underlying logic of this approach is that if certain inputs are supplied and activities undertaken, then intended outputs will result, given certain assumptions (Armytage 2011).

The Logframe is often used to report progress and achievements to project funders. It can be used by evaluators to assess actual achievements against the verifiable indicators and as a means to assess the efficiency evaluation criteria commonly required by donors (Armytage 2011). Because agricultural research impacts on poor farmers' livelihoods through highly complex, dynamic, and interactive processes, the Logframe approach, that assumes a single uninterrupted causative line between research and development, is likely to be unrealistic (Millstone, Van Zwanenberg and Marshall 2010). As a result, where interventions have both complicated (multilevel and multisite) and complex (emergent outcomes) aspects, theory of change approaches may be more appropriate (Rogers 2008).

While Logframes are a useful project tool if used in a flexible way, analysts (Dale 2003; Davies 2004; Bakewell and Garbutt 2005; Jacobs, Barnett and Ponsford 2010; Millstone, Van Zwanenberg and Marshall 2010) have identified four areas where its use can be problematic, particularly for evaluating agricultural research:

1. stakeholders generally are not involved in its preparation, the donor controls its finalization, and it does not include aspects of project management;
2. the reduction of complex, unpredictable social processes to a linear logic and not identifying which actors contribute to which activities;
3. its tendency to reduce consideration of emerging opportunities and unintended results; and
4. its inability to cope with real-world situations involving complex intervening processes and unpredicted circumstances during the project.

The Logframe methodology can assist an evaluation of achievements and impacts, but it does not provide a way of establishing the relative success of a project or why the results occurred.

3.3 Impact assessment

Impact assessment is the systematic analysis of the significant impacts brought about by given interventions, which requires

context-dependent judgements of what change is considered significant for whom and by whom (Roche 2000). Impact assessments can be undertaken before an intervention (ex ante), to anticipate impacts, or after an intervention (ex post), to provide proof of development effectiveness (Maredia 2009). In international agricultural research, they are generally used to provide research managers with information on how technologies and policies affect the welfare of agricultural producers and consumers (Hall et al. 2003). They may also be used to provide donors, governments, and the public with estimates of the benefits of publicly funded research (Liverani and Lundgren 2007), but the results may only be weakly linked to planning and management decision-making (Mackay and Horton 2003).

The dominant methodology for conducting impact assessments has been economic cost-benefit analysis, which utilizes the concept of social welfare to measure benefits and discounted measures of worth to compare costs with these benefits over time (Henderson and Burn 2004). Quantitative methods for impact assessments require the development of a counterfactual, to postulate the situation without any intervention (White 2010), which is challenging if real communities or farmers are involved, as people cannot simultaneously participate and not participate in a programme (Maredia 2009).

In practice, research and development interventions work as part of a causal package in combination with other factors, such as stakeholder behaviour, related programmes and policies, institutional capacities, cultural factors, and socioeconomic trends (Stern et al. 2012). There are many factors and actors that affect the long-term impacts of research projects and, in the case of socioeconomic impacts, intermediaries and the network of actor contributions play key roles in adoption of knowledge (Joly et al. 2015). While impact assessment has a role in project evaluation, commentators (Cracknell 1996; Alston and Pardey 2001; Ekboir 2003; Hall et al. 2003; Henderson and Burn 2004; Mercer 2004; Millstone, Van Zwanenberg and Marshall 2010; White 2010) have identified the following issues regarding its effectiveness for learning lessons:

- They are expensive to conduct and are generally only conducted on projects considered to be successful at the time of the study.
- The focus on average or total effect ignores the heterogeneous nature of communities and the fact that challenges facing farmers are highly variable and context-specific.
- Impacts may result from causes unrelated to the research being evaluated, including availability of credit, markets for inputs and outputs, security of land tenure, and the smallholder's ability to take risks.
- Constructing a plausible counterfactual, demonstrating causal effect, and determining which part of a benefit is attributable to an intervention are all difficult to achieve.
- They do not examine the research process and are uninformative about why particular outcomes did or did not occur as well as what elements of the project's design and implementation or other external processes contributed most to the outcomes.
- Because impacts generally only appear years after an intervention concludes, the opportunities for timely incorporation of lessons into scaling up activities are limited.

Impact assessment methodologies are best suited to quantifying economic impacts, rely on the ability to establish a credible counterfactual, and are expensive to conduct for large numbers of projects. If used to establish relative success of research projects, they are likely to have a bias towards those that can achieve high levels of economic impact quickly.

3.4 Participatory monitoring and evaluation

Participatory monitoring and evaluation refers to a wide range of methods, including participatory rural appraisal, community surveys, and storytelling, where those who are affected by the intervention are active participants in the process (Jacobs, Barnett and Ponsford 2010). Stakeholders are often involved when lesson-learning is the main evaluation objective, because the extent of success depends on the beneficiaries' reaction to the intervention (Cracknell 1996). This approach helps to capture local knowledge and views to facilitate greater relevance to local people's needs (Cullen, Coryn, and Rugh 2011) and greater accountability to them (Hilhorst and Guijt 2006). It also helps to focus on learning within organizations (Haddad, Lindstrom and Pinto 2010).

While participatory monitoring and evaluation clearly has a place, particularly in evaluations of people-centred projects, commentators (Cooke and Kothari 2001; Johnson, Lilja and Ashby 2003; Jacobs, Barnett and Ponsford 2010) have identified the following issues related to its broader application:

- the difficulty of achieving a high level of participation and the extent to which various stakeholders within diverse communities are engaged;
- the difficulty of aggregating qualitative data and drawing reliable conclusions;
- achieving effective community participation is difficult without capacity-building and requires a willingness of researchers to empower other stakeholders; and
- the participatory process can be time-consuming and expensive.

Depending on the nature of the evaluation questions used, participatory monitoring and evaluation approaches could help establish relative success of projects, though different people would evaluate each project, making it difficult to compare results across a large number of projects.

3.5 Theory-based evaluation

Theory-based evaluation evolved from other programme management initiatives where development agencies required project proposals to include a logic model or programme theory (Rogers and Weiss 2007). Various approaches to theory-based evaluation (Coryn et al. 2011), particularly the application of impact pathway analysis (Douthwaite et al. 2003), theories of change (CGIAR 2012), realistic evaluation (Pawson 2013), and contributions analysis (Mayne 2012), can enhance the understanding of research impact pathways. This is achieved by articulating what should happen following the intervention; questioning the causality assumptions in the relationships between research outputs, outcomes, and impacts; and identifying mechanisms by which change is expected to occur (Sullivan and Stewart 2006). These approaches can be implemented by the evaluator, by the project team, or with participation of project stakeholders.

Impact pathway analysis is a process for developing a causal model that links project inputs and activities to a chain of intended outcomes, and using this analysis to guide the evaluation (Rogers 2008). The impact pathway specifies the processes that connect the four stages of research: activities, outputs, outcomes, and impacts, distinguishing the processes that can and cannot be controlled by

researchers (Springer-Heinze et al. 2003). This approach recognizes that farmers often adapt new agricultural technologies and their own production systems, thereby affecting adoption rates (Douthwaite et al. 2003). Participatory impact pathway analysis is a subset of this approach, in which actors relevant to achieving the desired outcomes and impacts participate in the development of the impact pathway and network maps (Millstone, Van Zwanenberg and Marshall 2010). Network maps are drawn, both for the beginning of the project and the future, to identify the key actors that need to be engaged to achieve widespread adoption (Douthwaite et al. 2007).

Realistic evaluation (Pawson and Tilley 1997), which has mainly been associated with social programmes, involves the notion of context-mechanism-outcome pattern configurations, with the hypothesis that a programme or project results in an outcome because of the action of some underlying mechanisms, which only come into operation in particular contexts (Pawson 2013). Under realist evaluation, programmes are considered to comprise assumptions about participants' changed practice resulting from programme resources and activities (Astbury 2013). For the theory-based evaluator, context can be the key to uncovering the circumstances in which, and the reasons why, a particular intervention works, but it is multifaceted and operates at a variety of levels including political, social, organizational, and individual (Blamey and Mackenzie 2007).

Contribution analysis aims to make credible causal claims about interventions and their results using a six-step approach (Mayne 2001). It offers a way of addressing attribution where there is no counterfactual (Wimbush, Montague and Mulherin 2012). Its use has the potential to identify the impacts achieved and whether interventions do or do not work (Delahais and Toulemonde 2012), and should be embedded in the intervention's context and incorporate the stakeholders' perspectives (Mayne 2012). It may be well-suited to the evaluation of natural resource management interventions, which involve application of multiple actions, adapted by farmers over periods of time, and where the interventions are unlikely to be the sole cause of the impacts (Mayne and Stern 2013).

Various commentators (Simpson and Gill 2007; Franzel et al. 2008; Millstone, Van Zwanenberg and Marshall 2010; White 2010; Delahais and Toulemonde 2012) have identified the following issues with the application of these theory-based approaches:

- Theory-based approaches provide a framework for an evaluation, but they still need analytical methods to determine what has changed as a result of the intervention.
- Different stakeholders will have different levels of understanding of the wider operating context and some views may be asserted over others during the process.
- The process for developing the logic model can be costly, depending on the level of participation involved, and inaccessible to poor farmers.
- Applying contributions analysis is demanding in terms of resources and competencies, and hence, it is difficult to conduct rigorous analysis of more than a few causal issues.

Theory-based evaluation approaches should provide evaluators with useful information to understand why or why not particular achievements and impacts have occurred. However, they are not designed to identify the relative success of multiple projects and, in such cases, if they involve stakeholder participation, they may be expensive and time-consuming to apply.

Each of these four approaches to evaluation is supported by a strong body of literature and has a legitimate place in ODA evaluation, and each can facilitate the identification of achievements, impacts, and lessons from the implementation of research projects. However, they all have weaknesses in systematically evaluating a large programme of different projects in a cost-effective or timely manner. Perhaps the major deficiency is that, depending on how the approach is applied, it may not generate information that assists those such as research managers to understand why one project has been more successful than another.

4. A methodology for evaluating the relative success of collaborative research projects

Most ODA agencies have evaluation policies (IDRC 2010; DFID 2013) that recognize the multiple purposes of evaluation, including identifying lessons that can be applied to future projects. These agencies fund large numbers of projects that are implemented in many different countries, covering many different development issues and a wide range of implementation contexts. This presents a challenge in terms of understanding what lessons apply to what contexts and what factors contribute to the variable effectiveness of different projects. Systematically evaluating the relative success of each project in a cost-effective manner is fundamental to realizing this lesson-learning objective.

For organizations like ACIAR, the major deficiency with the current evaluation approaches, as identified above, constrains better understanding of the factors that contribute to the relative success of individual projects under different contexts. ACIAR currently utilizes impact assessments and adoption studies to identify lessons or generalizable mechanisms (ACIAR 2014). Because of the associated cost, ACIAR only conducts impact assessments on about 10% of its projects (Lindner, McLeod and Mullen 2013). This limits opportunities for learning lessons and, without an objective process for selecting which projects are evaluated in this way, may make it difficult to understand the factors that contribute to greater or lesser levels of success. This suggests the need for a more cost-effective rapid evaluation methodology to assess the relative success of individual projects that could be applied to all completed projects.

A review of the literature revealed little clear guidance and few examples of how to evaluate the relative success of multiple international agricultural or forestry research projects. Evaluations of ODA-funded forestry projects have been conducted to identify impacts (Raitzer 2010), to satisfy donor accountability interests (Raitzer and Lindner 2005), or at the programme level (Hardcastle et al. 2010). An evaluation of 12 World Bank PROFOR activities (Wells, Alderman and Stephanie 2011) compared the relative impacts of each project without explaining the assessment ranking methodology. Score-card approaches for comparing projects have been used as part of the ex ante evaluation for the selection of best project proposals, and a similar methodology to that proposed here has been used to evaluate international public health projects (Guinea et al. 2015). That method involved the use of a scoring matrix, and is intended for use where time and resources for evaluation tasks are limited, as is the case here.

The author therefore developed the following methodology, drawing on experience gained from managing international forestry research programmes. The methodology incorporates two dimensions that reflect 'success' in the terms described

Table 1. Rationale and maximum scores for eight evaluation criteria

Criteria		Rationale	Maximum score
C1	Project design	Good project design is fundamental to success. A well-designed research project includes agreed research questions with clear and achievable objectives, logically sequenced and well-targeted activities, appropriately skilled leader and project team, and an adequate budget.	2
C2	Results achieved	The degree of completion of planned research activities and delivery of agreed outputs is a major determinant of project success.	4
C3	Collaboration	As the projects involve scientists from international and local partners—the degree and effectiveness of collaboration and capacity-building is likely to influence project achievements.	2
C4	Publications	Publications, including journal articles, the project's final report, and other reports, provide the legacy of the project and opportunities for others to benefit from the research knowledge produced.	2
C5	Capacity-building	For ODA research projects, capacity-building is an important outcome that is under the control of the project team, and the outcomes from these activities should be apparent at the end of the project.	2
C6	Scientific outcomes	There should be evidence that the scientific knowledge and technologies developed by the project scientists are being utilized by next users and accessed by the wider scientific community.	4
C7	Economic outcomes	Adoption of new or improved agricultural technologies should lead to enhanced livelihoods and rural development. Economic impacts are the ones most commonly studied in impact assessments.	2
C8	Social and/or policy outcomes	Some research projects contribute to improved policies and many result in enhanced social outcomes, including empowerment, more equitable benefit sharing, and strengthening of local institutions.	2

previously: achievement of the intended research activities, and evidence of the apparent impacts. It identifies eight criteria, four for each of the two dimensions, and involves the evaluator(s) assessing project records to assign scores for each criterion. The rationale for selection of the eight criteria and the relative scores assigned for this evaluation are shown in Table 1.

The conduct of international agricultural research is a complex activity with achievements being influenced by the capacity of the collaborating partners and the stage of activities in the research-for-development continuum; hence, assessment of achievements has to be broader than published papers (Bantilan et al. 2004). Therefore, the evaluation criteria should be broad enough to cover the diversity of research projects and able to be assessed primarily from project records, supplemented where necessary by interviewing researchers who were involved in a project. On this basis, the four criteria considered most relevant to evaluating a project's research achievements in programmes such as ACIAR's are as follows:

- C1—project design;
- C2—results achieved;
- C3—collaboration; and
- C4—publications.

The selection of these four criteria[1] is based on the proposition that, for a collaborative research project to be considered successful in terms of research achievements, it will be based on a well-conceived project design, will exhibit strong collaboration amongst the partners, will have achieved the research it set out to do, and will leave a legacy of well-documented scientific publications. These four criteria are generally applicable to collaborative agricultural research projects such as those funded by ACIAR.

The four criteria considered most relevant to evaluating a project's research impacts in programmes such as ACIAR's are as follows:

- C5—capacity-building outcomes;
- C6—scientific outcomes;
- C7—economic outcomes; and
- C8—social and policy outcomes.

The selection of these criteria[2] is based on the proposition that, for a collaborative research project to be considered successful in terms of research impacts, it will have a legacy of partner scientists utilizing their enhanced capacity; it should have achieved scientific impact through adoption of the scientific outputs; and, as a result, there will be varying levels of economic, social, and policy impacts evident, depending on the nature of the research undertaken and the length of time that has elapsed since the project was completed. These categories are consistent with the four impact categories identified in an impact-oriented monitoring methodology recently proposed for international public health projects (Guinea et al. 2015): advancing knowledge (C6), capacity-building and research targeting (C5), informing decision-making practice and policy (C8), and population health and health sector benefits (C7).

The methodology proposed here involves evaluators reviewing project records and giving each project a score out of 10 for each dimension. Under each dimension, three criteria were assigned a maximum score of 2 and one criterion was assigned a maximum score of 4. The rationale for the higher scores was that, given it is an evaluation of research projects, the results achieved and scientific outcomes are likely to be most directly under the control of the project team. However, the relative weighting of scores for each criterion could be varied by evaluators, depending on the purpose and context of the evaluation. For each criterion, the evaluator considers the available evidence and assigns a score, to the nearest 0.5, up to the maximum score. The types of evaluation questions and nature of the evidence that could be sought when using this methodology are presented in Table 2. However, the precise nature of evaluation questions and evidence sought to determine scores for each criterion would be determined by the evaluators depending on the purpose and context of each evaluation.

In the case study application of this methodology, cumulative scores were derived for both the research achievements and the

Table 2. Evaluation questions and evidence guidance for the eight evaluation criteria

Criteria		Evaluation questions	Evidence sought
C1	Project design	How well was the project designed in terms of specific activities to address objectives and to facilitate adoption?	Consideration of research strategy and nature of research and dissemination activities planned; composition of project team; level of funding provided and co-contributions from partners; and findings from any mid-term review.
C2	Results achieved	What has been achieved in terms of completed activities and specified outputs?	Identification of the quality of actual achievements compared with planned outputs; adaptation of methods and activities to enhance outcomes; methods and level of dissemination of results; and findings from any end-of-project review.
C3	Collaboration	How well did the project team collaborate in conducting the research and what new skills did the scientists gain?	Information about collaboration in correspondence and reports; effectiveness of in-country coordination; joint authorship of reports; and level of networking developed and extent of within-project capacity-building activities.
C4	Publications	What is the relative magnitude and quality of publications produced?	Quality of information in final report; and amount and quality of project reports, including consideration of local language publications; number of published journal articles; and quality of website information.
C5	Capacity-building	What is occurring as a result of the enhanced capacity?	Evidence of enhanced capacity of project scientists; appraisal of how well these skills are being utilized; and local scientists' contributions to scientific publications.
C6	Scientific outcomes	How has the body of scientific knowledge been enhanced and how is this knowledge being used?	Number of international journal publications and citations; continuation of related research; evidence of networking between scientists; and appraisal of scientific contributions to international development.
C7	Economic outcomes	Has the research led to improved livelihoods or facilitated economic development?	Indications of improved productivity, greater access to markets, and higher prices for products; indications of costs or losses avoided; indications of greater employment levels or wages; and indications of new enterprises established.
C8	Social and/or policy outcomes	What changes to the social circumstances of project beneficiaries or the enabling policy environment have occurred that the project may have contributed towards?	Indications of enhanced social capital including strengthening of community institutions; evidence of empowerment of women and disadvantaged groups; more equitable benefit sharing from common property resources; and evidence of new or changed policies or effective input to policy processes.

research impacts of each project. The purpose of doing so was to give an indication of the relative success of the project compared with other projects evaluated similarly. However, in reality, it is unlikely that the overall success of a project can be judged solely on the basis of a cumulative evaluation score, because the design of different research projects gives greater or lesser emphasis to some of the identified criteria. Rather, the individual and cumulative scores can be used by evaluators to guide consideration of what factors are contributing to the identified level of success.

Methodologies such as this would normally be implemented through independent scoring of the projects by at least two evaluators, to reduce the potential for evaluator bias and to enhance the robustness and repeatability of results. Given that the case study evaluation presented later was only exploratory and for demonstration purposes, the scoring reported was conducted only by the author.

5. Case study: Evaluation of 10 forestry research projects from Vietnam

To test the applicability of this evaluation methodology, a case study trial was undertaken to evaluate the relative success of 10 collaborative forestry research projects funded by ACIAR, that were implemented in Vietnam between 1994 and 2012. Twenty ACIAR forestry research projects have been completed in Vietnam since 1992. The 10 projects examined in this evaluation were a representative sample of the different themes of research conducted across the 20-year period. Some projects were conducted entirely in Vietnam, but many involved multiple countries. The details of the projects evaluated are shown in Table 3.

The author conducted the evaluation by reviewing project records, particularly annual and final project reports, internal project research reports, external review and impact assessment reports, and relevant publications. The results of the evaluation of the relative success of each project for both the research achievements and the research impacts dimensions are presented in Table 4.

The information in project records was sufficient to determine scores for research achievements with a reasonable level of confidence, but the determination of scores for research impacts was more difficult, as the quality of information available was more variable. This was particularly the case for Criteria C7 and C8, which address economic, social, and policy outcomes, with no evidence evident for six of the projects. This may reflect the fact that these types of impacts often have a lag time in research projects, such as research on polyploidy breeding, or that the projects, such as control of the *Hypsipyla* pest, did not generate economic or policy outcomes. In any case, these outcomes highlight the point made above, that it may not be appropriate to simply add the scores from the four criteria to a single value. Alternatively, for example, evaluation scores could be compared visually, such as in a radar chart.

Table 3. Titles, timing and budget of the 10 ACIAR forestry research projects evaluated

Project code	Focus of research	Duration	Budget AUD $(nominal)
FST/1993/010	Physiology and genetic improvement of *Acacia auriculiformis*	1994–8	0.78 m
FST/1993/118	Provision and site testing of seeds of Australian trees	1993–9	3.84 m
FST/1997/024	Insect resistance and silvicultural control of *Hypsipyla* shoot borer	1999–2003	1.14 m
FST/1998/096	Domestication of Australian trees for reforestation and agroforestry systems	2000–4	2.21 m
FST/1999/095	Improving value chain for eucalypt sawn wood: Genetics and silviculture	2005–9	0.68 m
FST/2000/003	Mixed species plantations of high value trees for timber production and enhanced community services	2002–6	0.94 m
FST/2001/021	Improving value chain for eucalypt sawn wood: sawing and drying	2005–9	0.52 m
FST/2002/112	Domestication of Meliaceae and management of *Hypsipyla robusta* attack	2005–9	0.39 m
FST/2003/002	Development of polyploids and breeding strategies for commercial species of *Acacia*	2004–9	0.51 m
FST/2006/087	Optimizing silvicultural and management productivity of *Acacia* plantations for sawlogs	2008–12	0.93 m

Table 4. Evaluation scores for 10 forestry projects using criteria relevant to each of research achievements and research impacts

Project code	Research achievements				Total score	Research impacts				Total score
	C1	C2	C3	C4		C5	C6	C7	C8	
FST/1998/096	2.0	4.0	2.0	2.0	10	2.0	4.0	2.0	2.0	10
FST/1993/118	1.0	4.0	2.0	1.0	8	2.0	4.0	2.0	2.0	10
FST/2003/002	1.5	2.5	2.0	2.0	8	2.0	2.0	0	0	4
FST/2006/087	1.5	3.5	2.0	1.0	8	2.0	2.0	0	0	4
FST/1993/010	1.0	2.0	2.0	1.0	6	1.5	2.5	2.0	2.0	8
FST/1999/095	1.0	3.0	1.0	1.0	6	1.0	2.0	0	1.0	4
FST/2002/112	1.0	3.0	2.0	0	6	1.0	3.0	0	0	4
FST/2000/003	1.5	3.0	1.0	0.5	6	1.5	0.5	0	0	2
FST/2001/021	0.5	2.5	0.5	0.5	4	1.0	1.0	0	0	2
FST/1997/024	0.5	0.5	0.5	0.5	2	1.0	1.0	0	0	2

This case study showed that the evaluation methodology differentiated between projects in both research achievements and research impacts. Some projects scored highly for both achievements and impacts, others as having good achievements but limited impacts, and others still as having both limited achievements and limited impacts. The nature of these issues in the application of this two-dimensional evaluation methodology is demonstrated further by the following projects from the case study.

A 4-year project (FST/2006/087) conducted research on silvicultural regimes for *Acacia* sawlog production, which will require rotations of 7–10 years. It scored 8 for research achievements and 4 for research impacts using information available at the completion of the project in 2012. As the trials had not reached the rotation age, the project could not be expected to have generated evidence of economic, social, or policy impacts, even though it scored highly for all of the research achievement criteria. This highlights the importance of not judging the success of a research project of this nature on the basis of its research impact evaluation score.

A 5-year project (FST/2003/002) involved 'blue sky' research to develop polyploidy in tropical *Acacia* species as a possible way of enhancing genetic diversity and achieving sterility. It also scored 8 for research achievements and 4 for research impacts. As the development of polyploidy in trees had only previously been achieved with poplars (Griffin et al. 2015), this project was always going to have uncertain outcomes and require a multiphase research programme to achieve technologies that could be commercialized. At its completion, the project had generated good capacity-building impacts and some scientific impacts from new technologies for screening possible polyploidy plants and ACIAR agreed to fund another 5-year project. The application of the impact dimension of this methodology is not well-suited to research with uncertain outcomes or that requires investments longer than the traditional project period.

A 3-year project (FST/2002/112) involved replicated research trials in three countries to determine whether or not trees from the mahogany family (Meliaceae) displayed any genetic resistance to attack by the damaging *Hypsipyla* shoot borer. The research found that there was no natural genetic resistance to attack from this pest. It scored 6 for research achievements and 4 for research impacts, as there were no results that could be widely adopted by tree growers in South East Asia. While the extent of the research achievements was limited by inadequate funding, the project conclusively answered an important research question on the prospect of finding genetic resistance to the pest. For some research, even the best possible research design and implementation will not result in high impacts. Hence, caution is needed in using evaluations of relative success to guide future research investment choices to not adversely discriminate against this type of research.

A 4-year project (FST/2001/021) researched appropriate sawing and drying processes for small-diameter plantation-grown *Eucalyptus* logs. The project was poorly designed, with inadequate funding and incorrect underlying assumptions, and while technical solutions were identified, there was no interest in adoption by the next users (wood science researchers) or end-users (wood processors and manufacturers). This project scored poorly against the four criteria in each of the two evaluation dimensions. The methodology

enabled the identification of less successful projects, which is equally important as identifying successful projects, as there are undoubtedly important lessons to be learned from such projects.

6. Discussion

This research developed and tested a methodology for evaluating the relative success of ODA-funded collaborative research projects. The methodology considered both research achievements and research impacts and used a scoring matrix to assess four criteria for each dimension. The scoring matrix was relatively easy to use, and for most projects, it was possible to assign an appropriate score against each criterion based on the evidence in the project documentation. In some cases, there was little or no relevant information available for some criteria, which resulted in scores of zero being assigned. Having four criteria in each of two dimensions resulted in a reasonable spread of evaluation scores for the 10 projects, thereby facilitating consideration of projects with greater or lesser success.

In the case study, the methodology was able to distinguish relative success under both of the evaluation dimensions, with a range of scores from 2 to 10 for each dimension. The methodology to assess research achievements demonstrated its ability to distinguish relative success of projects. Two of the four projects with research achievement scores of 8 or more had concluded within the past 5 years, suggesting that the method could be useful in providing an early indication of relatively successful projects. While the methodology to assess research impacts demonstrated some ability to distinguish relative success, it was less effective than for research achievements. This was because for 6 of the 10 projects, there was no evidence of economic, social, or policy impacts—either because the project did not address these criteria or it was too early to assess them.

This two-dimensional methodology recognizes that there is great variability among research for development projects, and therefore, a degree of flexibility is needed in both the evaluation criteria and the way the results are interpreted. Some research projects may generate a range of impacts quickly, while others may be part of an ongoing programme with a long lag time to achieve impact. Also the type and extent of impacts can depend on the focus of the research project and the degree of external stakeholder engagement. By considering both research achievements and research impacts dimensions, the evaluation results will facilitate consideration of the factors that are, or are not, contributing to the desired outcomes.

The methodology was particularly useful for identifying the most successful research projects. The same two projects (FST/1998/096 and FST/1993/118) identified here as being the most successful were also identified as very successful by an ACIAR impact assessment study (Fisher and Gordon 2007). That study calculated economic benefits with a net present value of AUD $129 million and a benefit-cost ratio of 79.7. In a study on the returns from ACIAR's bilateral research investments (Lindner, McLeod and Mullen 2013), these two projects achieved the fifth highest benefit-cost ratio from the 103 projects assessed, with only 11 of the benefit-cost ratios examined exceeding 50:1. These impact assessment findings support the contention that consideration of the two dimensions of this evaluation methodology can assist with the timely and cost-effective identification of the most successful research projects.

The methodology also enabled the identification of the least successful projects, with two projects (FST/1997/024 and FST/2001/021) identified here as being the least successful. However, the situation is more complicated than for successful projects, particularly in relation to evaluation of the research impacts dimension. The case study identified projects that were quite successful in terms of research achievements, but which had only limited success in terms of research impact. When evaluating research achievements, 8 of the 10 projects achieved scores of $\geq$6, whereas when evaluating research impacts, only 3 projects achieved scores of $\geq$6 (Table 4) and each of these had been completed for at least 10 years. Two projects achieved a score of 8 for research achievements but only 4 for their research impacts, and both of these were phases of long-term research programmes. This result demonstrates the challenge of identifying success in research projects if the evaluation is based entirely on the impacts achieved. This does not mean that the evaluation methodology is problematic, as the same result is likely to occur using other evaluation methodologies, such as impact assessments.

There are plausible explanations as to why some projects score well against the research achievements dimension and poorly against the research impacts dimension under this evaluation methodology. In some situations, the factors that influence high impact will be beyond the control of the project team, but the impacts could not be achieved without the research being successful in developing an appropriate innovation. Much of the agricultural and forestry research requires a series of inter-related projects to fully develop a successful innovation and generate the full pathway of benefits (Pearce 2010). Projects that occur early in the life of such programmes are likely to have lower impact, if evaluated upon completion, compared with projects evaluated at the end of the programme. The timing of the evaluation after a project's completion may also affect the level of impact that can be identified. In some cases, research impacts will become more apparent with the passage of time as dissemination increases. In other situations, the impacts can become less apparent over time, particularly if the research and development effort is not sustained, while in other cases, the research may never lead to substantial impacts.

There are four reasons why it is beneficial for organizations like ACIAR to have a methodology that enables both cost-effective evaluation of all completed projects and the determination of relative success of projects. First, because of the long lag time associated with achieving impacts from agricultural and forestry research projects, an evaluation methodology that can identify relative success at an early stage will facilitate timely incorporation of lessons into ongoing research programmes. To do this well requires a good understanding of factors that are contributing to greater and lesser success in different projects and different contexts. Second, the methodology could be used to categorize all completed projects on the basis of their apparent success. This information could then be used to assist with more systematic sampling of projects to be included in the more detailed and costly impact assessment studies. Third, having a methodology that could easily be repeated for the same project over time would help improve understanding on how the various impact categories manifest themselves over time in different contexts. Fourth, the information from an early evaluation of research impacts may give an indication of situations whereby further investment is needed by partner governments and donor agencies to facilitate greater adoption of research outputs.

7. Conclusions

A variety of well-developed methodologies exist for evaluating ODA-funded projects, and all have appropriate applications, given an appropriate focus, adequate resources, and an understanding of the most appropriate timing for conducting the evaluation. However, there is a paucity of methodologies available for undertaking cost-effective

evaluations of large numbers of projects, and particularly for evaluating the relative success of projects to aid a better understanding of what works, or does not work, in different situations.

The evaluation methodology described in this article enables the success of ODA-funded collaborative research projects with quite different contexts, nature, and expected outputs to be evaluated from typical project records. One of the challenges in developing an evaluation methodology for this purpose is the need to balance the number and complexity of criteria to be evaluated with the practicality of sourcing sufficient useful information to conduct the evaluation. The consideration of 8 criteria and the use of a simple scoring matrix enabled judgements to be made about a project's relative success in terms of both its research achievements and research impacts.

The case study evaluation of 10 completed ACIAR forestry research projects from Vietnam demonstrated that the methodology was most informative for evaluating the research achievements dimension. The results from the research impacts dimension were also useful, provided they were interpreted appropriately depending on the nature of the research project and expected impacts, and in the context of the timing of the evaluation after project completion. This was particularly the case for projects where either the research was part of a longer-term programme, or where important scientific results were generated, even if they will not lead to widespread adoption. This suggests that appropriate interpretation of the results of the impact dimension of the methodology is particularly important, and emphasizes the need for evaluators who are well-informed about the purpose and context of the research.

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Notes

1. ACIAR's approach to commissioning collaborative agricultural research places significant emphasis on the project design, the documentation of results, the collaboration and relationships between partners, and the communication of scientific results.
2. ACIAR's approach requires ex ante and ex post identification of these categories of impact.

References

ACIAR. (2014) *ACIAR Strategic Plan 2014-18*, p. 20. Canberra: Australian Centre for International Agricultural Research.

Alston, J. M. and Pardey, P. G. (2001) 'Attribution and Other Problems in Assessing the Returns to Agricultural R&D', Agricultural Economics, 25/2–3: 141–52.

Armytage, L. (2011) 'Evaluating Aid: An Adolescent Domain of Practice', Evaluation, 17/3: 261–76.

Astbury, B. (2013) 'Some Reflections on Pawson's Science of Evaluation: A Realist Manifesto', *Evaluation*, 19/4: 383–401.

Bakewell, O. and Garbutt, A. (2005) *The Use and Abuse of the Logical Framework Approach*. Stockholm: SIDA.

Bantilan, M. C. S. et al. (2004) 'Dealing with Diversity in Scientific Outputs: Implications for International Research Evaluation', *Research Evaluation*, 13/2: 87–93.

Bartlett, A. G. (2016) 'The Evolution and Impacts of ACIAR's Forestry Research Program over Three Decades', *Australian Forestry*, 79/3: 171–88.

Blamey, A. and Mackenzie, M. (2007) 'Theories of Change and Realistic Evaluation: Peas in a Pod or Apples and Oranges?', *Evaluation*, 13/4: 439–55.

Cartwright, N. (2010) 'What are Randomised Controlled Trials Good For?', *Philosophical Studies*, 147/1: 59–70.

CGIAR. (2005) *Science for Agricultural Development: Changing Contexts, New Opportunities*. Rome, Italy: CGIAR Science Council Secretariat

CGIAR. (2012) *Strategic overview of CGIAR Research programs Part I. Theories of Change and Impact Pathways*. Rome, Italy: Independent Science and Partnership Council.

Chambers, R. and Jiggins, J. (1987a) 'Agricultural Research for Resource-Poor Farmers Part I: Transfer-of-Technology and Farming Systems Research', *Agricultural Administration and Extension*, 27/1: 35–52.

Chambers, R. and Jiggins, J. (1987b) 'Agricultural Research for Resource-Poor Farmers Part II: A Parsimonious Paradigm', *Agricultural Administration and Extension*, 27/2: 109–28.

Conlin, S. and Stirrat, R. L. (2008) 'Current Challenges in Development Evaluation', *Evaluation*, 14/2: 193–208.

Cooke, B. and Kothari, U. (2001) *Participation, the New Tyranny?* London: Zed Books.

Coryn, C. L. S. et al. (2011) 'A Systematic Review of Theory-Driven Evaluation Practice from 1990 to 2009', *American Journal of Evaluation*, 32/2: 199–226.

Cracknell, B. E. (1988) 'Evaluating Development Assistance: A Review of the Literature', *Public Administration and Development (1986-1998)*, 8/1: 75.

Cracknell, B. E. (1996) 'Evaluating Development Aid: Strengths and Weaknesses', *Evaluation*, 2/1: 23–33.

Cullen, A. E., Coryn, C. L. S. and Rugh, J. (2011) 'The Politics and Consequences of Including Stakeholders in International Development Evaluation', *American Journal of Evaluation*, 32/3: 345–61.

Dale, R. (2003) 'The Logical Framework: An Easy Escape, A Straitjacket, or a Useful Planning Tool?', *Development in Practice*, 13/1: 57–70.

Davies, R. (2004) 'Scale, Complexity and the Representation of Theories of Change', *Evaluation*, 10/1: 101–21.

Davis, J. et al. (2008) *Guidelines for Assessing the Impacts of ACIAR's Research Activities ACIAR Impact Assessment Series Report No. 58*. Canberra, Australia: Australian Centre for International Agricultural Research 120.

de Janvry, A., Dunstan, A. and Sadoulet, E. (2011) *Recent Advances in Impact Analysis Methods for Ex-post Impact Assessments of Agricultural Technology: Options for the CGIAR*. Rome: CGIAR Independent Science and Partnership Council Secretariat.

Deaton, A. (2010a) 'Instruments, Randomization, and Learning about Development', *Journal of Economic Literature*, 48/2: 424–55.

Deaton, A. (2010b) 'Understanding the Mechanisms of Economic Development', *The Journal of Economic Perspectives*, 24/3: 3–16.

Delahais, T. and Toulemonde, J. (2012) 'Applying Contribution Analysis: Lessons from Five Years of Practice', *Evaluation*, 18/3: 281–93.

DFID. (2013) *International Development Evaluation Policy*, 20 pp. London: UK Department for International Development.

Douthwaite, B. et al. (2003) 'Impact Pathway Evaluation: An Approach for Achieving and Attributing Impact in Complex Systems', *Agricultural Systems*, 78/2: 243–65.

Douthwaite, B. et al. (2007) 'The Impact Pathways Approach: A Practical Application of Program Theory in Research-for-Development', *The Canadian Journal of Program Evaluation*, 22/2: 127–59.

Ekboir, J. (2003) 'Why Impact Analysis should not be used for Research Evaluation and What the Alternatives Are', *Agricultural Systems*, 78/2: 166–84.

Fisher, H. and Gordon, J. (2007) *Improved Australian Tree Species for Vietnam*, 33 pp. Canberra: Australian Centre for International Agricultural Research.

Franzel, S. et al. (2008) 'Collaborative Monitoring and Evaluation: Assessing the Uptake of Improved Fallows and Biomass Transfer in Western Kenya', *Experimental Agriculture*, 44/1: 113–27.

Griffin, A. R. et al. (2015) 'Breeding Polyploid Varieties of Tropical Acacias: Progress and Prospects', *Southern Forests: a Journal of Forest Science*, 77/1: 41–50.

Guinea, J. et al. (2015) 'Impact Oriented Monitoring: A New Methodology for Monitoring and Evaluation of International Public Health Research Projects', *Research Evaluation*, 24/2: 131–45.

Haddad, L., Lindstrom, J. and Pinto, Y. (2010) 'The Sorry State of M&E in Agriculture: Can People-centred Approaches Help?', *IDS Bulletin*, 41/6: 6–25.

Hall, A. et al. (2003) 'From Measuring Impact to Learning Institutional Lessons: An Innovation Systems Perspective on Improving the Management of International Agricultural Research', *Agricultural Systems*, 78/2: 213–41.

Hardcastle, P. et al. (2010) *Finnish Support to Forestry and Biological Resources: Evaluation Report 2010: 5/I*, 174 pp. Helsinki: Ministry of Foreign Affairs for Finland.

Henderson, J. S. and Burn, R. W. (2004) 'Uptake Pathways: The Potential of Bayesian Belief Networks to Assist the Management, Monitoring and Evaluation of Development-Orientated Research', *Agricultural Systems*, 79/1: 3–15.

Hilhorst, T. and Guijt, I. (2006) *Participatory Monitoring and Evaluation - A Process to Support Governance: A Guidance Paper,* 52 pp. Washington DC, USA, The World Bank.

Horton, D. and Mackay, R. (2003) 'Using Evaluation to Enhance Institutional Learning and Change: Recent Experiences with Agricultural Research and Development', *Agricultural Systems*, 78/2: 127–42.

IDRC. (2010) *IDRC Evaluation Strategy 2010-2015*. Ottawa: International Development Research Centre.

Jacobs, A., Barnett, C. and Ponsford, R. (2010) 'Three Approaches to Monitoring: Feedback Systems, Participatory Monitoring and Evaluation and Logical Frameworks', *IDS Bulletin*, 41/6: 36–44.

Johnson, N. L., Lilja, N. and Ashby, J. A. (2003) 'Measuring the Impact of User Participation in Agricultural and Natural Resource Management Research', *Agricultural Systems*, 78/2: 287–306.

Joly, P.-B. et al. (2015) 'ASIRPA: A Comprehensive Theory-Based Approach to Assessing the Societal Impacts of a Research Organization', *Research Evaluation*. 24/4: 440–453.

Lindner, R., McLeod, P. and Mullen, J. (2013) *Returns to ACIAR's Investment in Bilateral Agricultural Research*, p. 48. Canberra: Australian Centre for International Agricultural Research.

Liverani, A. and Lundgren, H. E. (2007) 'Evaluation Systems in Development Aid Agencies: An Analysis of DAC Peer Reviews 1996—2004', *Evaluation*, 13/2: 241–56.

Lucas, H. and Longhurst, R. (2010) 'Evaluation: Why, for Whom and How?', *IDS Bulletin*, 41/6: 28–35.

Maredia, M. K. (2009) *Improving the Proof: Evolution of and Emerging Trends in Impact Assessment Methods and Approaches in Agricultural Development*, 48 pp. Washington: International Food Policy Research Institute.

Maredia, M. K. and Raitzer, D. A. (2010) 'Estimating Overall Returns to International Agricultural Research in Africa through Benefit-cost Analysis: A "best-evidence" Approach', *Agricultural Economics*, 41/1: 81–100.

Mayne, J. (2001) 'Addressing Attribution through Contribution Analysis: Using Performance Measures Sensibly', *The Canadian Journal of Program Evaluation*, 16/1: 1–24.

Mayne, J. (2012) 'Contribution Analysis: Coming of Age?', *Evaluation*, 18/3: 269.

Mayne, J. and Stern, E. (2013) *Impact Evaluation of natural Resource Management Research Programs: A Broader View*, 79 pp. Canberra: Australian Centre for International Agricultural Research.

Mercer, D. E. (2004) 'Adoption of Agroforestry Innovations in the Tropics: A Review', *Agroforestry Systems*, 61–62/1–3: 311–28.

Millstone, E., Van Zwanenberg, P. and Marshall, F. (2010) 'Monitoring and Evaluating Agricultural Science and Technology Projects: Theories, Practices and Problems', *IDS Bulletin*, 41/6: 75–87.

OECD. (1991) *Principles for Evaluation of Development Assistance*. Paris: OECD.

OECD. (2002) *Glossary of Key Terms in Evaluation and Results Based Management*, 38 pp. Paris: OECD.

OECD. (2010) Quality Standards for Development Evaluation. *DAC Guidelines and Reference Series*, 2nd edn. Paris, OECD Publishing. 34.

Pawson, R. (2013) *The Science of Evaluation: A Realist Manifesto*. London: SAGE Publications Ltd.

Pawson, R. and Tilley, N. (1997) *Realistic Evaluation*. London, United Kingdom, Sage. 256.

Pawson, R. and Tilley, N. (1998) 'Caring Communities, Paradigm Polemics, Design Debates', *Evaluation*, 4/1: 73–90.

Pearce, D. (2010) *Lessons Learned from Past ACIAR Impact Assessments, Adoption Studies and Experience*. Canberra: Australian Centre for International Agricultural Research.

Picciotto, R. (2013) 'The logic of development effectiveness: Is it time for the broader evaluation community to take notice?', *Evaluation*, 19/2: 155–70.

Raitzer, D. A. (2003) *Benefit-cost meta-analysis of investment in Intenational Agricultural Research Centres of the CGIAR*, 45 pp. Rome: Food and Agricultural Organisation of the United Nations.

Raitzer, D. A. (2010) 'Assessing the Impact of Policy-Oriented Research: The Case of CIFOR's Influence on the Indonesian Pulp and Paper Sector', *World Development*, 38/10: 1506–18.

Raitzer, D. A. and Lindner, D. (2005) *Review of the Returns to ACIAR's Bilateral R & D investments*. Canberra: Australian Centre for International Agricultural Research.

Raitzer, D. A. and Norton, G. W. (2009) *Prioritizing Agricultural Research for Development: Experiences and Lessons*. Wallingford, United Kingdom, CAB International. 234.

Rebien, C. C. (1997) 'Development Assistance Evaluation and the Foundations of Program Evaluation', *Evaluation Review*, 21/4: 438–60.

Roche, C. (2000) 'Impact Assessment: Seeing the Wood and the Trees', *Development in Practice*, 10/3–4: 543–55.

Rogers, P. J. (2008) 'Using Programme Theory to Evaluate Complicated and Complex Aspects of Interventions', *Evaluation*, 14/1: 29–48.

Rogers, P. J. and Weiss, C. H. (2007) 'Theory-based Evaluation: Reflections Ten Years On: Theory-Based Evaluation: Past, Present, and Future', *New Directions for Evaluation*, 2007/114: 63–81.

Ross, L. A. (1988) 'Collaborative Research for More Effective Foreign Assistance', *World Development*, 16/2: 231–6.

Simpson, R. and Gill, R. (2007) 'Design for Development: A Review of Emerging Methodologies', *Development in Practice*, 17/2: 220–30.

Springer-Heinze, A. et al. (2003) 'Impact Pathway Analysis: An Approach to Strengthening the Impact Orientation of Agricultural Research', *Agricultural Systems*, 78/2: 267–85.

Stame, N. (2010) 'What Doesn't Work? Three Failures, Many Answers', *Evaluation*, 16/4: 371–87.

Stern, E. et al. (2012) Broadening the Range of Designs and Methods for Impact Evaluations. *Working Paper 38*. 127 pp. Department of International Development.

Sullivan, H. and Stewart, M. (2006) 'Who Owns the Theory of Change?', *Evaluation*, 12/2: 179–199.

van Kerkhoff, L. and Lebel, L. (2006) 'Linking Knowledge and Action for Sustainable Development', In *Annual Review of Environment and Resources*, pp. 445–77. Palo Alto: Annual Reviews.

Wells, M. P., Alderman, C. and Stephanie, A. (2011) *An Evaluation of the Impacts of Selected Activities Supported by the Program on Forests*, 57 pp. Washington, DC: Program on Forests (PROFOR).

White, H. (2010) 'A Contribution to Current Debates in Impact Evaluation', *Evaluation*, 16/2: 153–64.

Wimbush, E., Montague, S. and Mulherin, T. (2012) 'Applications of Contribution Analysis to Outcome Planning and Impact Evaluation', *Evaluation*, 18/3: 310–29.

PART 2: THE CASE STUDIES

Chapter 4. Identifying factors that influence the success of forestry research projects implemented in developing countries: case study results from Vietnam.

This chapter reports the results of the first of three country case studies, in this case focussing on ten completed forestry research projects from Vietnam. It utilises the new evaluation methodology (presented in Chapter 2) and describes the methods used in the three phases of research, which are also applied in the other two case studies. In conducting the first case study, I developed and tested the methods for conducting the interviews and analysing the interview data, that was used in all three case studies. The chapter presents the findings from Vietnam on the relative success of the ten projects, the identified factors that affect success, and some apparent relationships between these factors and relative success of a project.

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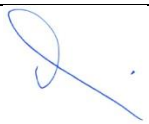
Bartlett	Instigated the work, undertook the research and analysis, drafted the manuscript and co-ordinated revisions following peer review.	
Kanowski	Provided academic guidance on the structure, content and presentation of data and further academic input to revisions following external review	
van Kerkhoff	Provided academic guidance on the structure, content and presentation of data and further academic input to revisions following external review	
Byron	Provided academic guidance on the structure, content and presentation of data and further academic input to revisions following external review	

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Identifying factors that influence the success of forestry research projects implemented in developing countries: case study results from Vietnam

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This paper reports a qualitative investigation of factors contributing to success in 10 collaborative international forestry research projects funded by the Australian Centre for International Agricultural Research (ACIAR) in Vietnam. Success factors were identified, and the relative success of projects was evaluated in terms of research achievements and impacts, through analysis of ACIAR's project records and interviews with key project participants. This process identified 22 factors considered to either enhance or diminish project success, with the most frequently identified being: collaborative scoping and design; skills mix and time allocations; funding and equipment; scientists' commitment and collaboration; and capacity building. Three projects, representing different categories of assessed research achievement and impact, were examined for evidence of relationships between these success factors and the relative success of the projects. This assessment suggested that most of the identified success factors were evident in the project with high research achievements and high impacts; and, conversely, that there was evidence of factors that diminish project success in a project that had low achievements and low impacts. The results reported here can help improve the design and implementation of future collaborative forestry research projects.

Introduction

International collaborative research in agricultural and natural resource management is often funded through Official Development Assistance (ODA) programs, and evaluations have shown such investments can generate significant benefits to farmers and rural communities (Raitzer, 2003; Lindner *et al.*, 2013). The conduct of international agricultural research is a complex activity, producing a wide variety of outputs, which are influenced by factors such as the capacity of the collaborating partners and the stage of activities in the research-for-development continuum (Bantilan *et al.*, 2004). In addition, the pathways from research to impact in agriculture, forestry, fisheries and natural resources research are complex and non-linear (Millstone *et al.*, 2010; Mayne and Stern, 2013; Joly *et al.*, 2015), and definitions of 'success' can be contested and controversial (McLeod *et al.*, 2012). ODA interventions interact with other factors and rarely lead to development outcomes on their own; consequently, there are various challenges in establishing relationships between an intervention and its impact (Stern *et al.*, 2012). Similarly, even well-designed evaluations of research investments may not lead to organizational learning for research project leaders, team members or funders (Forss *et al.*, 1994; Horton and Mackay, 2003). For example, findings from economic impact assessments may not identify why changes occurred, or how to improve future research programs (Horton and Mackay, 2003).

In this context, this article seeks to identify factors that affect the success of international collaborative forestry research projects, and explore whether there is an apparent relationship between these factors and the evaluated level of success of a project. We investigated these questions through a comparative qualitative analysis of 10 collaborative forestry research projects between Australia and Vietnam. We evaluated the relative success of each project from project records, using a previously developed methodology (Bartlett, 2016a), and surveyed the views of key project participants, and then sought evidence of how the factors were manifested in projects with different levels of success. We distil lessons that are able to be influenced, enhanced or facilitated by those who design and

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fund ODA-research projects and those with responsibility for implementing these projects. Our approach was informed by that of McLeod *et al.* (2012), who advocated a qualitative approach focused on 'understanding how the various project stakeholders subjectively perceived project outcomes and the evaluation criteria they drew on in doing so'.

There is limited published literature that documents the generic factors that affect the success of ODA-funded forestry research projects. As Blamey and Mackenzie (2007) have noted, context can be the key to uncovering the circumstances in which, and the reasons why, a particular intervention works. Because each project inevitably faces its own unique set of opportunities and constraints, it is often difficult to define which factors are unique and context dependent, and which are more widely applicable. There are many external factors that can play a role in determining the ultimate impact (or lack of impact) for any given project. Some examples from the literature include the availability of the technologies, such as improved germplasm (Franzel *et al.*, 2004); dissemination of knowledge in a form appropriate to the users (Thangata and Alavalapati, 2003); their capacity to take risks (Mercer, 2004); market incentives (Pattanayak *et al.*, 2003); security of land tenure (Suyanto *et al.*, 2005) and their access to ancillary resources such as skills and finance (Farrington *et al.*, 1997). Forestry research typically involves complex systems involving biophysical and social elements and which, compared with agricultural systems, require much longer time frames to produce the desired products (Henderson, 2000). For forestry research projects undertaken in developing countries, achieving positive impacts is likely to depend on multiple factors, which can be interdependent (Byron, 2001).

The Australian Centre for International Agricultural Research

The Australian Centre for International Agricultural Research (ACIAR) is a federally funded agency that commissions collaborative agriculture, fisheries and forestry research projects in developing countries. ACIAR projects seek to generate knowledge, technologies and capacity to achieve better decision-making, changed agricultural practices and policies that, in turn, generate positive scientific, economic, social or environmental impacts (ACIAR, 2014). In ACIAR terminology, projects generate outputs which, if adopted, lead to outcomes and impacts. Outputs are defined as the products of the research, including technologies, knowledge, capacity and policy inputs, that can be adopted or used by the 'next users' as inputs for further research; outcomes are changes in practice, products or policies consequent on the adoption of outputs and impacts are changes in markets, the state of common resources and to individuals or communities that can be attributed to the adoption of the research outputs by the 'end users' of the research (Davis *et al.*, 2008).

In accordance with its governing legislation (Commonwealth of Australia, 1982), ACIAR funds research projects conducted by Australian or international scientists with scientists in partner countries, with capacity building of research partners supported in parallel with research activities. Over a 30-year period, ACIAR has invested over AUD 100 million to fund 150 forestry projects and activities in 29 countries; most projects have been implemented in Indonesia, Vietnam and Papua New Guinea (Bartlett, 2016b). ACIAR has a commitment to evaluating the effectiveness and benefits of its projects (ACIAR, 2014), with all large projects having externally conducted end-of-project reviews, some projects having adoption studies conducted by former project leaders and ~10 per cent of projects subject to externally conducted impact assessments. However, it does not have a standard approach for comparing project achievements or for identifying the factors that contribute to the relative success of projects (Bartlett, 2016a).

Defining project success

In this paper, success is defined following the interpretation used in other ACIAR studies as having two primary dimensions: the first is the extent to which planned research outputs are achieved and adopted by 'next users', such as the participating scientists, farmers, processors and policy makers, termed achievements; the second is the extent of the impacts resulting from wider adoption of the research outputs by 'end users', typically stakeholders outside the project and often beyond its life, termed impacts (Pearce, 2010). In both dimensions, this study focuses on those factors that could be influenced by those responsible for research design, implementation and support, rather than external factors that are beyond the reach of the project leaders or managers to influence. Carden (2004) presents a complementary approach that focuses on factors beyond the reach of a research project, such as its influence on policy formulation.

Factors believed to influence a research project's success

There are few studies that report project-level factors contributing to success of agricultural research projects. An ACIAR impact assessment study (Pearce, 2010) surveyed 30 people, who were Australian project leaders or ACIAR-employed research program managers and country managers and identified 14 factors that contributed to successful project outcomes, with the following six factors most often identified by respondents:

- Clearly defined objectives and research questions based on a clear stakeholder needs and with a project plan that assigns clear responsibilities to participants.
- Strong communication leading to good collaboration, including formal and informal communication arrangements and compatible language skills.
- Trust, complementarity and alignment of interests, including effective interpersonal relationships and mutual empathy and respect.
- Good project leadership and management support, including the capacity to empower the research team, co-ordinate diverse groups and engender institutional support.
- Strong and capable research team, including having the right technical abilities and the time commitment to undertake the required research; and
- Institutional support both for the Australian and in-country partner.

This list provides a useful benchmark for this research, which seeks to confirm their applicability for forestry research projects from Vietnam and explore whether or not scientists from the partner country have the same view as Australians on the relevance of these factors.

Forestry development and ACIAR's forestry research investments in Vietnam

Vietnam is a country of almost 90 million people in South-East Asia. Over the 60 years up to 1995, forest extent declined to ~9.8 million hectares or 29.6 per cent of Vietnam's land area (Government of Vietnam, 2007), but has since increased to 14.7 million hectares or 44.4 per cent of land area (FAO, 2015). Planted forests have played a very significant role in achieving this restoration of forest cover, with a total of 3.66 million hectares or 25 per cent of Vietnam's forest area being classified as planted (FAO, 2015). Since 1988, the Government of Vietnam has allocated forest land to communities on renewable 50 year leases and much of this has been planted with fast-growing short rotation species such as *Eucalyptus* and *Acacia* (Amat *et al*., 2010). An estimated 250 000 smallholder farmers are growing acacia plantations on rotations of 5–10 years (Nambiar *et al*., 2014), primarily for the production of pulpwood.

Following the *Doi Moi* economic reform policies of the mid-1980s, the Government of Vietnam introduced a range of measures, including land tenure reforms and forestry policies, such as the 1998 Five Million Hectare Reforestation Program, to encourage smallholder farmers to plant commercial trees. The Vietnam Forestry Development Strategy 2006–2020 aspires to 16.24 million hectares of forest by 2020, including 4.15 million hectares of plantations, and recognizes the contribution that science and technology transfer has made to the quality and efficiency of its afforestation programs (Government of Vietnam, 2007). Both the achievements and concerns about aspects of Vietnam's reforestation program have been discussed in the literature. For example, increasingly substantial economic benefits for smallholders and regional economies are being generated from acacia plantations (Byron, 2014): but these gains followed an initial phase of poor growth associated with use of inferior germplasm or incorrect species-site matching (Nguyen and Gilmour, 1999); and future growth of this sector depends on avoiding environmental degradation (Amat *et al*., 2010), and improving and sustaining productivity from these plantings (Nambiar *et al*., 2014). Concerns have been expressed about loss of higher quality agricultural land (de Jong *et al*., 2006), disruption of existing land use systems (Clement and Amezaga, 2009), and loss of access for collection of non-timber forest products, and inequitable allocation to poor households (McElwee, 2009).

Vietnam has a large and expanding timber processing industry, with the annual value of export timber products growing at a rate of 40 per cent between 2000 and 2010 (Phuc and Canby, 2011); by 2005, wood products had become the nation's fifth largest export commodity. Vietnam is now one of the world's largest exporters of secondary wood products, principally furniture, with wood products' export earnings reaching $3.4 billion in 2010 (Phuc and Canby, 2011). However, there may be impediments that prevent smallholders from fully capitalizing on the markets associated with domestic wood processing industries (Putzel *et al*., 2012).

ACIAR's forestry research investments in Vietnam began in 1993 and, until 2011, all projects were undertaken only with the Forest Science Institute of Vietnam, the predecessor of the Vietnam Academy of Forest Sciences. From 1992 to December 2014, ACIAR completed 20 forestry research projects in Vietnam; the majority of these operated in multiple countries, with the activities in Vietnam being part of a larger research project. The projects cover 5 of the 10 research themes from the ACIAR forestry program (Bartlett, 2016b):

Theme 1: Domestication and improvement of Australian trees.
Theme 2: Silviculture for Australian trees.
Theme 3: Domestication and silviculture of non-Australian trees.
Theme 4: Forest health and biosecurity.
Theme 5: Value added processing and treatment of wood.

The domestication and improvement of Australian tree species, which could be grown on short rotations, contributed greatly to the expansion of the planted forests in Vietnam. Various species of *Eucalyptus*, *Melaleuca* and *Acacia* were first introduced to Vietnam in the 1950s and 1960s. ACIAR's projects on the domestication and management of *Eucalyptus* and *Acacia* have facilitated significant improvement in the productivity of these Australian trees in Vietnam (Fisher and Gordon, 2007), with 50–100 per cent gains in wood production demonstrated in trials (Harwood *et al*., 2015). By 2013, the estimated area of *Acacia* plantations was 1.1 million hectares and there was a further 200 000 hectares of *Eucalyptus* plantations (Harwood and Nambiar, 2014).

Methods

The methodology for this case study involved a preparatory phase to identify suitable research projects for the study followed by three phases of research: identification of success factors; evaluation of relative success of projects and identification of relationships between the success factors and the relative success of different projects. This process is illustrated in Figure 1.

Phase 0: Identification of projects for the case study

In the preparatory phase, 10 of the 20 projects ACIAR implemented in Vietnam between 1994 and 2012 (Table 1) were selected for the case study, taking into account the following factors:

- Focusing on medium to large research projects, rather than small research activities.
- Ensuring representation of projects from each research theme.
- Inclusion of projects across the 20-year period, including some projects that were part of a linked program over at least 10 years.
- Inclusion of some projects conducted entirely in Vietnam and some that were regional projects, with smaller components conducted in Vietnam.
- Having adequate project records available, including project document, annual final report and external end-of-project review report.

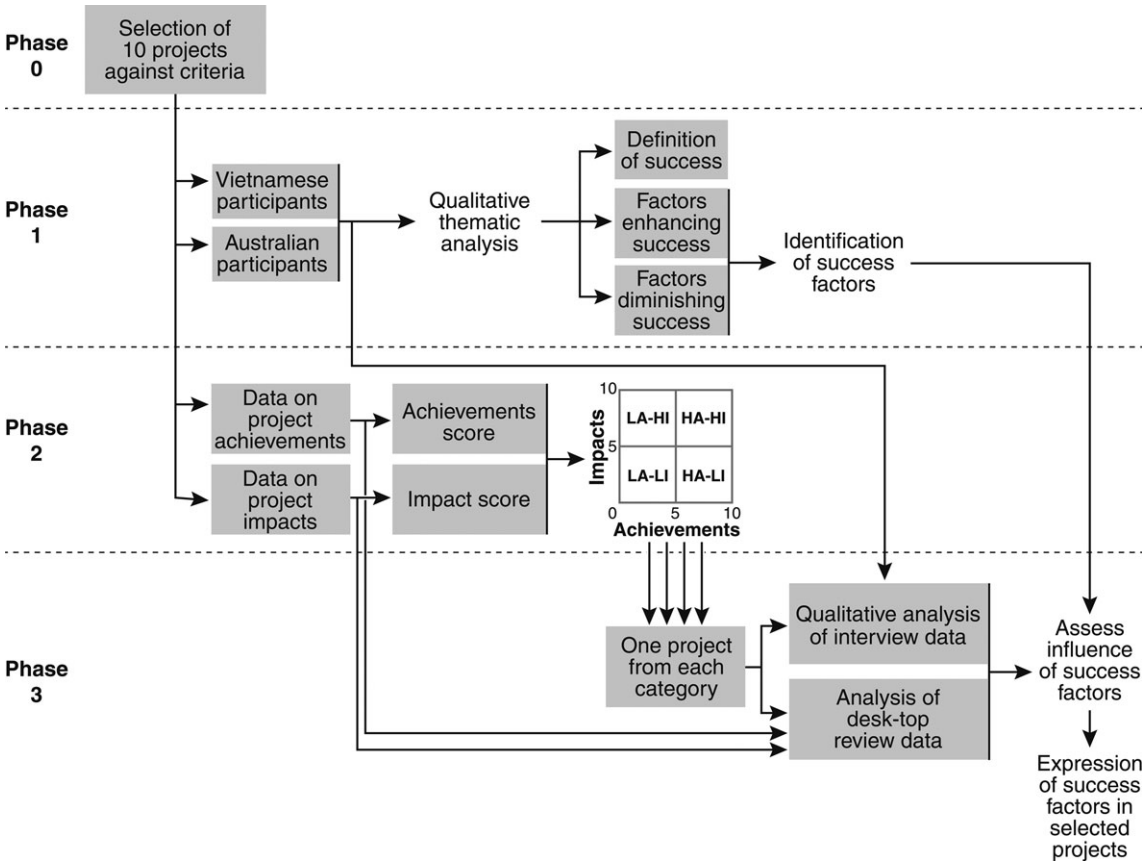


Figure 1 Research methods flow diagram.

Table 1 Summary information for ACIAR's completed Vietnam forestry projects

ACIAR project code	Focus of research	Duration	Funding (AUD M)	Countries	Theme
FST/1992/027	Domestication of Australian *Acacias*	1994–1998	1.040	China, Vietnam	T1
FST/1993/010*	Physiology and genetics of *Acacia auriculiformis*	1994–1998	0.785	Thailand, Vietnam	T1
FST/1993/112	Double diffusion treatment of eucalypt poles	1994–1995	0.061	Vietnam	T5
FST/1993/118*	Seeds of Australian trees	1993–1999	3.844	Vietnam +6 others	T1
FST/1994/019	Genetic diversity and propagation of mangroves	1999–2005	0.867	Thailand, Vietnam	T3
FST/1994/033	Leucaenas for Asian, Pacific and Australian agriculture	1995–2000	1.279	Vietnam +2 others	T3
FST/1994/041	Minimizing disease impacts on eucalypts in south-east Asia	1996–2000	0.788	Thailand, Vietnam	T4
FST/1995/124	Insect threats to *Acacia* and *Eucalyptus* plantations in Asia	1997–1998	0.138	Vietnam +3 others	T4
FST/1996/005	Domestication strategies for important species of Meliaceae	1999–2003	0.629	Vietnam +3 others	T3
FST/1997/024*	Resistance and control of *Hypsipyla* shoot borer	1999–2003	1.145	Vietnam +4 others	T4
FST/1998/085	The taxonomy of *Hypsipyla robusta* and allied species	1999–2001	0.153	Vietnam + 9 others	T4
FST/1998/096*	Domestication of Australian trees	2000–2004	2.209	Vietnam +7 others	T1
FST/1999/095*	Improving eucalypt sawn wood: genetics and silviculture	2005–2009	0.683	China, Vietnam	T2
FST/2000/003*	Mixed species plantations of high value trees	2002–2006	0.940	Vietnam	T3
FST/2001/021*	Improving eucalypt sawn wood: sawing and drying	2005–2009	0.520	China, Vietnam	T5
FST/2002/112*	Domestication of Meliaceae and management of *Hypsipyla*	2005–2009	0.386	Vietnam +2 others	T4
FST/2003/002*	Development of triploids and polyploid breeding for Acacias	2004–2009	0.506	Vietnam, Sth Africa	T1
FST/2006/087*	Sawlog silviculture for Acacias	2008–2012	0.928	Vietnam	T2
FST/2005/047	Eucalyptus biosecurity workshop	2004	0.043	Vietnam	T4
FST/2007/025	Socio-economic study of *Acacia*	2004–2009	0.029	Vietnam	T5

* Projects analysed in the case study.

Phase 1: Identification of project success factors

We used qualitative data, derived from interviews with former research project participants, to identify the factors considered to be most influential in achieving or hindering project success. For each project, the Australian project leaders, Vietnamese project coordinators and other scientists who had been involved in each project were interviewed. A total of 24 scientists, comprising 11 from Australia and 13 from Vietnam, were identified from project records and interviewed individually by the primary author using a standard set of questions (available as Supplementary online material). Interviewees were asked to explain what they thought constituted success for an ACIAR project, and then to nominate five factors that can enhance project success, and five factors that can diminish project success. Other questions sought their views about aspects of the project's design, implementation and other contextual factors. The research protocol was approved by the Australian National University Human Ethics Committee (protocol no. 2014/051).

HyperRESEARCH (Researchware, Inc. – http://www.researchware.com/ accessed 13 June 2014) qualitative data analysis software was used to analyse interview data to establish perspectives on the definition of project success and to facilitate aggregation of thematic aspects of the responses into two lists of factors that contribute to either enhancing or diminishing project success. Individuals' responses to questions about each project's design and implementation were analysed as well as their responses on factors affecting project success. When respondents covered aspects of multiple factors in a single response, each aspect was identified, allocated to the most relevant factor and counted. When the respondents identified aspects related to the same factor in two or more responses, the aspect was counted only once, against the most relevant factor.

The primary author compared the two lists to identify complementary expressions of the same factor, and prepared concisely worded statements of the factors that can enhance or diminish the success of research projects. The data were further analysed to identify the frequency of identification of each success factor, to give an indication of which success factors are considered most important, and whether there were any notable differences in the factors identified by Vietnamese or Australian respondents.

Phase 2: Evaluation of relative success of the case study projects

We used qualitative data drawn from internal ACIAR project records to evaluate the relative success (the evaluation questions and guidance on evidence sought are available as Supplementary online material) of each of the 10 projects. The records included project documents; annual reports; mid-term reviews; final reports; external end-of-project reviews; adoption studies and external impact assessments; project-related publications and written correspondence between ACIAR and project staff. These data provided perspectives from project participants, research program managers and external reviewers of projects.

To evaluate relative success, the author used a score-card matrix methodology (Bartlett, 2016a) for each project, and assigned scores for four criteria related to research achievements: project design; results achieved; collaboration and publications; and four criteria related to research impacts: capacity building outcomes; scientific outcomes; economic outcomes; and social and policy outcomes. Under this methodology, scores totalling 10 were assigned for each of research achievements and research impacts, with both research achievements and scientific outcomes criteria assigned scores of up to 4 and all other criteria assigned scores of up to 2. The resulting scores for each of research achievements and research impacts were summed and then graphed. Scores of 0.0–5.0 were considered to be low achievements or low impacts; scores of 5.1–10.0 were considered to be high achievements or high impacts. This approach facilitated the identification of projects that represent one of four project success categories based on the assessed levels of research achievements and impacts: high achievements–high impacts; high achievements–low impacts; low achievements–low impacts and low achievements–high impacts.

Phase 3: Identification of relationships between success factors and the level of relative success achieved by different projects

To explore possible relationships between the identified success factors and the evaluated relative success of a project, three projects, representing different project success categories, were selected for a more detailed analysis. The nature of the selected projects is shown in Table 2; with further information on the type of research conducted in each project and the way in which various success factors influenced its level of success provided in Appendix 1.

As this task was exploratory in nature, two methods were used. Firstly, interview responses (IR) from the Australian and Vietnamese respondents who had held leadership positions in the selected projects were further analysed using HyperRESEARCH to identify any references to the way each of the success factors identified through the Phase 1 methods had enhanced or diminished success. Secondly, relevant project records (PR) for the three projects were reviewed by the primary author to identify any evidence about the way the various success factors may have influenced the project's success. Using these two sources of information, subjective ratings were assigned by the primary author for the apparent influence of each of these success factors on the project's success. The following five category rating system was used:

Strongly enhances – presence of factor appears to have strongly enhanced success.
Enhances – presence of factor appears to have enhanced success.
Neutral – no evidence that the factor enhanced or diminished success.
Diminishes – absence of factor appears to have diminished success.
Strongly diminishes – absence of factor appears to have strongly diminished success.

Results

Interpreting success and identifying success factors

Views from project participants on what constitutes project success varied considerably, with some finding it difficult to articulate what success meant to them. The HyperRESEARCH analysis enabled the sentiments from the participants' responses to be combined into a definition of success. A successful ACIAR forestry

Table 2 Details of projects analysed to explore relationships between success factors and project success categories

Project success category	Project number	Theme	Title of project
High achievements-High impacts	FST/1998/096	T1	Domestication of Australian trees for reforestation and agroforestry
High achievements-Low impacts	FST/2006/087	T2	Optimizing silvicultural management and productivity of *Acacia* plantations for sawlogs
Low achievements-Low impacts	FST/2001/021	T5	Improving the value chain for eucalypt sawn wood: sawing and drying

research project can be considered to be one which, in the context of the time and resources available, involves good scientific methods, achieves what it set out to do, enhances capacity, facilitates ongoing scientific relationships and generates knowledge or technologies that can improve the system under investigation and result in benefits for the next or end users.

The HyperRESEARCH analysis of participants' responses on the factors that can enhance or diminish project success identified 20 factors that they considered to enhance project success and 19 factors they considered to diminish project success (Table 3). When considered as a whole, there were 22 different factors identified that influence project success (Table 3), with

Table 3 Success factors, ordered by their frequency of identification, showing participants' views on aspects that enhance or diminish project success

Factor No.	Success factors	Participants' views on factors that can enhance success (ES) or diminish success (DS)
1	Collaborative scoping and design	ES: Collaboration and quality of project scoping and design DS: Topic poorly understood, poor design, too complicated or ambitious, inflexible
2	Skills mix and time allocations	ES: Appropriate researcher skills mix and time allocations DS: Researcher skills or time allocation
3	Funding, facilities and equipment	ES: Adequate funding and other resources, including donor and partner contributions DS: Inadequate funds or restrictions on funding flow or provision of research facilities
4	Scientists commitment, collaboration and focus	ES: Good commitment, implementation focus and collaboration of partner scientists DS: Scientists not committed or collaborating well, inflexible or not completing tasks
5	Team and technical capacity building	ES: Supporting capacity building, informal and formal study DS: Poor focus on capacity or team building
6	Mutual benefit of research topic	ES: Selection of research issue with mutual benefits DS: Research not linked to both partners' interests
7	Selection and commitment of partner institutions	ES: Appropriate selection and commitment of partner institutions DS: Inappropriate selection and lack of commitment from partner institution
8	Site selection and scientific rigour of trials	ES: Selection of sites and scientific rigour of trials DS: Inappropriate locations for research trials or lacking secure tenure
9	Leadership and management	ES: Effective project leadership and management DS: Poor leadership or management of project
10	Strong, culturally appropriate team relationships	ES: Strong, respectful and culturally appropriate team relationships DS: Collaborating scientists not understanding or respecting local culture and partners
11	Time spent on in-country collaboration	ES: Sufficient time spent in country DS: Inadequate time in country
12	Effective communications and research networks	ES: Within-project communications, use of knowledge, researcher networks DS: Poor communications or misunderstandings due to language barriers
13	Links to impact pathway and user benefits	ES: Impact pathway links during and after project generating benefits for end users DS: Research not connected to impact pathway or outputs is inappropriate for end users
14	Implementation flexibility, monitoring and review	ES: Implementation flexibility with systems for managing, monitoring and adapting activities DS: No flexibility to adapt or no review during implementation
15	Continuity of partner institutions and team	ES: Continuity of partner institutions and team DS: Collaborators not motivated or leaving project
16	Duration of project	ES: Not identified DS: Project duration too short
17	Donor influence on design	ES: Donor input to quality of project design DS: Donor imposition on project design or inadequate discussion with country partner
18	Long-term research collaborations	ES: Long-term relationships *via* follow on projects DS: Not identified
19	Continuation of research post project	ES: Scientists actively continuing research theme after project using enhanced capacity DS: Scientists not do not utilize new capacity or continue research post project
20	Alignment with national development objectives	ES: Alignment with government objectives DS: Not contributing to government objectives
21	Experience of project leader in country	ES: Not identified DS: Project leader lacking country experience or cultural sensitivity
22	Trust within team	ES: Trust within team DS: Not identified

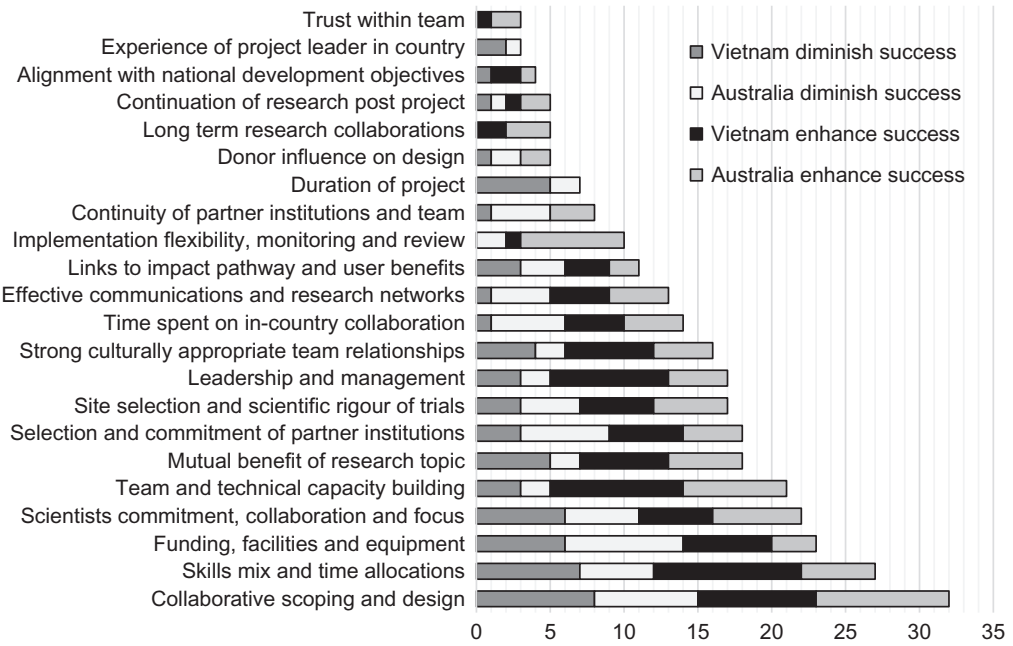


Figure 2 Frequency of identification of the 22 project success factors by Australian and Vietnamese respondents.

most responses on factors which diminish success being the converse of those nominated for enhancing success. However, among the responses, there were three factors identified that diminish success, and two factors that enhance success, for which there was no converse factor nominated.

The interview data comprised 299 participant responses related to individual success factors. The frequency of identification of the 22 success factors by the 11 Australian and 13 Vietnamese respondents, for responses related to both enhancing and diminishing project success, is shown in Figure 2. The two most frequently identified factors, which together represented 20 per cent of the responses, were collaborative scoping and design; and skills mix and time allocations. Twelve of the success factors (Nos. 1–12 from Table 3) together represented 80 per cent of the responses, and so were considered as the most important factors affecting project success in this study.

Most of the success factors were identified consistently by Australian and Vietnamese respondents, but there were some differences apparent. Vietnamese respondents more frequently identified success factors such as skills mix and time allocation; mutual benefit of research topic; strong, culturally appropriate relationships; leadership and management; and duration of project. Australian respondents more frequently identified success factors such as: time spent on in-country collaboration; effective communications and research networks; implementation flexibility, monitoring and review; continuity of partner institutions and team; and donor influence on design.

Evaluation of the relative success of the forestry projects

The results of this analysis (shown in Figure 3) demonstrate that the apparent success of a project can be quite different depending on whether the evaluation focuses on its achievements, its impacts or both its achievements and its impacts. In the

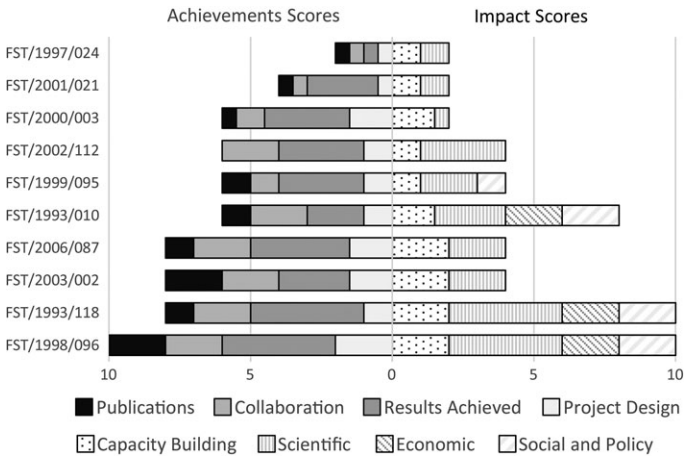


Figure 3 Evaluation of relative success of the 10 Vietnam forestry projects.

evaluation based on research achievements, eight projects (80 per cent) received scores of six or more, whereas in the evaluation based on research impacts, seven projects (70 per cent) received scores of only four or less. If success requires both high achievements and high impacts, then only three projects (30 per cent) could be considered successful.

Considering the evaluation scores for both the research achievements and the research impacts, it is apparent that the case study projects represent three categories of project success (see Figure 4): projects with low achievements and low impacts; projects with high achievements but low impacts and projects with high achievements and high impacts. In this case study, there were no examples of projects that had the unlikely combination of low achievements yet high impacts.

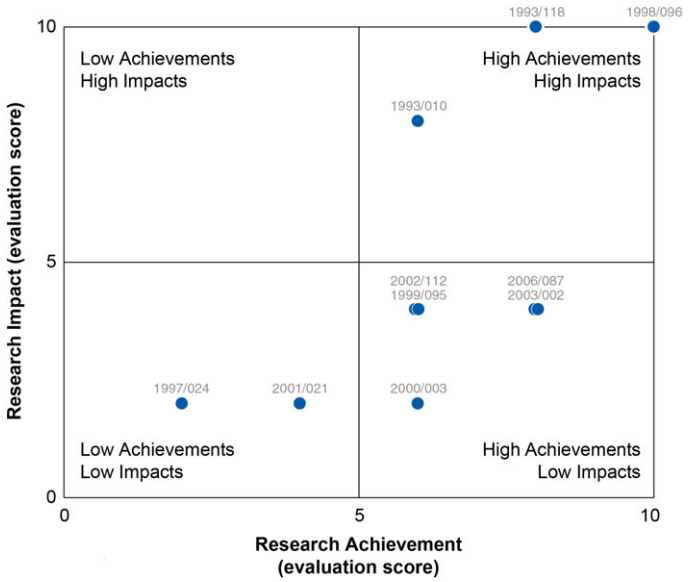


Figure 4 Project success categories based on combinations of research achievement and impact evaluation scores, and location of case study projects within those categories.

Evidence of success factors in selected projects

The primary author's assessment for the apparent influence of each success factor on project success, derived from the IR and evidence from PR, is shown in Table 4.

This analysis showed that for the project that had high achievements and high impacts on the evaluation scores, there was good evidence that the presence of most of the success factors strongly enhanced the project's success. Conversely, the evidence from the analysis showed that, for the project that had low achievements and low impacts, nearly half of the success factors were absent. The project that had high achievements but low impacts showed the presence of some success factors and the absence of others, particularly the absence of links to the impact pathway. These relationships were more evident in information from interview records than in project records. This may be because the interview questions were designed to identify this type of information, whereas project records are variable in content and may not contain information specific to the success factors.

The analysis also showed that there is a reasonably clear relationship pattern between those success factors which can be influenced during project design (Nos. 1, 2, 3, 6, 7, 16, 17, 20 and 21) and the evaluated level of research achievement and research impact. The high achievement–high impact project showed evidence of almost all of these factors strongly enhancing or enhancing the project's success. This demonstrates the importance of careful consideration of these success factors during the design of a forestry research project.

Patterns of relationship were less clear for the 10 success factors, which can be influenced during project implementation. There was evidence that the presence of most of these factors had enhanced the level of success, which suggests that regardless of the quality of the project design, a project team that is well led and focused is more likely achieve the planned project outputs. Similarly, the absence of the success factor related to links to the impact pathway and user benefits appears to have strongly diminished the success of both the high achievement–low impact and the low achievement–low impact projects.

Discussion

Factors that influence a research project's success

Many forestry production systems involve a complex diversity of components, have relatively long production cycles compared with most agricultural crops and involve products that require an efficient value chain and well-developed markets to realize their economic value. This means that forestry research generally requires long-term commitments and multi-faceted programs to generate substantial impacts (Henderson, 2000). Various authors have examined the factors that influence the success of forestry development initiatives which research projects seek to support. For example, preconditions for success of smallholder plantation forestry have been identified as secure land tenure, viable production technologies, the ability to protect trees to maturity and demand and access to profitable markets (Byron, 2001). Factors that influence the success of community forestry programs have been shown to include addressing social, economic and gender inequalities, secure property rights, intra-community governance, government support for community forestry and material benefits to community members (Baynes *et al.*, 2015). While the impact of forestry research projects may be influenced by these factors, there are also other factors that can affect the success of a research project.

Almost all of the success factors identified in this study have relevance for project design and/or project implementation, with only three factors (Nos. 15, 18 and 19) being beyond the control of those who design and implement research projects and one other factor (No. 13) being only partially under their control. The approach used in this study indicates that project participants can identify a wide range of factors that influence success. It also found that it is possible to demonstrate that there is some relationship between the expression of these success factors in a project and its evaluated level of success. However, the findings on success factors should not be regarded as blueprint for successful projects. Rather, they should be considered carefully during project design and implementation and the relevant factors applied where appropriate.

Many of the 22 success factors identified by this study, that can enhance or diminish success of forestry research projects implemented in developing countries, are broadly consistent with those identified in previous studies of research projects (Miles, 1998; Pearce, 2010) and of development projects (Miles, 1998).

However, some are additional to those reported previously, and others highlight the importance of particular aspects of previously identified factors. The additional success factors were

- *provision of adequate funding and facilities to conduct the planned research* – this was the third most frequently identified factor and includes having mechanisms to ensure funds flow to researchers in a timely manner.
- *team and technical capacity building* – this was the fifth most frequently identified factor and considered a particularly

important contributor to greater success. It was previously identified only in the study of construction projects (Miles, 1998). It includes on the job training and mentoring, post-graduate study, study tours and work placements with the Australian partner.

- *site selection and scientific rigour of trails* – for those projects for which this factor is relevant, these included elements such as long-term tenure security, appropriateness for species being planted, support of the local community and research being designed and implemented in a way that will produce scientifically valid results.
- *implementation flexibility with processes for monitoring and reviewing activities* – this was more frequently identified by Australian respondents, reflecting the importance of having flexibility within the design, systems for monitoring project activities and donor support to review and adapt project activities including through a mid-term review.
- *donor influence on project design* – this was considered a positive contributing factor when the donor influenced the quality of the science, but a negative factor when donor driven aspects were imposed or unilateral decisions were made.
- *existence of long-term research collaborations* – this was identified as a factor contributing to greater success, and reflects the contrasting situations of projects that follow a previous project with those that are one-off.
- *continuation of the research post project* – this was identified by some Australian and Vietnamese respondents, and reflects their view that the willingness of the receiving institution and the scientists to use the new research skills and knowledge to continue related research after the project ends is important in judging a project's success; and
- *project leader's experience in the partner country* – this was identified only as a contributor to lesser success and reflects the importance of the project leader having a good understanding of the culture and operating environment in the partner country.

Of the factors that had been previously identified, and for which this research identified particular aspects, the most significant were

- *collaborative scoping and design* – including a strong emphasis on the importance of genuine collaboration between the partners in formulating the project design, and the potentially negative impact when Australian scientists insist on aspects of the design, as well as reiterating the importance of properly understanding the topic and situation and then having clear objectives and activities that are not overly ambitious.
- *skills mix and time allocations* – this included recognition of the importance of having the right skills in the team to conduct the research as well as having adequate time allocations for each scientist working on the project.
- *institutional support* – selecting partner institutions that are genuinely interested and willing to provide institutional support during project implementation.
- *good leadership and management* – this was considered relevant to both the international and partner sides of the collaboration and includes ensuring partner scientists understand what tasks need to be undertaken and by when.
- *time in country* – funding sufficient travel to enable adequate time to be spent in country working with the partner scientists.
- *effective communications and research networks* – while the importance of having good communication within the team has previously been identified, the respondents also emphasized the value of researchers developing and using research networks beyond the team.
- *trust and interpersonal relationships* – fostering an environment where partner scientists respect and trust each other, with international scientists displaying cultural sensitivity.
- *project duration* – having sufficient time to achieve the planned research outputs; and
- *links to impact pathway and user benefits* – previously the importance of having explicit adoption mechanisms had been identified, but this research highlighted the broader issue of embedding the research within the context of the impact pathway and ensuring that the research outputs are relevant to the needs of the end users.

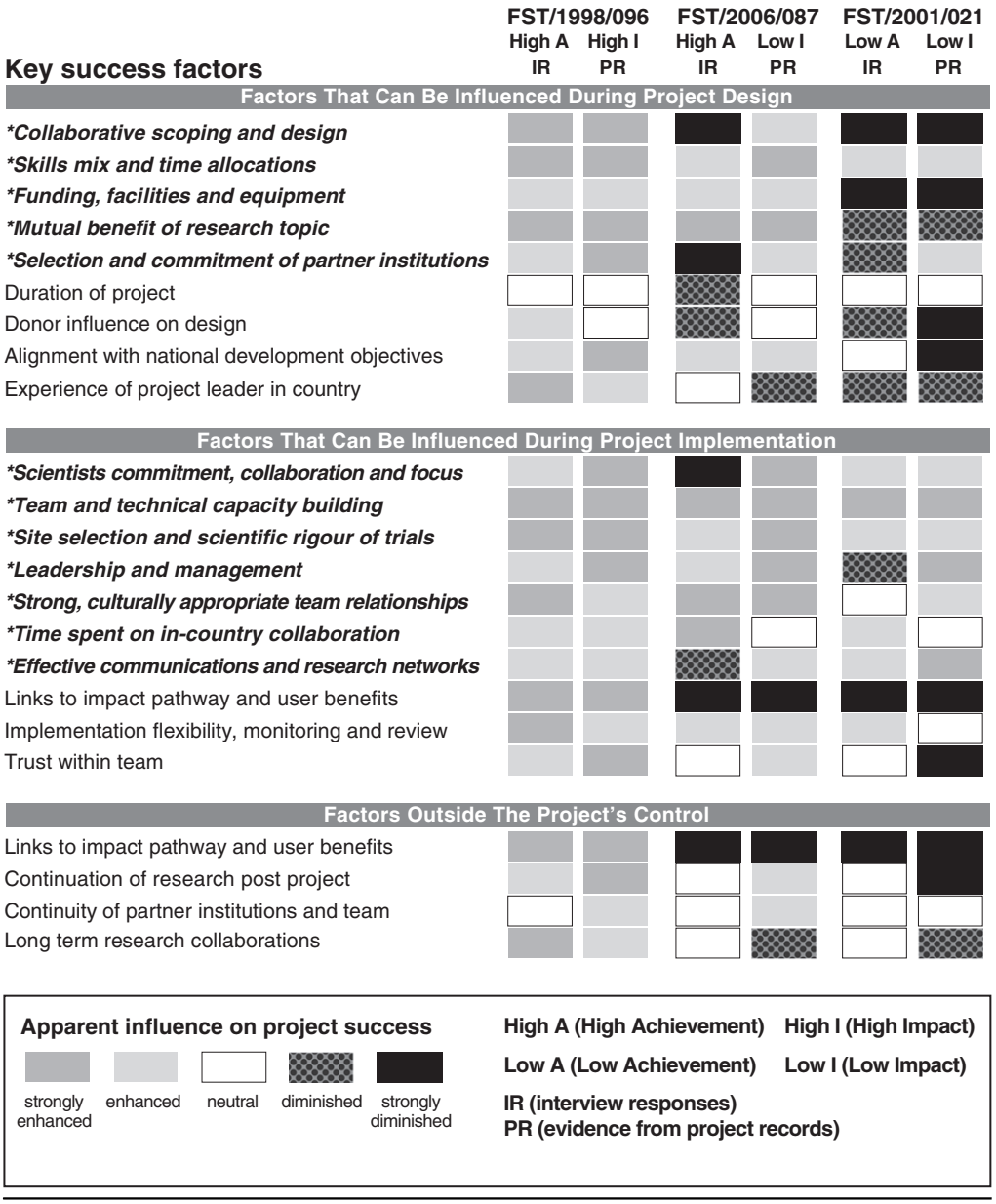
Two factors that had previously been identified (Pearce, 2010) as factors that contributed to the success of ACIAR research projects were not identified by the participants in this research. They were having in-country collaborators with good linkages to other relevant agencies; and the involvement of industry and commercial partners. This may be because the original study included participants from a broader range of agricultural and fisheries projects.

Relationships between success factors and a project's assessed level of success

Previous work by the primary author (Bartlett, 2016a) to develop and test a method for evaluating the relative success of multiple research projects has been extended in this study, by exploring whether relationships exist between a project's assessed level of success and the series of factors thought by project participants to enhance or diminish success. Understanding how the success factors are expressed in projects with different combinations of research achievements and impact could facilitate improvement in the design and implementation of future research projects. Over time, the results of such evaluations and analysis may help to improve the effectiveness of both individual projects and a program of research.

The study has shown evidence that these success factors are manifested in different ways in projects with different levels of evaluated success (see Table 4). It is clear that a project that has high research achievements and high impacts is likely to exhibit evidence that most of the identified success factors have contributed to the enhanced success, as illustrated by the domestication of Australian trees project (FST/1998/096). Conversely, a project that has low achievements and low impacts is likely to exhibit evidence of the expression of these factors that diminish project success. In the project on sawing and drying of eucalypt timber (FST/2001/021), factors such as scoping and design, funding, donor influence on project design, selection of trial sites, and leadership and management all contributed to the lower level of success. These relationships with relative project success appear to be strongly evident for the 12 success factors most frequently identified by project participants.

Table 4 Expression of success factors within three projects with different evaluated levels of success, with the 12 most frequently identified factors shown in ***bold italics***



Conclusions

There is a strong emphasis on aid effectiveness in the delivery of ODA-funded research programs (OECD, 2005). In the case of agricultural (and related) research, it is important to have an understanding of the ways in which desirable impacts can be enhanced and adverse impacts diminished (Millstone *et al.*, 2010). Better understanding of the factors that can enhance or diminish the success of different research projects in different circumstances is an important element of this more general understanding. This case study of 10 ACIAR forestry research projects implemented in Vietnam has identified 22 success factors, 12 of which represent 80 per cent of participants' responses, indicating that these factors are likely to have a strong influence on the perceived level of success achieved by a project.

The findings from this research on factors that contribute to project success correspond well with those previously identified (Miles, 1998; Pearce, 2010), but also suggest some additional factors and clarified particular aspects of some previously identified factors. Most of the success factors in this study had particular relevance to project design and project implementation. This finding is helpful for research program managers and project leaders, as they have the ability to influence these factors and thereby the ultimate effectiveness of the research project.

This study demonstrated that it is informative to consider both research achievements and impacts when evaluating the success of a research project, and that the success factors identified do relate to levels of project success. Paying attention to success factors related to project design, particularly the degree of collaboration with partners, the experience of the project leader in the country where the project will be implemented and the time allocations for the collaborating scientists, is likely to enhance prospects of the project's success. Success is also influenced by some aspects of project implementation, including the commitment and collaboration of the partners, the degree of capacity building undertaken, the selection of locations for conducting field research, how much time the collaborating scientists are able to spend in country working with their partners, and – where relevant – the quality and design of experimental sites. There are also factors outside the control of a project that can affect its success, including the longevity of the research collaboration, the continuity of partners involved in a project and the mechanisms that enable research outputs to be widely disseminated to end users. Overall, the results reported here suggest that the qualitative approach applied in this research can help understand why some research projects are more or less successful than others, and that the identification of factors that contribute to the level of project success provides useful guidance for those managing and implementing collaborative forestry research programs and projects.

Supplementary data

Supplementary data are available at *Forestry* online.

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Conflict of interest statement

The primary author is an employee of the Australian Centre for International Agricultural Research.

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References

ACIAR. 2014 *ACIAR Strategic Plan 2014–18*. Australian Centre for International Agricultural Research.

Amat, J.P., Tùu, B.P., Robert, A. and Hùu, N.T. 2010 Can fast growing species form high-quality forests in Vietnam, examples in Thù'a Thiên-Huê province. *Bois et Forêts des Tropiques* **No. 305** (3), 67–76.

Bantilan, M.C.S., Chandra, S., Mehta, P.K. and Keatinge, J.D.H. 2004 Dealing with diversity in scientific outputs: implications for international research evaluation. *Res. Eval.* **13** (2), 87–93.

Bartlett, A.G. 2016a Evaluating relative success of donor-funded collaborative research projects. *Res. Eval*. doi:10.1093/reseval/rvw009.

Bartlett, A.G. 2016b The evolution and impacts of ACIAR's forestry research program over three decades. *Aust. For.* **79** (3), 171–188.

Baynes, J., Herbohn, J., Smith, C., Fisher, R. and Bray, D. 2015 Key factors which influence the success of community forestry in developing countries. *Glob. Environ. Chang.* **35**, 226–238.

Blamey, A. and Mackenzie, M. 2007 Theories of change and realistic evaluation: peas in a pod or apples and oranges? *Evaluation* **13** (4), 439–455.

Byron, N. 2001 Keys to smallholder forestry. *For. Trees Livelihoods* **11** (4), 279–294.

Byron, N. 2014 The acacia economy of Viet Nam. *Unpublished report for ACIAR*. Australian Centre for International Agricultural Research, p. 76

Carden, F. 2004 Issues in assessing the policy influence of research. *Int. Soc. Sci. J.* **56** (179), 135–151.

Clement, F. and Amezaga, J.M. 2009 Afforestation and forestry land allocation in northern Vietnam: Analysing the gap between policy intentions and outcomes. *Land Use Policy* **26** (2), 458–470.

Commonwealth of Australia. 1982 *Australian Centre for International Agricultural Research Act, 1982*. Commonwealth of Australia.

Davis, J., Gordon, J., Pearce, D. and Templeton, D. 2008 Guidelines for assessing the impacts of ACIAR's research activities *ACIAR Impact Assessment Series Report No. 58*. Australian Centre for International Agricultural Research. p. 120.

de Jong, W., Sam, D.D. and Hung, T.V. 2006 *Forest Rehabilitation in Vietnam: Histories, Realities and Future*. Center for International Forestry Research (CIFOR), p. 6.

FAO. 2015 *Global Forest Resources Assessment 2015: Desk Reference*. Food and Agriculture Organization of the United Nations. p. 253.

Farrington, J., Thirtle, C. and Henderson, S. 1997 Methodologies for monitoring and evaluating agricultural and natural resources research. *Agric. Syst.* **55** (2), 273–300.

Fisher, H. and Gordon, J. 2007 Improved Australian tree species for Vietnam. *ACIAR Impact Assessment Series Report No. 47*. Australian Centre for International Agricultural Research. p. 33.

Forss, K., Cracknell, B. and Samset, K. 1994 Can evaluation help an organization to learn? *Eval. Rev.* **18** (5), 574–591.

Franzel, S., Denning, G.L., Lillesø, J.P.B. and Mercado, A.R. Jr 2004 Scaling up the impact of agroforestry: lessons from three sites in Africa and Asia. *Agrofor. Syst.* **61–62** (1–3), 329–344.

Government of Vietnam. 2007 Viet Nam Forestry Development Strategy 2006–2020. Hanoi, Office of Prime Minister, 54 pp.

Harwood, C.E., Ha, H.T., Tran, H.Q., Butcher, P.A. and Williams, E.R. 2004 The effect of inbreeding on early growth of *Acacia mangium* in Vietnam. *Silvae Genet.* **53**, 65–69.

Harwood, C.E., Hardiyanto, E.B. and Yong, W.C. 2015 Genetic improvement of tropical acacias: achievements and challenges. *South. For.* **77** (1), 11–18.

Harwood, C.E. and Nambiar, E.K.S. 2014 Sustainable plantation forestry in South-East Asia. *ACIAR Technical Reports No. 84*. Australian Centre for International Agricultural Research.

Henderson, J.S. 2000 Evaluating the impact of forestry research for development. *Int. For. Rev.* **2** (3), 191–199.

Horton, D. and Mackay, R. 2003 Using evaluation to enhance institutional learning and change: recent experiences with agricultural research and development. *Agric. Syst.* **78** (2), 127–142.

Joly, P.-B., Gaunand, A., Colinet, L., Larédo, P., Lemarié, S. and Matt, M. 2015 ASIRPA: a comprehensive theory-based approach to assessing the societal impacts of a research organization. *Res. Eval.* **24** (4), 440–453.

Lindner, R., McLeod, P. and Mullen, J. 2013 Returns to ACIAR's investment in bilateral agricultural research. *ACIAR Impact Assessment Series No. 86*. Australian Centre for International Agricultural Research. p. 48.

Mayne, J. and Stern, E. 2013 Impact evaluation of natural resource management research programs: a broader view. *ACIAR Impact Assessment Series Report No. 84*. Australian Centre for International Agricultural Research. p. 79.

McElwee, P. 2009 Reforesting "Bare Hills" in Vietnam: social and environmental consequences of the 5 Million Hectare Reforestation Program. *AMBIO* **38** (6), 325–333.

McLeod, L., Doolin, B. and MacDonell, S.G. 2012 A perspective-based understanding of project success. *Project Manag. J.* **43** (5), 68–86.

Mercer, D.E. 2004 Adoption of agroforestry innovations in the tropics: a review. *Agrofor. Syst.* **61-62** (1–3), 311–328.

Miles, D.W.J. 1998 Evaluating international development projects: lessons from the construction sector. *Evaluation* **4** (4), 469–482.

Millstone, E., Van Zwanenberg, P. and Marshall, F. 2010 Monitoring and evaluating agricultural science and technology projects: theories, practices and problems. *IDS Bull.* **41** (6), 75–87.

Nambiar, E.K.S., Harwood, C.E. and Kien, N.D. 2014 Acacia plantations in Vietnam: research and knowledge application to secure a sustainable future. *South. For.* **77** (1), 1–10.

Nguyen, V.S. and Gilmour, D. 1999 Forest rehabilitation policy and practice in Vietnam. *Proceedings of a National Workshop November 1999*. IUCN.

OECD. 2005 Paris Declaration on Aid Effectiveness. Paris, Organisation for Economic Cooperation and Development, 15 pp.

Pattanayak, S.K., Mercer, D.E., Sills, E. and Yang, J.-C. 2003 Taking stock of agroforestry adoption studies. *Agrofor. Syst.* **57** (3), 173–186.

Pearce, D. 2010 Lessons learned from past ACIAR impact assessments, adoption studies and experience. *ACIAR Impact Assessment Series Report No. 69*. Australian Centre for International Agricultural Research.

Pearce, D., Jilani, A. and Templeton, D. 2013 Adoption of ACIAR project outputs 2013 *ACIAR Adoption Studies Reports No. AS010*. Australian Centre for International Agricultural Research. p. 87.

Phi, H.H., Harwood, C., Beadle, C., Nambiar, S., Pinyopusarek, K., Vu, D.H. *et al*. 2009 Sustainable and profitable development of acacia plantations for sawlog production in Vietnam. *Unpublished report from AusAID's Collaboration for Agriculture and Rural Development (CARD) program - Project Number: 032/05 VIE*, p. 10.

Phuc, X.T. and Canby, K. 2011 *Vietnam: Overview of Forest Governance and Trade*. European Forest Institute. p. 51.

Putzel, L., Dermawan, A., Moeliono, M. and Trung, L.Q. 2012 Improving opportunities for smallholder timber planters in vietnam to benefit from domestic wood processing. *International Forestry Review* **14** (2), 227–237.

Raitzer, D.A. 2003 *Benefit-Cost Meta-Analysis of Investment in Interational Agricultural Research Centres of the CGIAR*. Food and Agricultural Organisation of the United Nations. p. 45.

Stern, E., Stame, N., Mayne, J., Forss, K., Davies, R. and Befani, B. 2012 Broadening the Range of Designs and Methods for Impact Evaluations. *Working Paper 38*. Department of International Development London, p. 127.

Suyanto, S., Pandu Permana, R., Khususiyah, N. and Joshi, L. 2005 Land tenure, agroforestry adoption, and reduction of fire hazard in a forest zone: a case study from Lampung, Sumatra, Indonesia. *Agrofor. Syst.* **65** (1), 1–11.

Thangata, P.H. and Alavalapati, J.R.R. 2003 Agroforestry adoption in southern Malawi: the case of mixed intercropping of Gliricidia sepium and maize. *Agric. Syst.* **78** (1), 57–71.

Appendix 1: Additional information on the three projects studied to explore the expression of success factors in projects assessed as having different success categories

FST/1998/096 'Domestication of Australian Trees'

This 5-year domestication and tree breeding project increased the capacity of Vietnamese tree breeding scientists and established seedling seed orchards, seed production areas and genetics gains trials for key *Acacia* and *Eucalyptus* species. Various scientific and technical publications were produced by project partners including an international journal article (Harwood *et al*., 2004). This project followed more than 10 years of previous collaboration related to supply and testing of Australian tree germplasm.

The project has been assessed by the author and the respondents as the most successful of the 10 projects studied. Almost all of the identified success factors apparently have contributed to enhancing its success with about half of the factors being considered by the respondents to have strongly enhanced its success. The project design that had been influenced by the donor was relatively simple, but effective. Only one of the four objectives had a strong research focus while the others focussed on related development activities. The project had good leadership on both the Australian and Vietnamese sides, both partners were strongly committed to the project and saw mutual benefits from the project. The Australian scientists had strong scientific skills in tree breeding and domestication of Australian trees and had existing working relationships with the Vietnamese partners, with the main scientists spending 60–80 per cent of their time on the project. The Vietnamese scientists were well led and highly motivated and their institution contributed additional financial resources to expand the number of trials established.

An ACIAR impact assessment found that this project and its predecessor had generated very substantial economic impacts from the widespread planting of improved tree germplasm and the research investment had generated benefit cost ratio of 79:1 (Fisher and Gordon, 2007). This project was very well connected to the impact pathway during its implementation and after it concluded. The Government of Vietnam established mechanisms through the Ministry of Agriculture and Rural Development to disseminate the certified tree germplasm to farmers throughout the country under the 5 Million Hectare Reforestation Policy. The project outputs have had an enduring legacy, with the seed orchards still being used today. One Vietnamese respondent indicated that seed from the seed orchards is marketed globally and the profits are used to fund additional tree breeding research.

FST/2006/087 'Optimizing silvicultural management and productivity of high-quality acacia plantations, especially for sawlogs'

This 4-year project focused on developing silvicultural practices to enable production of sawlogs from smallholder plantations, in support of Vietnam's goal to increase the supply of domestically produced timber for its wood industries (Government of Vietnam, 2007). When acacias are grown for pulpwood rotations of 5–6 years are common, whereas rotations of 10–12 years are needed for one quarter of the logs to achieve sawlog specifications (Byron, 2014). The project followed a 3-year development project (AusAID's Collaboration for Agriculture and Rural Development (CARD) Project Number: 032/05 VIE), involving pruning and thinning trials in acacia plantations in north-central Vietnam, which had showed some promising prospects for sawlog production – although some of the trials were impacted by a typhoon in 2008 (Phi *et al*., 2009). This ACIAR project established new trials involving fertilization, thinning and pruning at seven sites located in southern, central and northern Vietnam and monitored these trials for 3 years.

The project was assessed by the author as having high research achievement but low impact. It would always be difficult for a 4-year project on a forestry system that takes 10–12 years to reach rotation age to achieve substantial impacts for end users. The project design included activities to disseminate information to smallholders but these were not implemented during the life of the project. The analysis shows that most of the success factors related to the project implementation phase contributed positively to the success of the project, though there were problems related to poor collaboration between partners in the different regions of Vietnam where the various trials were located.

The weaknesses in this project appear to relate predominantly to various success factors related to the project design. The duration of the project meant that, while the project produced good information on the system's productivity up to age three, it could not present conclusive results on the sawlog system's financial returns, which is necessary to convince growers to change their practices and delay income receipt for several years. It was also apparent from the respondents that lack of effective collaboration with Vietnamese partners on the project design and ACIAR's influence on the selection of partners and locations for the research trials diminished the project's success.

FST/2001/021 'Improving the value chain for plantation-grown eucalypt sawn wood in China, Vietnam and Australia: sawing and drying'

This 4-year project was designed to conduct research related to improving the production of sawn timber from small diameter eucalypt logs, with research conducted in China, Vietnam and Australia. Apart from building research capacity, the project conducted a sawing trial involving 10-year-old *Eucalyptus urophylla* logs processed in a small sawmill in Vietnam. This analysis focused on the activities conducted in Vietnam but it is apparent that there were greater achievements in China (Pearce *et al*., 2013).

The Vietnamese component of the project was assessed by the author as having low achievements and low impacts. The analysis suggests that the project was poorly designed, with many of the success factors related to project design contributing to diminished project success. The analysis indicated that respondents considered about half of the success factors related to project implementation, particularly the capacity building factor, had contributed to enhanced success. Inadequate attention to the others resulted in diminished success. At the completion of the project, the scientific reports from the Australian sawing trials were not translated into a manual that could be easily understood by Vietnamese partners. The project had no mid-term review, which precluded a discussion on how the research might have been refocussed to generate outputs more aligned to end user needs.

There were four design-related issues that also diminished success. Firstly, there was inadequate scoping and collaboration with Vietnamese partners in the project design. ACIAR and the Australian researchers assumed that research was necessary on the production of sawn timber, rather than on other products, such as veneer, and that there were sufficient suitable eucalypt resources existing in Vietnam to sustain a sawlog industry. Secondly, it assumed that appropriate and committed Vietnamese wood processors could be found to participate in the research and then adopt the recommended practices. However, only one small sawmill participated and it did not have the technology available to properly dry or recondition the sawn timber. Thirdly, inadequate funding was provided for the planned activities, with ACIAR reducing the project's funding by 46 per cent in the final stages of design without adjusting the magnitude of the planned research activities. Fourthly, the project leader had not previously worked in Vietnam and only became involved in the final stages of the project's design, following the retirement of the planned leader.

Supplementary Information (available on line)

A) Interview questions.

1. General questions

What ACIAR projects have you been involved with?

What other donor funded projects have you been involved with?

What do you think about the approach that ACIAR uses for its research projects?

What are the benefits that have come from working with ACIAR projects?

What are the benefits of this approach compared to other donor project approaches?

What do you think constitutes success for an ACIAR project?

What do you think are the 5 most important factors that contribute to project success?

What do you think are the 5 most important factors that result in less successful projects?

2. Questions repeated for each project that a participant was involved with

What was your role in this ACIAR project?

What were the main outputs from this project?

What outcomes have occurred as a result of the outputs from the project?

What do you think the main impacts have been from the project?

How successful do you think the project was on a scale of 1 to 10, where 10 is most successful?

Why do you think the project was successful or not successful?

What do you remember as the most important aspects of the project's design that contributed to how well the project went?

What do you think were the most important aspects of the project's implementation that contributed to how well the project went?

Are there any factors related to the project's operating environment that were outside the control of the project that either assisted or limited the success of the project?

What do you think are the most important aspects that affected the adoption of project outputs during the project?

What factors do you think have influenced the degree to which the research results have been adopted since the project was completed?

Now that the project is completed, are there any things that you think should have been done differently which might have led to the project achieving better results?

B) Evaluation questions and evidence guidance for the eight evaluation criteria.

Criteria		Evaluation Questions	Evidence Sought
C1	Project Design	How well was the project designed in terms of specific activities to address objectives and to facilitate adoption?	Consideration of research strategy and nature of research and dissemination activities planned; Composition of project team; Level of funding provided and co-contributions from partners; and Findings from any mid-term review.
C2	Results Achieved	What has been achieved in terms of completed activities and specified outputs?	Identification of the quality of actual achievements compared to planned outputs; Adaptation of methods and activities to enhance outcomes; Methods and level of dissemination of results; and Findings from any end-of-project review.
C3	Collaboration	How well did the project team collaborate in conducting the research and what new skills did the scientists gain?	Information about collaboration in correspondence and reports; Effectiveness of in-country coordination; Joint authorship of reports; and Level of networking developed and extent of within-project capacity building activities.
C4	Publications	What is the relative magnitude and quality of publications produced?	Quality of information in Final Report; and Amount and quality of project reports, including consideration of local language publications; Number of published journal articles; and Quality of website information.
C5	Capacity Building	What is occurring as a result of the enhanced capacity?	Evidence of enhanced capacity of project scientists; Appraisal of how well these skills are being utilised; and Local scientists contributions to scientific publications.
C6	Scientific Outcomes	How has the body of scientific knowledge been enhanced and how is this knowledge being used?	Number of international journal publications and citations; Continuation of related research; Evidence of networking between scientists; and Appraisal of scientific contributions to international development.
C7	Economic Outcomes	Has the research led to improved livelihoods or facilitated economic development?	Indications of improved productivity, greater access to markets and higher prices for products; Indications of costs or losses avoided; Indications of greater employment levels or wages; and Indications of new enterprises established.
C8	Social and/or Policy Outcomes	What changes to the social circumstances of project beneficiaries or the enabling policy environment have occurred that the project may have contributed towards?	Indications of enhanced social capital including strengthening of community institutions; Evidence of empowerment of women and disadvantaged groups; More equitable benefit sharing from common property resources; and Evidence of new or changed policies or effective input to policy processes.

PART 2: THE CASE STUDIES

Chapter 5. Factors affecting the success of collaborative forestry research in Indonesia.

This chapter reports the results of the second of three country case studies, in this case focussing on ten completed forestry research projects from Indonesia. It utilises the new evaluation methodology (presented in Chapter 3) and the same case study methods as used in the Vietnam case study (as described in Chapter 4). The chapter presents the findings from Indonesia on the relative success of the ten projects, the identified factors that affect success, and some apparent relationships between these factors and relative success of a project. It also provides a brief comparison with the findings from the Vietnam case study (as presented in Chapter 4).

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Original Article

Factors Affecting the Relative Success of Collaborative Forestry Research Projects in Indonesia

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Abstract The success of research for development projects is of keen interest to project funders and participating researchers, and underpins project impact. This paper reports a qualitative investigation of factors identified by project researchers as affecting relative success in ten collaborative forestry research projects in Indonesia. Interviews with 33 project participants identified 30 factors that influence project success. The most frequently identified factors were scientists' commitment and collaboration; collaborative scoping and design; funding and equipment; effective communications and networks; implementation flexibility, monitoring and review; and skills mix and time allocations. The relative success of projects was evaluated through an analysis of project records, and examination of three projects of different relative success provided evidence of relationships between relative success and the identified success factors. As most of the success factors relate to project design or implementation, this knowledge can assist funders, research managers and project staff to improve project success.

Le succès de la recherche pour les projets de développement est d'un vif intérêt pour les bailleurs de fonds et les chercheurs qui y participent, et sous-tend l'impact des projets. Cet article rend compte d'une enquête qualitative sur les facteurs identifiés par des chercheurs comme les clés d'un succès relatif dans dix projets de recherche forestière en Indonésie. Des entretiens avec 33 participants du projet ont permis d'identifier les 30 facteurs qui influent sur le succès du projet. Les facteurs les plus fréquemment identifiés étaient l'engagement et la collaboration des scientifiques; la démarche collaborative dans l'identification et la conception du projet; le financement et l'équipement; une communication et des réseaux efficaces; la souplesse de mise en œuvre, le suivi et la révision du projet; et la diversité des compétences et la répartition du temps. La réussite relative des projets a été évaluée au moyen d'une analyse des documents du projet et l'examen de trois projets différents ayant eu un succès relatif a permis de fournir les preuves d'une corrélation entre le succès relatif du projet et les facteurs de succès identifiés. Comme la plupart des facteurs de réussite se rapportent à la conception ou à la mise en œuvre du projet, cette connaissance peut aider les bailleurs de fonds, les directeurs de recherche et le personnel de projet à améliorer le succès des projets.

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Keywords: project success factors; evaluation; international development projects; forestry research; Indonesia

Introduction

Many developed countries fund agricultural and natural resource management programs and projects in developing countries through their official development assistance (ODA) programs. While such projects can generate significant benefits to farmers and rural communities (Raitzer, 2003; Lindner *et al*, 2013), the poor performance and mixed success of many ODA projects have long been a concern (Yalegama *et al*, 2016; Ika *et al*, 2012). This challenge can be exacerbated in research-for-development projects, as the relationships between research-based

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knowledge and action are complex and often poorly understood (van Kerkhoff and Lebel, 2006). Understanding the factors that influence project success, referred to as success factors or critical success factors (Ika *et al*, 2012), enhances the ability of donors and implementing agencies to realise desired outcomes (Khang and Moe, 2008). However, surprisingly little has been documented on ODA project success factors (Diallo and Thuillier, 2004; Yalegama *et al*, 2016), which can vary according to the type of project and stage of the project life cycle (Pinto and Mantel, 1990) and the context in which the project is conducted (Ika and Donnelly, 2017).

Research evaluation is challenging because, even in the most efficient system, there is typically a lag of many years for the full impact of the research to emerge (Buxton, 2011); hence, impact assessments undertaken soon after a project concludes tend to under-estimate research impacts (Arnold, 2012). Not all impacts are easy to measure, and therefore impact assessments mostly focus on measurable economic and social impacts, with very few addressing environmental impacts (Weißhuhn *et al*, 2017). It is challenging to identify factors that contribute to project success in a consistent and meaningful way in the forestry sector in general, and for forestry research projects in particular. As Henderson (2000) observes, because of the complex nature and long production cycles of forestry systems, forestry research generally requires long-term commitments and multi-faceted programs to generate substantial impacts.

Research funders may also want to compare the relative success of projects addressing different topics or conducted in different contexts, and of successive projects addressing the same topic. In this general context, Bartlett (2016a) proposed a methodology for evaluating the relative success of collaborative ODA research projects, based on scoring against eight evaluation criteria. Bartlett *et al* (2017) applied this methodology to a sample of Australian Centre for International Agricultural Research (ACIAR) forestry projects in Vietnam, and complemented it with interviews of project leaders and researchers, to investigate the factors perceived to enhance or diminish success of these projects. Results demonstrated how such an analysis could assist implementing organisations to improve the likelihood of project success.

The definition of 'success' itself can be contested and controversial (McLeod *et al*, 2012). In this study, success is defined in terms of two primary dimensions, specifically related to the purpose of research for development projects, drawing on the approaches used by Pearce (2010) and Bartlett *et al* (2017). The first dimension, termed 'achievements', is the extent to which planned research outputs are achieved and adopted by 'next users', such as the participating scientists; the second dimension, termed 'impacts', is the extent of the impacts resulting from wider adoption of the research outputs by 'end users', such as forest growers.

This paper continues this series of investigations, and reports a qualitative study involving ten collaborative forestry research projects between Australia and Indonesia supported by ACIAR. It addresses three questions: What differences exist in the level of success achieved by these projects? What are the factors that are considered by project leaders and researchers to affect the relative success of these projects? and Is there evidence that the way these factors have been managed in individual projects has affected their relative success? The results are relevant to both researchers and international development practitioners, because greater knowledge about research for development (R4D) (sensu lato Høgh-Jensen *et al*, 2010) project success factors can assist those responsible for project design and implementation to improve project effectiveness.

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The Australian Centre for International Agricultural Research

The Australian Centre for International Agricultural Research (ACIAR) is a federally funded agency that commissions collaborative agriculture, fisheries and forestry research projects in developing countries. ACIAR funds R4D projects conducted by Australian or Consultative Group on International Agricultural Research (CGIAR) scientists working collaboratively with scientists from the partner countries to address a research priority identified by the partner country. ACIAR projects seek to generate knowledge, technologies and capacity to achieve better decision making, changed agricultural practices and policies that, in turn, generate positive scientific, economic, social or environmental impacts (ACIAR, 2014). These projects involve capacity building and research activities and, where relevant, develop an understanding of the farming and forestry systems as well as policy settings to enhance the prospects that the knowledge and technologies developed will be adopted. Over a 30-year period, ACIAR has invested over AUD 100 million to fund 150 forestry research projects, with the greatest number of projects implemented in Indonesia, Vietnam and Papua New Guinea (Bartlett, 2016b).

ACIAR regularly evaluates the impacts and effectiveness of a sample of its projects, including quantifying their economic returns (ACIAR, 2014). An ACIAR study by Pearce (2010) identified 14 factors that were considered important to achieving successful project outcomes, but it did not examine how these factors may have contributed to different levels of success in different projects.

ACIAR's Support for Forestry Research in Indonesia

In 2011, Indonesia's forestry sector, based on each of natural and planted forests, contributed USD 14.57 billion to the national economy (FAO, 2014). Indonesia's diverse natural forests have been heavily exploited for timber production over the past 50 years, and rates of conversion to agriculture have been high (Tsujino *et al*, 2016). Nevertheless, Indonesia retains the eighth largest area of forest in the world, with about 91 million hectares (53 per cent of its land area) classified as forest (FAO, 2015).

Indonesian farmers have a long history of planting trees and allowing natural regeneration of trees on private land. Smallholders grow trees as a 'living savings account', though their returns are constrained by poor knowledge of silviculture, timber standards and markets, and complicated regulations governing timber trading (Roshetko *et al*, 2013). These smallholders supply timber to thousands of wood manufacturing industries (Perdana and Roshetko, 2015), but many of these suffer from inefficient value chains and inappropriate processing and manufacturing techniques for small-diameter logs (Wibowo *et al*, 2013).

Indonesia has encouraged the development of large-scale timber plantations. In 2014, the area of fast-growing acacia and eucalypt plantations was 1.5 million hectares, with 800,000 hectares located in large estates managed by plantation companies on Sumatra (Harwood and Nambiar, 2014). However, the viability of fast-growing plantations based on these exotic species is threatened, due to the increasing impacts of damaging diseases such as *Ganoderma* (Francis *et al*, 2014) and *Ceratocystis* (Tarigan *et al*, 2011), as well as restrictions on the use of peatlands (Jauhiainen *et al*, 2012).

ACIAR's forestry projects in Indonesia have covered a broad range of themes in the context of forest-based development described above; they have included technical, social and policy aspects of plantation and smallholder forestry systems (Mendham and Hardiyanto, 2011; Rohadi *et al*, 2012), climate change (Irawan and Tacconi, 2009) and value adding of timber and

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non-timber forest products (Cunningham *et al*, 2011; Purnomo *et al*, 2014). From 1987 to December 2015, ACIAR completed 21 forestry research projects in Indonesia (Table 1), representing about one-fifth of all forestry projects commissioned by ACIAR over three decades (Bartlett, 2016b). An ACIAR impact study of 12 completed ACIAR forestry projects in Indonesia (Lindner, 2011) reported high returns on investment overall, but evidence of impact from only some of the projects. These results highlight the need for improved understanding of the factors that affect project outcomes and impacts.

Methods

The methods for this study follow those developed by Bartlett (2016a) and refined in a companion study by Bartlett *et al* (2017), involving three phases as outlined below. Here, success factors, which were identified from information provided by project researchers, are considered to be factors that can enhance or diminish project success, but they are not in themselves indicators of project success. The evaluation of relative success of the case study projects was undertaken by the author prior to identification of the success factors, using information from a variety of sources in ACIAR project records, as described below. The research protocol was approved by the Australian National University Human Ethics Committee (protocol no. 2014/051).

Selection of Projects for the Case Study

Ten of the 21 ACIAR forestry projects completed in Indonesia between 1987 and 2015 (Table 1) were selected for the study, taking into account the following factors:

- Focussing on medium to large research projects conducted entirely in Indonesia; these included some projects that were part of a longer-term program;
- Ensuring representation of projects from across the ten research themes, five of which were represented;
- Including some projects commissioned through the CGIAR international agricultural research centres;
- Having adequate project records available for analysis and being able to locate researchers involved in a project for interview.

In this sample, eight projects were led by Australian research agencies and two by CGIAR centres. Each project involved collaboration with scientists from various Indonesian partner organisations, including the national Forestry Research and Development Agency (FORDA), universities, non-governmental organisations and private-sector companies. The selected projects included two that continued long-term research commenced in three earlier projects and included many of the same project team members. One of these successor projects combined research on tree diseases and plantation productivity previously undertaken in two separate projects.

Phase 1: Identification of Project Success Factors

Thirty-three scientists from a range of partner organisations were identified for interview from records of the ten projects. They were selected using a purposive strategy because they had

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Table 1: Summary information for ACIAR's completed Indonesian forestry projects, with those selected for study highlighted, and those for phase 3 evaluation identified

ACIAR project code	*Duration*	*Value AUD m*	*Research theme*[1]	*Title of project*
FST/2009/051	2011–2015	1.873	T2 T4	Increasing productivity and profitability of Indonesian smallholder plantations
FST/2008/030	2011–2015	0.898	T6	Overcoming constraints to community-based commercial forestry in Indonesia
FST/2007/119	2008–2013	1.012	T5	Mahogany and teak furniture: improving value chain efficiency and enhancing livelihoods
FST/2007/052	2008–2014	1.450	T10	Improving governance, policy and institutional arrangements for REDD in Indonesia
FST/2006/117	2009–2014	1.001	T5	Improving added-valued furniture production from plantation timber in the Jepara region
FST/2005/177[2]	2007–2011	0.810	T6	Improving profitability from smallholder teak agroforestry
SMAR/2006/011	2006–2009	0.273	T7	Enterprise development, value chains and evaluation of non-timber forest products
FST/2004/058	2006–2010	0.703	T2	Improving water and nutrient management in Indonesian and Australian plantations
FST/2003/048[2]	2006–2010	0.710	T4	Management of fungal root rot in plantation acacias in Indonesia
FST/2003/025	2005–2007	0.400	T6	Community partnerships for plantation forestry in eastern Indonesia and Australia
FST/2001/105	2003–2007	0.641	T10	Impacts of decentralisation on sustainable forest management, development and livelihoods
FST/2001/020	2001–2004	0.302	T6	Facilitating development of agroforestry systems as alternatives to slash-and-burn agriculture
FST/2000/123	2001–2006	0.679	T4	Heart rots in plantation hardwoods in Indonesia and southeast Australia
FST/2000/122[2]	2001–2003	0.394	T1	Application of molecular marker technologies for genetic improvement of forest plantation species
FST/2000/001	2002–2005	0.795	T9	Impacts of fire and its use for sustainable land and forest management
FST/1999/035	2002–2007	1.143	T6	The impact of changing agroforestry mosaics on catchment water yield and quality in SE Asia
FST/1998/096	2000–2004	2.209	T1	Domestication of Australian trees for reforestation and agroforestry
FST/1998/085	1999–2001	0.153	T4	The taxonomy of *Hypsipyla robusta* and allied species
FST/1993/709	1993–1996	0.135	T6	Agroforestry solutions to rehabilitate *Imperata* grasslands
FST/1990/043	1991–1995	0.437	T3	Multi-purpose tree and sandalwood silviculture in Indonesia
FST/1986/013	1987–1991	0.451	T3	Fuelwood and sandalwood silviculture in eastern Indonesia

[1]ACIAR forestry program research themes as described in Bartlett (2016b)
Theme 1: Domestication and improvement of Australian trees
Theme 2: Silviculture for Australian trees
Theme 3: Domestication and silviculture of non-Australian trees
Theme 4: Forest health and biosecurity
Theme 5: Value-added processing and treatment of wood
Theme 6: Agroforestry and community forestry
Theme 7: Non-timber forest products
Theme 9: Fire management
Theme 10: Forestry and environment policies
[2]Phase 3 evaluation projects
FST/2005/177 – high achievements/high impacts
FST/2003/048 – high achievements/low impacts
FST/2000/122 – low achievements/low impacts

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worked as project leaders, Indonesian project coordinators or collaborating researchers on one or more of the selected projects, and were still able to be contacted. The interviewees comprised 7 scientists from Australian agencies, 9 scientists from the CGIAR centres and 17 scientists from Indonesian partner agencies. They were interviewed individually by the author using a standard set of questions (see Bartlett *et al*, 2017), which asked them to describe what they thought constituted success for an ACIAR project, and to nominate five factors that can enhance, and five factors that can diminish, project success. Their views on aspects of the design and implementation of each project, and other contextual factors, were also sought.

HyperRESEARCH[1] qualitative data analysis software was used to assist analysis of interview data by aggregating responses to specific questions into single reports and searching the data for commonly used phrases and similar concepts. This enabled the author to establish participants' perspectives on the definition of project success, and facilitated aggregation of thematic aspects of the responses into two lists, of factors that either enhance or diminish project success. Participants' responses about factors affecting project success and about each project's design and implementation were analysed and results were aggregated into two groups: those from the Indonesian participants, and those from the Australian and CGIAR participants. The frequency with which each success factor was identified by each group was recorded, and complementary expressions of the same factor from the two lists identified, as the basis for preparing concisely worded statements of the factors identified as enhancing or diminishing project success.

Phase 2: Evaluation of Relative Success of the Case Study Projects

In this study, the relative success of each of the ten projects was evaluated using qualitative data, drawn from internal ACIAR project records, and the score-card matrix methodology described by Bartlett (2016a). The records included: project documents; annual reports; annual assessments and mid-term reviews conducted by the program manager; final reports; external end-of-project reviews; adoption studies and external impact assessments; project-related publications; and written correspondence between ACIAR and project staff. These data provided a degree of triangulation by presenting the perspectives of research program managers and external reviewers of projects, as well as those of project participants.

As explained by Bartlett (2016a), scores were assigned for four criteria related to research achievements: project design, results achieved, collaboration and publications, and for four criteria related to research impacts: capacity building outcomes, scientific outcomes, economic outcomes and social and policy outcomes. For each criterion, the available evidence was considered and a score assigned by the author, to the nearest 0.5, up to the maximum score. The types of evaluation questions, maximum scores and nature of the evidence sought are presented in Table 2. Scores totalling ten were assigned for each of research achievements and research impacts. Scores of 0.0–5.0 were categorised as low achievements or low impacts; scores of 5.1–10.0 were categorised as high achievements or high impacts. This classification generates four categories of project success: high achievements/high impacts, high achievements/low impacts, low achievements/low impacts and low achievements/high impacts. A companion study (Bartlett *et al*, 2017) demonstrated this categorisation to be helpful in relating success factors to levels of relative success.

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Table 2: Evaluation questions, maximum scores and evidence guidance for the eight project evaluation criteria

Criterion	*Score*	*Evaluation questions*	*Evidence sought*
Project design	2	How well was the project designed in terms of specific activities to address objectives and to facilitate adoption?	Consideration of research strategy and nature of research and dissemination activities planned; Composition of project team; Level of funding provided and co-contributions from partners; Findings from any mid-term review
Results achieved	4	What has been achieved in terms of completed activities and specified outputs?	Identification of the quality of actual achievements compared with planned outputs; Adaptation of methods and activities to enhance outcomes; Methods and level of dissemination of results; Findings from any end-of-project review
Collaboration	2	How well did the project team collaborate in conducting the research, and what new skills did the scientists gain?	Information about collaboration in correspondence and reports; Effectiveness of in-country coordination; Joint authorship of reports; Level of networking developed and extent of within-project capacity building activities
Publications	2	What is the relative magnitude and quality of publications produced?	Quality of information in final report; Amount and quality of project reports, including consideration of local language publications; Number of published journal articles; Quality of website information
Capacity building	2	What is occurring as a result of the enhanced capacity?	Evidence of enhanced capacity of project scientists; Appraisal of how well these skills are being utilised; Local scientists' contributions to scientific publications
Scientific outcomes	4	How has the body of scientific knowledge been enhanced, and how is this knowledge being used?	Number of international journal publications and citations; Continuation of related research; Evidence of networking between scientists; Appraisal of scientific contributions to international development
Economic outcomes	2	Has the research led to improved livelihoods or facilitated economic development?	Indications of improved productivity, greater access to markets and higher prices for products; Indications of costs or losses avoided; Indications of greater employment levels or wages; Indications of new enterprises established
Social and/or policy outcomes	2	What changes to the social circumstances of project beneficiaries or the enabling policy environment have occurred that the project has contributed towards?	Indications of enhanced social capital including strengthening of community institutions; Evidence of empowerment of women and disadvantaged groups; More equitable benefit sharing from common property resources; Evidence of new or changed policies or effective input to policy processes

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Phase 3: Identification of Relationships Between Success Factors and the Level of Relative Success Achieved by Different Projects

Three projects representing different success categories were selected (Table 1) for a more detailed analysis, with supporting information presented in Appendix 1.

For each selected project, interview responses from the project leader and two Indonesian participants were further analysed to identify any references to the way the success factors identified in the phase 1 analysis had enhanced or diminished success. The ACIAR project records were reviewed to identify evidence about the way these success factors may have influenced the project's success. Using these two sources of information, subjective ratings were assigned for the apparent influence of each of these success factors on the project's success. The following five-category rating system was used:

Strongly enhances—presence of factor appears to have strongly enhanced success
Enhances—presence of factor appears to have enhanced success
Neutral—no evidence that the factor enhanced or diminished success
Diminishes—absence of factor appears to have diminished success
Strongly diminishes—absence of factor appears to have strongly diminished success.

Results

Interpreting Success in a Collaborative Research Project

The views expressed by participants on what constitutes project success varied considerably, with some articulating factors that influence success rather than what success meant to them. Several participants noted that an individual project in a long-term program of research could be considered successful even if the project outputs could not be widely adopted at the end of the project. The thematic analysis enabled a common definition of success to be developed from participants' responses: *a successful ACIAR forestry research project in Indonesia was one which uses good but flexible scientific methods to achieve the planned outputs, enhances the capacity of partners, facilitates ongoing scientific networks, and disseminates the results to achieve impacts for the intended beneficiaries*.

Identification of Success Factors

The thematic analysis of participants' responses on the factors that can enhance or diminish project success identified 26 factors that were considered to enhance, and 29 factors considered to diminish, project success; when taken as a whole, there were 30 different factors identified that influence project success (Table 3). While most factors which diminish success were the converse of those that enhance success, there were three factors identified that diminish success (continuity of partner institutions and team; experience of project leader in country; external factors: policies, markets, environmental, security) and one factor that enhances success (collaboration with international scientists), for which there was no converse factor identified by participants.

The 17 Indonesian participants and the group of 16 Australian and CGIAR participants generated a total of 424 responses related to individual success factors. The frequency of identification of each of the 30 factors considered to enhance or diminish project success is shown in Figure 1. The two most frequently identified factors, which together represented 18

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Table 3: Success factors, showing participants' views on aspects that enhance or diminish project success

Factor no.	*Success factor*	*Participants' views on factors that can enhance success (ES) or diminish success (DS)*
1	Collaborative scoping and design	**ES:** Shared research agenda and good collaboration on scoping and design **DS:** Inadequate consultation with partners and too ambitious or poorly focussed design
2	Skills mix and time allocations	**ES:** Having diversity of skilled and experienced scientists with sufficient time allocations **DS:** Team with narrow skills mix, inexperienced or overcommitted scientists
3	Funding, facilities and equipment	**ES:** Adequate funding and other resources, including donor and partner contributions **DS:** Inadequate funding or facilities to undertake planned activities
4	Scientists' commitment, collaboration and focus	**ES:** Dedicated and focussed scientists and collaborative team work **DS:** Scientists lacking interest, commitment or focus and poor collaboration within team
5	Team and technical capacity building	**ES:** Supporting capacity building, informal and formal study **DS:** Poor focus on capacity building of project partners
6	Mutual benefit of research topic	**ES:** Selection of research issue with mutual benefits **DS:** Research does not provide mutual benefits or linkages between activities in each country
7	Selection and commitment of partner institutions	**ES:** Effective selection and ongoing commitment of project partners **DS:** Poor support or conflict with partners or too many partners
8	Site selection and scientific rigour of trials	**ES:** Appropriate sites for research trials with good scientific design and stakeholder support **DS:** Inappropriate trial location or poor scientific discipline in trial establishment
9	Leadership and management	**ES:** Good leadership and effective project planning and oversight **DS:** Poor leadership and inefficient project management
10	Strong, culturally appropriate team relationships	**ES:** Respect of culture, patience and developing friendships **DS:** Poor relationships or misunderstandings within team
11	Time spent on in-country collaboration	**ES:** Sufficient resourcing to enable adequate time of external researchers in country **DS:** Inadequate travel funds or other restrictions limit in-country collaboration
12	Effective communications and research networks	**ES:** Good communications within project and effective dissemination of knowledge **DS:** Poor communications between team members and failure to disseminate results to stakeholders
13	Links to impact pathway and user benefits	**ES:** Results linked to stakeholder benefits **DS:** Lack of benefits for stakeholders from research
14	Implementation flexibility, monitoring and review	**ES:** Flexibility to adapt activities and appropriate monitoring and review of progress **DS:** No flexibility to adapt, poor monitoring or no review
15	Continuity of partner institutions and team	**ES:** Not identified **DS:** Changes in project staff or structures of partner institutions

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Table 3: *continued*

Factor no.	*Success factor*	*Participants' views on factors that can enhance success (ES) or diminish success (DS)*
16	Duration of project	**ES:** Duration long enough to implement activities and build partnerships **DS:** Duration too short to implement activities or to obtain and publish results
17	Donor influence on design	**ES:** Effective support from donor to enable collaborative design **DS:** Donor insisting on design elements not supported by project researchers
18	Long-term research collaborations	**ES:** Long-term relationships supported via follow-on projects **DS:** Lack of follow-on research projects
19	Continuation of research post project	**ES:** Agencies continue research after project or clear exit strategy **DS:** No funding available after project or no exit strategy
20	Alignment with national development objectives	**ES:** Research relevant to national policies and programs **DS:** Project not relevant to national policies and programs
21	Experience of project leader in country	**ES:** Not identified **DS:** Naivety of project leader about local context
22	Trust within team	**ES:** Trust between project participants **DS:** Lack of trust within team or of confidence with stakeholders
23	Local government and community support	**ES:** Good support from local government and communities **DS:** Poor collaboration or conflicts with local government or communities
24	Engagement with private sector	**ES:** Effective engagement of private-sector partners in conduct and adoption of research **DS:** Lack of engagement or support from private-sector partners
25	Publication and dissemination of results	**ES:** Effective dissemination of scientific and extension information **DS:** Ineffective dissemination of scientific or extension information
26	External factors: policies, markets, environmental, security	**ES:** Not identified **DS:** External factors influencing research facilities, trials or markets and lack of appropriate supporting policies
27	Engagement of policy actors	**ES:** Effective engagement of policy actors **DS:** Inability to engage policy makers
28	Willingness to adopt innovation	**ES:** Not identified **DS:** Culture, finance or risk limit adoption of technologies
29	User champions	**ES:** Engagement of farmer or industry champions **DS:** Poor selection of or lack of commitment of champions
30	Collaboration with international scientists	**ES:** Benefits from collaboration with international scientists **DS:** Not identified

per cent of the responses, were: scientists' commitment, collaboration and focus (40 responses); and collaborative scoping and design (35 responses). Thirteen of the success factors (nos. 1–7, 9, 12, 14, and 23–25) together represented 74 per cent of the responses, and so can be considered as the most important factors affecting project success identified in this study.

Most of the success factors were consistent across the two country groups (Indonesian and Australian/CGIAR), but some differences were apparent. Indonesian participants more frequently identified success factors such as: scientists' commitment, collaboration and focus;

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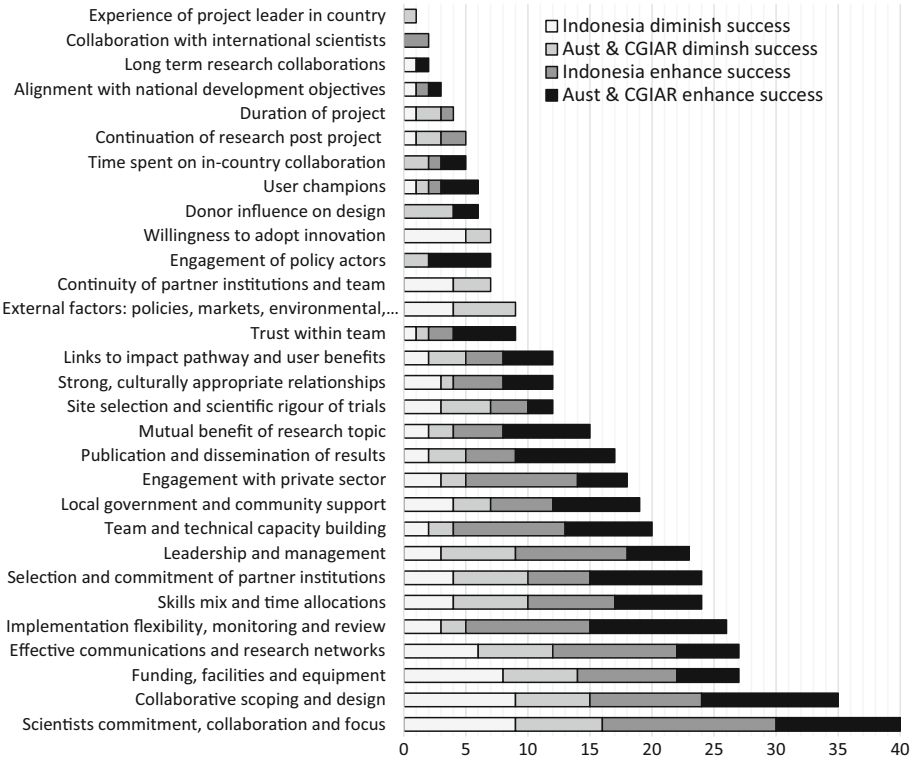

Figure 1: Frequency of identification of the 30 factors considered by the Indonesian and the Australian/CGIAR groups of respondents to enhance or diminish project success.

funding, facilities and equipment; effective communications and research networks; and engagement with the private sector. Australian/CGIAR participants more frequently identified key success factors such as: selection and commitment of partner institutions; publication and dissemination of results; and engagement of policy actors. These differences probably reflect a combination of cultural, experiential and institutional differences between the two groups of researchers, as well as the different challenges each experienced in conducting research projects in the Indonesian context. The Indonesian scientists placed a stronger emphasis on having staff that were committed, adequate funding and good communications within the team, while the Australian and CGIAR scientists were more concerned about the importance of institutional commitment and effective dissemination of results, including into the policy arena.

Evaluation of the Relative Success of Projects

The results of the evaluation of project achievements and project impacts for each of the 10 case study projects are shown in Figure 2. The 10 projects had different levels of apparent success, with scores ranging from 3 to 9 for research achievements and 2 to 7 for research impacts. In the evaluation of research achievements, nine projects (90 per cent) received scores of more than five, whereas in the evaluation of research impacts only four projects (40 per cent) received scores of more than five. Only four projects (40 per cent) achieved scores of more than five for both achievements and impacts. The evaluation methodology proved informative: even

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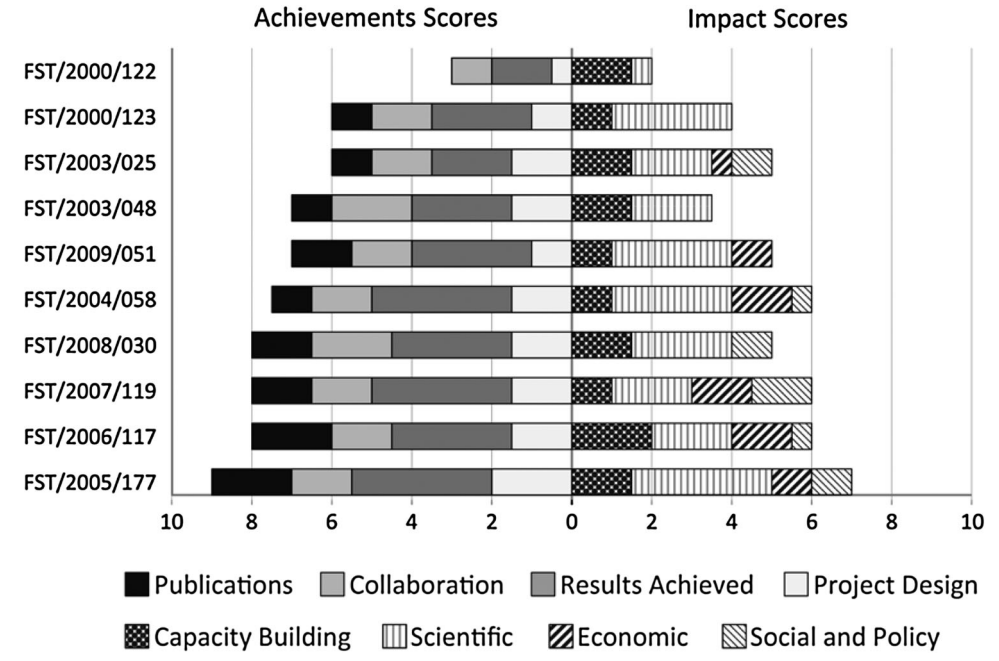

Figure 2: Overall and constituent project achievement and impact scores for the 10 case study Indonesian forestry projects.

when projects received the same overall evaluation scores for research achievements and research impacts (as was the case for FST/2006/117 and FST/2007/119), they received different scores for the constituent criteria.

The case study projects represent three categories of project success (Figure 3): one project with low achievements and low impacts, five projects with high achievements but low impacts, and four projects with high achievements and high impacts. No projects were categorised with the unlikely combination of low achievements yet high impacts.

This study showed that subsequent projects on the same research topic may not always result in improved achievements and impacts compared with those from a precursor project. There were two projects that directly followed on from other projects: Project FST/2008/030 continued research on community forestry commenced in FST/2003/025. FST/2009/051 was a multidisciplinary project that continued research on plantation productivity and tree diseases commenced under two separate projects (FST/2004/058 and FST/2003/048). The results of the relative success evaluations for these related projects are shown in Figure 4.

A project which commenced long-term research on root rot disease (FST/2003/048) received a high score for research achievements but a low score for research impact. The research was continued in a successor project (FST/2009/051) which received a similar evaluation score for achievements but a higher score for impacts, driven by increased scientific impacts from the ongoing research. Conversely, this same project (FST/2009/051), which also continued research on productivity of short-rotation plantations commenced under another project (FST/2004/058), achieved lower scores for both achievements and impacts than were achieved in that precursor project. The reason for this 'unexpected' result was that ACIAR combined the two different research themes into one project but did not provide sufficient financial resources to

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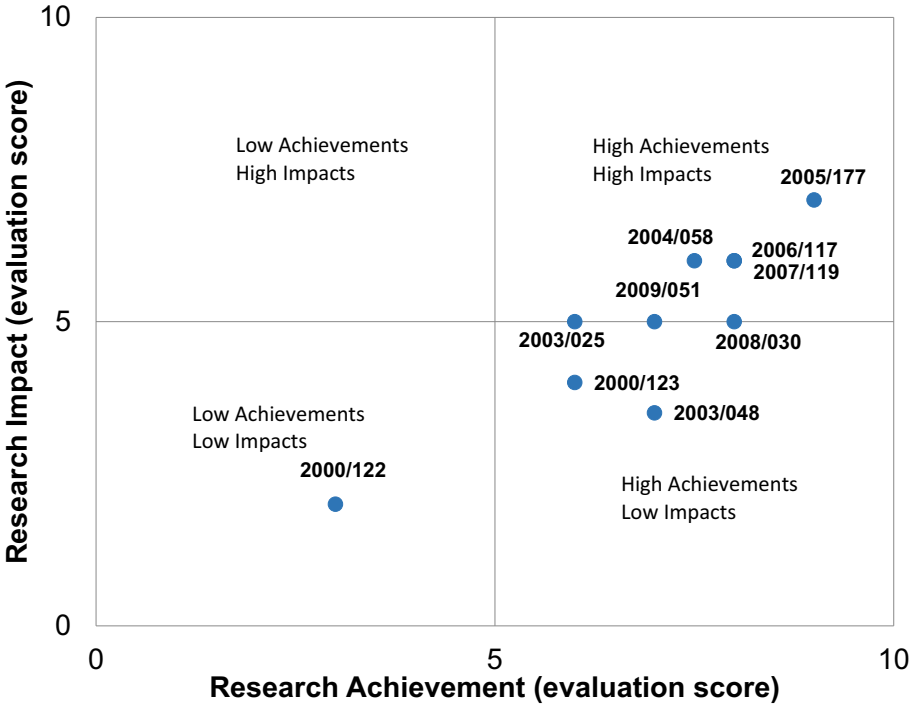

Figure 3: Case study project impact and evaluation scores and assignment to success categories.

support all the required research activities. A third project (FST/2008/030) continued research on community forestry commenced in another project (FST/2003/025). Both projects received similar scores for research impacts, but the successor project had a higher score for achievements, as improved collaboration within the team led to completion of a higher proportion of planned activities and more publications.

A project which researched the application of molecular markers in tree breeding (FST/2000/122) received low scores for both research achievements and research impacts, reflecting an inadequate project duration of only 2 years with no follow-on phase of research. However, the Indonesian partner was still using the scientific capacity some 12 years after the project concluded, demonstrating that a relatively unsuccessful project may result in some enduring impacts. The finding on the importance of having long-term funding commitments for research programs to achieve substantial impacts is consistent with the findings of other studies of collaborative research endeavours, including an evaluation of Australia's Cooperative Research Centre program (Allen Consulting Group, 2012).

Evidence of Success Factors in Selected Projects

The author assessed the apparent influence of each of the 30 success factors identified by project participants (Table 3) on the success of the three projects chosen to represent different evaluated levels of relative success (Table 1), using both interview responses and evidence from project records. This assessment is presented in Table 4.

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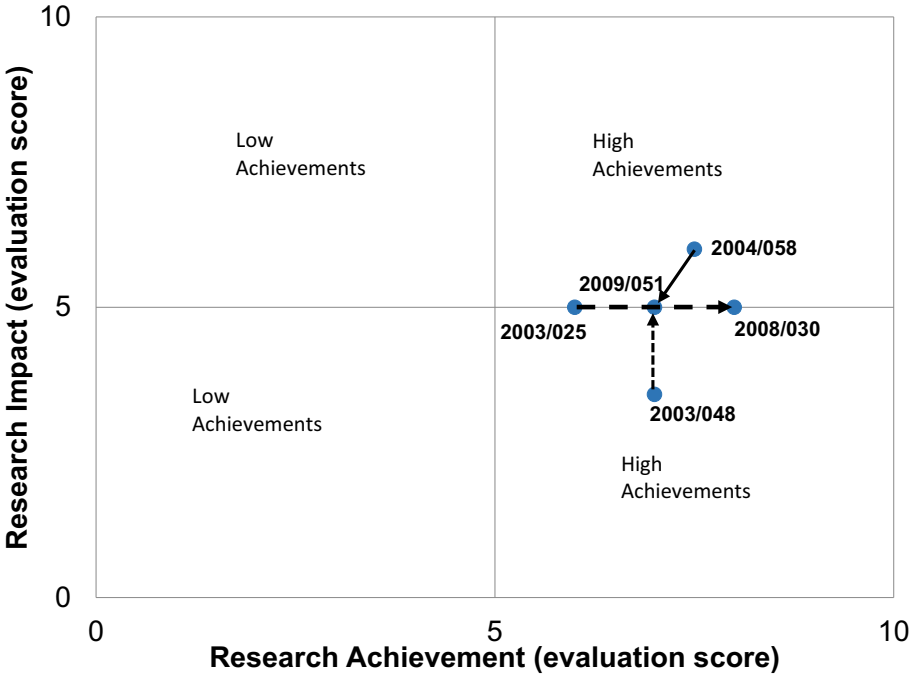

Figure 4: Changes in relative success of related projects.

This analysis showed that, for the project evaluated as having high achievements and high impacts, there was good evidence that about two-thirds of the success factors had strongly enhanced the project's success. Conversely, for the project evaluated as having low achievements and low impacts, it was apparent that about half of these factors had not been appropriately addressed and thereby had contributed to the diminished success of the project. The project with high achievements but low impacts had a lesser number of the factors that appeared to strongly enhance project success than did the project with high achievements and high impacts, and some factors, such as project duration, effective communications and monitoring and review, had contributed to diminished success. These relationships were more evident in information from the project records than from the interview responses, perhaps because the project-related interview questions did not directly address how the particular success factors may have influenced the project. These results demonstrate that project records, including external review reports, can provide evaluators with both positive and negative project performance-related information.

The analysis also showed that there is a reasonably clear relationship between the presence of those success factors which can be influenced during project design (nos. 1–3, 6, 7, 16, 17, 20 and 21) and evaluated levels of project research achievement and impact. The high achievements/high impacts project showed evidence of almost all of these factors either strongly enhancing or enhancing success, while in the low achievements/low impacts project, the evidence suggested that inadequate attention to over half of these factors had either strongly diminished or diminished success. This demonstrates the importance of careful attention to these factors in the design of research projects.

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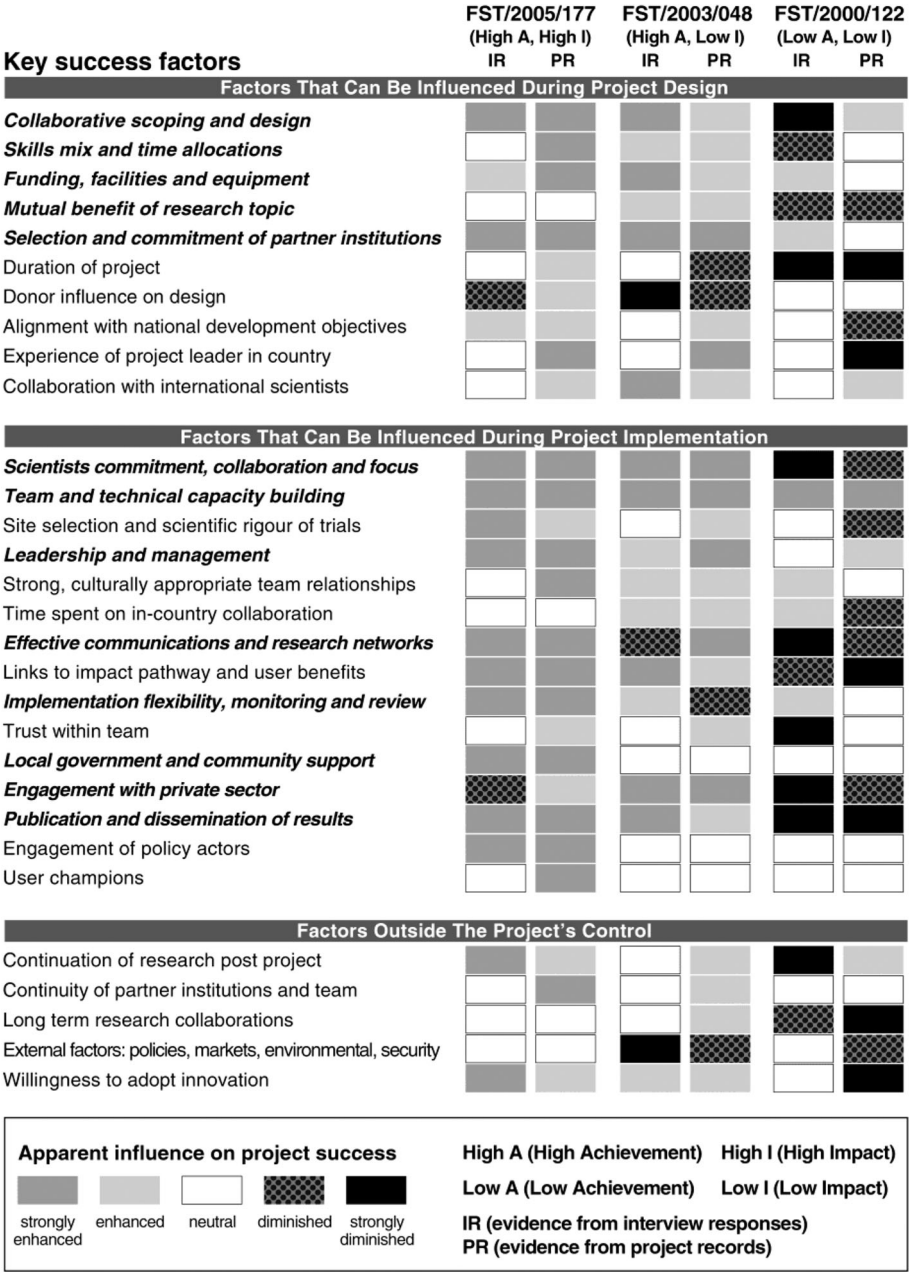
Table 4: Expression of success factors within three projects with different evaluated levels of success, with the 13 most frequently identified factors shown in ***bold italics***



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Discussion

Various authors (Bartlett *et al*, 2017; Baynes *et al*, 2015; Byron, 2001; Pearce, 2010) have examined the factors that influence the success of forestry development initiatives, and Pearce (2010) examined project-level factors that affect the success of ACIAR projects. The main purpose of studies such as these is to improve understanding of the factors that enhance or diminish success of ODA-funded projects, so that those responsible for project design and implementation can take them into account to improve project effectiveness. The findings of this study both confirm and supplement those from these previous studies.

The 14 success factors identified by Pearce (2010) as relevant to ACIAR research projects were all identified in this study, as were the 22 success factors identified in a companion study of ACIAR forestry research projects in Vietnam (Bartlett *et al*, 2017). The relative frequency of the factors differed between Vietnam and Indonesia, and a further eight success factors were identified by the Indonesian study participants. The apparent relationship between the presence of these success factors and the evaluated level of relative project success found by Bartlett *et al* (2017) for the Vietnam projects was also evident in this study.

The most notable differences in the factors identified in this study, when compared with the Vietnam study, were in the substantially increased frequency of two factors: effective communications and research networks (no. 12) and implementation flexibility, monitoring and review (no. 14), and the inclusion of three new factors in the 13 most frequently identified factors, viz. local government and community support (no. 23), engagement with the private sector (no. 24) and publication and dissemination of results (no. 25).

The eight success factors identified for the first time in this study were:

Local government and community support (no. 23)—this reflects the decentralised responsibility for forestry in Indonesia, and the need to have active participation of communities and smallholders to enhance the prospects of adoption of the forestry innovations from many projects.

Engagement with the private sector (no. 24)—this recognises the importance of the private sector in both smallholder and industrial forestry systems in Indonesia, and reflects a research focus on topics relevant to these systems: plantation productivity, disease management, timber and non-timber value chains and wood processing.

Publication and dissemination of results (no. 25)—this reflects the desirability and challenges of preparing and disseminating scientific articles and appropriate extension materials within the timeframe of a research project, in a research system that did not historically have a strong emphasis on academic writing, particularly in English.

External factors: policies, markets, environmental, security (no. 26)—this reflects a range of factors that are outside the control of projects but can affect project achievements, including unsupportive policies, access to markets, unforeseen diseases, natural disasters and political or security issues that limit travel to research sites.

Engagement of policy actors (no. 27)—this recognises that, in Indonesia's dynamic and decentralised political system, it can be difficult for researchers to achieve effective engagement with relevant policy actors.

Willingness to adopt innovation (no. 28)—this reflects the constraints on the capacity of some end users, including smallholders and small enterprises, to adopt innovations, for example because of risk aversion or lack of access to the finance needed to utilise a technology.

User champions (no. 29)—this reflects the benefits that can arise from having effective user champions actively engaged in a research project and, conversely, the challenges that exist when such champions are not present or are unable to lead adoption.

Collaboration with international scientists (no. 30)—this reflects the benefits that come from networking and collaboration with skilled international scientists and the challenges that many developing-country scientists have in accessing or capitalising on such collaborations.

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These results illustrate how the factors that influence project success may be both common and different between projects; For example, the factor 'mutual benefit of research topic' was not considered to have influenced the success of a teak agroforestry project, whereas its absence was considered to have diminished success in a molecular marker project. Differences are likely to be attributable to both differences in the nature of the research itself, and in the local contexts within which the research and adoption occur. This shows the importance of having a flexible, content-driven approach to considering the relevance of and managing the individual success factors during project design and implementation, rather than a pre-determined list that is presumed to apply universally. While some of the identified success factors are closely related, for example 'collaborative scoping and design' and 'mutual benefit of research topic', they have been listed separately so that the subtle differences can be considered, as appropriate.

The identification in this study of the three new frequently identified success factors (nos. 23–25), which relate to engagement of relevant stakeholders beyond the project team and publication of project results, is also important. The identification of the factor expressed as publication and dissemination of results refers to preparation of a range of communications materials, such as journal articles, technical reports, information and policy briefs, training manuals, field guides, websites and blogs. It also relates to ensuring that the information is effectively disseminated to the stakeholders, who either will benefit directly from the research findings or have responsibilities for policies or programs that affect adoption of research findings. This finding is likely to reflect both the strong pressures on Australian, international and Indonesian scientists to publish research results, as well as the recognition that the results have to be appropriately communicated to end users to facilitate adoption. The identification of factors related to engagement with key external stakeholders – the private sector, policy actors, local communities and user champions – emphasises the importance of factors that facilitate the relevance of research to, and knowledge of research results by, their ultimate users. This in turn is likely to affect the prospects for adoption and thereby the magnitude of the impacts from the research investment.

In this study, over 80 per cent of the factors identified as affecting project success, including all of the 13 most frequently identified factors, relate to either project design or project implementation. Therefore, paying close attention to success factors related to project design, particularly the degree of collaboration with partners on project design, the quality of the research design, the selection and commitment of partner organisations and the time allocations for the collaborating scientists, is likely to enhance prospects of the project's success. Likewise, project success will also be influenced by how well project teams pay attention to those success factors that can be influenced during project implementation. The most important of these factors are the commitment, focus and collaboration of the partner scientists, the effectiveness of leadership and communication processes, the degree of capacity building undertaken, and the flexibility the project has to modify its activities and approaches in response to feedback from monitoring and review.

Conclusions

Since the agreement of the Paris Declaration on Aid Effectiveness (OECD, 2005), and in the context of significant global negative externalities such as climate change and the global financial crisis (Haddad, 2012), there has been an increased interest in understanding both how aid effectiveness is evaluated and which factors contribute to the success of aid programs and projects. As Ofir (2010) notes, there is a need for deeper understanding of the essential and

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sufficient conditions for success, and also of the context necessary to achieve successful implementation and sustained impacts from agricultural research. This study has contributed to this learning, both by reinforcing the conclusions of an earlier companion study in Vietnam (Bartlett *et al*, 2017) and by broadening the understanding of which factors enhance or diminish the success of international collaborative forestry research projects. This study also demonstrated the utility of conducting evaluations of the relative success of related projects, through the finding that subsequent projects on the same research topic do not necessarily result in improved achievements and impacts relative to a precursor project.

As in the companion study, the results from this study suggest that there was a good convergence of assessment amongst project participants about the most important factors influencing project success, with about three-quarters of the responses relating to 13 of the identified success factors. This suggests that the majority of research project participants have a good understanding of the factors that influence the success of collaborative forestry research projects, which is consistent with the view of Haddad (2012) that the agricultural development evidence base needs to be broadened beyond the views of evaluation experts. It is encouraging that all of these 'most important' factors can be influenced by research program managers, or project leaders and researchers, during project design and implementation.

This study also provides further evidence of the linkages between the identified success factors and the success of research projects. It is likely that the effectiveness of international collaborative research projects in forestry and similar sectors could be improved if research program managers and project leaders considered which of these factors might be most relevant to a particular project, and then took appropriate action to address the relevant factors during project design and implementation. Collaborative research projects, in either the forestry or other sectors, are not limited to the international level; for example, both Australia and Germany have Cooperative Research Centre programs (Turpin *et al*, 2011; Schröder *et al*, 2014). It would be informative for further research to explore the application of relative success evaluations, the generality of the factors identified here, and our understanding of how identified success factors relate to the success of projects, in different national and international contexts.

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Note

1. Researchware, Inc. (http://www.researchware.com/, accessed 13/06/2014).

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References

ACIAR. (2014). ACIAR Strategic Plan 2014–18. Canberra: Australian Centre for International Agricultural Research.

Allen Consulting Group. (2012). *The Economic, Social and Environmental Impacts of the Coopertative Research Centres Program: A Report to the Department of Industry, Innovation, Science, Research and Tertiary Education*. Canberra: Allen Consulting Group.

Arnold, E. (2012). Understanding long-term impacts of R&D funding: The EU framework programme. *Research Evaluation* 21: 332–343.

Bartlett, A.G. (2016a). Evaluating relative success of donor-funded collaborative research projects. *Research Evaluation* 25: 405–415.

Bartlett, A.G. (2016b). The evolution and impacts of ACIAR's forestry research program over three decades. *Australian Forestry* 79: 171–188.

Bartlett, A.G., Kanowski, P.J., Van Kerkhoff, L. and Byron, R.N. (2017). Identifying factors that influence the success of forestry research projects implemented in developing countries: case study results from Vietnam. *Forestry* 90: 413–425.

Baynes, J., Herbohn, J., Smith, C., Fisher, R. and Bray, D. (2015). Key factors which influence the success of community forestry in developing countries. *Global Environmental Change* 35: 226–238.

Buxton, M. (2011). The payback of 'Payback': Challenges in assessing research impact. *Research Evaluation* 20: 259–260.

Byron, N. (2001). Keys to smallholder forestry. *Forests, Trees and Livelihoods* 11: 279–294.

Cunningham, A.B., Ingram, W., Daos Kadati, W., Howe, J., Sujatmoko, S., Refli, R., Liem, J.V., Tari, A., Maruk, T., Robianto, N., Sinlae, A., Ndun, Y., Made Maduarta, I., Sulistyohardi, D. and Koeslutat, E. (2011). Hidden Economies, Future Options: Trade in Non-timber Forest Products in Eastern Indonesia. *ACIAR Technical Reports No. 77*. Canberra: Australian Centre for International Agricultural Research.

Diallo, A. and Thuillier, D. (2004). The success dimensions of international development projects: The perceptions of African project coordinators. *International Journal of Project Management* 22: 19–31.

Eyles, A., Beadle, C., Barry, K., Francis, A., Glen, M. and Mohammed, C. 2008. Management of fungal root-rot pathogens in tropical *Acacia mangium* plantations. *Forest Pathology* 38: 332–355.

FAO. (2014). Contribution of the forestry sector to national economies, 1990–2011. In: A. Lebedys, A. and Y. Li (eds.) *Forest Finance Working Paper FSFM/ACC/09*. Rome: Food and Agriculture Organization of the United Nations.

FAO. (2015). *Global Forest Resources Assessment 2015: Desk Reference*. Rome, Italy: Food and Agriculture Organization of the United Nations.

Francis, A., Beadle, C., Puspitasari, D., Irianto, R., Agustini, L., Rimbawanto, A., Gafur, A., Hardiyanto, E., Junarto, Hidyati, N., Tjahjono, B., Mardai, U., Glen, M. and Mohammed, C. (2014). Disease progression in plantations of *Acacia mangium* affected by red root rot (*Ganoderma philippii*). *Forest Pathology* 44: 447–459.

Haddad, L. (2012). Five assumptions of dominant thinking in international development. *Development* 55: 34–44.

Harwood, C.E. and Nambiar, E.K.S. (2014). Sustainable plantation forestry in South-East Asia. *ACIAR Technical Reports No. 84*. Canberra: Australian Centre for International Agricultural Research.

Henderson, J.S. (2000). Evaluating the impact of forestry research for development. *International Forestry Review* 2: 191–199.

Høgh-Jensen, H., Oelofse, M. and Egelyng, H. (2010). New challenges in underprivileged regions call for people-centered research for development. *Society & Natural Resources* 23: 908–915.

Ika, L.A., Diallo, A. and Thuillier, D. (2012). Critical success factors for World Bank projects: An empirical investigation. *International Journal of Project Management* 30: 105–116.

Ika, L.A. and Donnelly, J. (2017). Success conditions for international development capacity building projects. *International Journal of Project Management* 35: 44–63.

Irawan, S. and Tacconi, L. 2009. Reducing emissions from deforestation and forest degradation (REDD) and decentralized forest management. *International Forestry Review* 11: 427–438.

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Jauhiainen, J., Hooijer, A. and Page, S.E. (2012). Carbon dioxide emissions from an *Acacia* plantation on peatland in Sumatra, Indonesia. *Biogeosciences* 9: 617–630.
Khang, D. B. and Moe, T.L. (2008). Success criteria and factors for international development projects: A life-cycle-based framework. *Project Management Journal,* 39: 72–84.
Lindner, R. (2011). The economic impact in Indonesia and Australia of investment in plantation forestry research, 1987–2009. *ACIAR Impact Assessment Series Report No. 71.* Canberra: Australian Centre for International Agricultural Research.
Lindner, R., Mcleod, P. and Mullen, J. (2013). Returns to ACIAR's investment in bilateral agricultural research. *ACIAR Impact Assessment Series No 86.* Canberra: Australian Centre for International Agricultural Research.
Mcleod, L., Doolin, B. and Macdonell, S.G. (2012). A perspective-based understanding of project success. *Project Management Journal* 43: 68–86.
Mendham, D. and Hardiyanto, E. (2011). Realising genetic gains in Indonesia and Australian plantations through water and nutrient management. *ACIAR Final Reports No. FR2011-07.* Canberra: Australian Centre for International Agricultural Research.
OECD (2005). Paris declaration on aid effectiveness. Paris: Organisation for Economic Cooperation and Development.
Ofir, Z. (2010). Commentary on 'The sorry state of M&E in agriculture: can people-centred approaches help?'. *IDS Bulletin* 41: 26–27.
Pearce, D. (2010). Lessons learned from past ACIAR impact assessments, adoption studies and experience. *ACIAR Impact Assessment Series Report No 69.* Canberra: Australian Centre for International Agricultural Research.
Pearce, D. and Alford, A. (2015). Adoption of ACIAR project outputs 2015. *ACIAR Adoption Studies Report No. 12.* Canberra: Australian Centre for International Agricultural Research.
Perdana, A. and Roshetko, J.M. (2015). Survival strategy: Traders of smallholder teak in Indonesia. *International Forestry Review* 17: 461–468.
Pinto, J.K. and Mantel, S.J. (1990). The causes of project failure. *IEEE Transactions on Engineering Management* 37: 269–276.
Pramono, A.A., Fauzi, M.A., Widyani, N., Heriansyah, I. and Roshetko, J.M. (2011). *Managing smallholder teak plantations: Field guide for farmers*. Bogor: Center for International Forestry Research (CIFOR).
Purnomo, H., Achdiawan, R., Melati, Irawati, R. H., Sulthon, Shantiko, B. and Wardell, A. (2014). Value-chain dynamics: strengthening the institution of small-scale furniture producers to improve their value addition. *Forests, Trees and Livelihoods* 23: 87–101.
Raitzer, D.A. (2003). Benefit-cost meta-analysis of investment in International Agricultural Research Centres of the CGIAR. Rome: Food and Agricultural Organisation of the United Nations.
Rohadi, D., Roshetko, J., Perdana, A., Blyth, M., Nuryartono, N., Kusumowardani, N., Pramono, A., Widyani, N. and Fauzan, A. (2012). Improving economic outcomes for smallholders growing teak in agroforestry systems in Indonesia. *ACIAR Final Reports No. FR2012-11.* Canberra: Australian Centre for International Agricultural Research.
Roshetko, J.M., Rohadi, D., Perdana, A., Sabastian, G., Nuryartono, N., Pramono, A.A., Widyani, N., Manalu, P., Fauzi, M.A., Sumardamto, P. and Kusumowardhani, N. (2013). Teak agroforestry systems for livelihood enhancement, industrial timber production, and environmental rehabilitation. *Forests, Trees and Livelihoods* 22: 241–256.
Schröder, S., Welter, F., Leisten, I., Richert, A. and Jeschke, S. (2014). Research performance and evaluation—empirical results from collaborative research centers and clusters of excellence in Germany. *Research Evaluation* 23: 221–232.
Tarigan, M., Roux, J., Van Wyk, M., Tjahjono, B. and Wingfield, M.J. 2011. A new wilt and die-back disease of *Acacia mangium* associated with *Ceratocystis manginecans* and *C. acaciivora* sp. nov. in Indonesia. *South African Journal of Botany* 77: 292–304.
Tsujino, R., Yumoto, T., Kitamura, S., Djamaluddin, I. and Darnaedi, D. 2016. History of forest loss and degradation in Indonesia. *Land Use Policy* 57: 335–347.
Turpin, T., Woolley, R. and Garrett-Jones, S. (2011). Cross-sector research collaboration in Australia: the Cooperative Research Centres Program at the crossroads. *Science and Public Policy* 38: 87–97.
Van Kerkhoff, L. and Lebel, L. (2006). Linking knowledge and action for sustainable development. *Annual Review of Environment and Resources.* Palo Alto: Annual Reviews.

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Weißhuhn, P., Helming, K. and Ferretti, J. (2017). Research impact assessment in agriculture—a review of approaches and impact areas. *Research Evaluation* rvx034–rvx034.
Wibowo, L.R., Race, D.H. and Curtis, A.L. (2013). Policy under pressure: Policy analysis of community-based forest management in Indonesia. *International Forestry Review* 15: 398–405.
Yalegama, S., Chileshe, N. and Ma, T. (2016). Critical success factors for community-driven development projects: A Sri Lankan community perspective. *International Journal of Project Management* 34: 643–659.

Appendix 1: Information About Projects Studied to Explore the Expression of Success Factors in Projects

FST/2005/177 "Improving the Profitability from Smallholder Teak Agroforestry"

This four-year project aimed to improve the livelihoods of smallholder teak growers by conducting research on: encouraging the use of silviculture; exploring how micro-finance might enhance smallholder teak profitability; and enhancing market access. The results are summarised by Rohadi *et al* (2012). The project built substantial capacity among stakeholders and produced many scientific and extension publications (Roshetko *et al*, 2013; Perdana and Roshetko, 2015; Pramono *et al*, 2011).

The factors that contributed to its success included: collaborative project design, good leadership and collaboration between partners, engagement of policy actors, local government and communities, and preparation of publications. The least successful activity was the micro finance trial, due to lack of support from financial institutions. The adoption study (Pearce and Alford, 2015) found that project outputs had been used by farmers, researchers and policy makers at village, district, national and global levels.

FST/2003/048 "Management of Fungal Root rot in Plantation Acacias in Indonesia"

This four-year project aimed to develop simple control strategies that reduce root-rot damage in Acacia mangium plantations through research on: identification of the causal agents of root-rot; investigation of factors that influence its distribution; and development of control options. Eyles *et al* (2008) report the findings and control challenges. The factors that contributed to its success included: collaborative scoping, selection of partners, scientists' commitment and collaboration, and the capacity building undertaken. The involvement of plantation companies as research partners provided links to the impact pathway and facilitated collaboration between government and private sector researchers.

The factors that reduced its success related predominantly to the project design or to factors beyond the control of the project team. The four year duration meant that, while the project produced good information the biology of the pathogen and some understanding on factors affecting its spread, it could not achieve the development of an effective bio-control agent. The rapid unpredictable spread of the disease and a volcanic eruption, which impacted on the research laboratory, also limited its success.

FST/2000/122 "Application of Molecular Marker Technologies for Genetic Improvement of Forest Plantation Species"

This two-year project had an ambitious aim to progress the development of molecular markers for tree breeding in Australia and enable their use in Indonesia at a new donor-funded laboratory. It had eight objectives, with unrelated research activities in Indonesia and Australia.

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The Australian partner provided the capacity building to Indonesian staff and transferred the molecular marker technologies for Acacia mangium. The project did not produce any scientific publications and, when it ended, there was no further collaboration and the Australian partner discontinued its Acacia genetics research. An ACIAR impact assessment study (Lindner, 2011), found no evidence of uptake or impact from this project in either Indonesia or Australia.

Factors related to the project design and implementation reduced its success. Two years was inadequate for this type of research, especially for a new collaboration where the project leader had not worked previously in Indonesia. There were too many objectives to be achieved in two years and insufficient time was allocated for Australian scientists to work with Indonesian partners to conduct clonal propagation and establish new tree breeding trials. Restrictions on travel by Australian scientists to Indonesia limited collaboration and implementation of project activities.

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PART 2: THE CASE STUDIES

Chapter 6. Factors affecting the success of collaborative forestry research projects in Papua New Guinea.

This chapter reports the results of the third country case study, in this case focussing on ten completed forestry research projects from Papua New Guinea. It utilises the new evaluation methodology (presented in Chapter 3) and the same case study methods used in the Vietnam and Indonesia case studies (as described in Chapters 4 and 5). The chapter presents the findings from Papua New Guinea on the relative success of the ten projects, the identified factors that affect success, and some apparent relationships between these factors and relative success of a project. It also provides a brief comparison with the findings from the other two case studies (as presented in Chapters 4 and 5).

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Factors affecting the success of collaborative forestry research in Papua New Guinea

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ABSTRACT

Papua New Guinea (PNG) and Australia have a close relationship, including through development assistance in agriculture and forestry. Delivering successful research and development projects in PNG is challenging due to weak government service delivery, poor infrastructure and a clan-based society. This paper reports a qualitative investigation of factors contributing to success in ten collaborative forestry research projects implemented in PNG by the Australian Centre for International Agricultural Research. The relative success of the projects was evaluated, and 37 contributing factors were identified from an analysis of project records and interviews with 33 project participants. The most frequently identified success factors were collaborative scoping and design, funding and equipment, leadership and management, selection and commitment of partner institutions, and effective communications. Relationships between these success factors and the success of the projects were evident in a closer study of four projects with different relative success. This study broadens the understanding of factors that enhance or diminish the success of international forestry research projects, confirms results from companion studies, and identifies some additional aspects that are relevant to the PNG context. This knowledge could help improve the effectiveness of future research for development projects.

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Introduction

The Australian Centre for International Agricultural Research (known as ACIAR) commissions collaborative Research for Development (R4D) (*sensu lato* Høgh-Jensen et al. 2010) projects in the agriculture, fisheries and forestry sectors in developing countries. ACIAR has a mission to achieve more productive and sustainable agricultural systems for the benefit of both developing countries and Australia through international agricultural research partnerships (ACIAR 2014). Research in support of a particular development goal is inherently a medium-risk to high-risk activity, with potentially significant returns generally dependent on complementary development interventions (Fargher & Kelly 2012).

Papua New Guinea (PNG), having gained independence from Australia in 1975, is a young, resource-rich yet poorly developed nation facing major development challenges. Papua New Guinea's development record is generally regarded as poor because, by international standards, its level of development remains extremely low: for example, PNG's Human Development Index ranked 154 out of 188 countries (UNDP 2016). Australia provides the majority of PNG's Official Development Assistance (ODA).[1] In 2016–2017, Australia allocated approximately 21% of its country and regional ODA funding to PNG (DFAT 2017a), with 17% of these funds directed towards agriculture, fisheries and water (DFAT 2017b). However, both official aid program evaluations and other analysts have long painted a bleak picture of aid effectiveness in PNG (Hughes 2003; Feeny 2005; Heinecke et al. 2008). Other studies of aid effectiveness have found that the probability of aid projects and programs being successful in PNG and the Pacific is significantly less than in Asian countries such as China, Vietnam and Indonesia (Feeny & Vuong 2017).

The PNG economy depends largely on the resources sector (minerals, gas and oil), with a smaller contribution from renewable resources, including marine products, timber and agricultural cash crops, such as coffee, tea, palm oil, copra and coconut (Bird et al. 2007a). The potential contribution of PNG's forests resources to economic development was recognised in the 1970s, and in 1979, a revised forest policy paved the way for foreign companies to commence export-oriented logging operations (Bird et al. 2007b). However, forest-based development has a chequered and contested history in PNG, with 'successful' forest-based development projects considered to be relatively rare (Bird et al. 2007b), and seldom delivering long-term benefits to landowners (Forest Trends 2006). Likewise, there are many challenges to be overcome before forest-based communities can benefit from new revenue sources under initiatives such as REDD+ (Babon & Gowae 2013; Cadman et al. 2017). The Papua New Guinea Vision 2050 (Government of Papua New Guinea 2009) articulates the PNG Government's vision to meet the aspirations of its people, including through wealth creation from PNG's forests. The strategies identified for PNG's forestry sector include transitioning from export logging to domestic downstream wood processing, development of a large plantation estate in conjunction with customary landowners and facilitating carbon trade payments from forests.

For ACIAR, PNG is its most important partner country, accounting for 13.6% of its research program budget in 2016–2017 (ACIAR 2016). Papua New Guinea is also a very

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[1]OECD PNG Snapshot of ODA flows http://www.oecd.org/countries/papuanewguinea/aid-at-a-glance.htm

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important part of the ACIAR Forestry Program. Over the first 30 years of ACIAR's existence, PNG had the third largest number of projects within the ACIAR Forestry Program (Bartlett 2016a), and in 2015–2016 the five projects being implemented in PNG represented 25% of the Forestry Program budget.[2] Despite the importance of PNG, to both ACIAR investments and Australian development assistance more generally, there is a dearth of published information about the effectiveness of these investments or on what country-specific lessons could help improve the success of future projects.

While PNG is a very logical country in which to implement ACIAR forestry projects, it is a difficult environment in which to deliver successful R4D projects. For example, an ACIAR impact assessment study of ten PNG forestry projects implemented between 1995 and 2010 found that adoption of project outputs was mixed, and appeared to have been greatest in projects aimed at and that engaged with local communities, and least in policy-related projects (Fisher 2011). Other ACIAR impact assessment studies relevant to PNG also indicate mixed results (Fisher 2010; Fisher et al. 2012).

As Ofir (2010) noted, there is a need for a deeper understanding of the context and essential conditions for success to achieve successful implementation and sustained impacts from agricultural research projects. Systematically studying the factors that enhance or diminish success of ODA-funded research projects could assist organisations that implement such projects to improve their understanding of what works when, why and for whom (Bartlett et al. 2017). In this study, success is considered to have two primary dimensions. The first is the extent to which planned research outputs are achieved and adopted by 'next users', such as the participating scientists, here called 'achievements'; the second is the extent of the impacts resulting from wider adoption of the research outputs by 'end users', here called 'impacts' (Pearce 2010).

This article reports a qualitative investigation involving ten collaborative forestry research projects between Australia and PNG, to distil lessons relevant to program managers and project leaders. It seeks to answer two questions: what are the factors that are considered to affect the relative success of collaborative forestry research projects in PNG; and, is there evidence that the presence or absence of these factors has affected the relative success of individual projects? The research is part of a wider study that addresses these questions in Vietnam (Bartlett et al. 2017) and Indonesia (Bartlett 2018), and seeks to inform both researchers and international development practitioners about the project success factors in a way that will enable them to improve project effectiveness.

Forests and forest-based development in Papua New Guinea

Papua New Guinea, with a population of about 8 million people, has the 19th largest area of forest in the world. The 2015 Global Forest Resource Assessment (FAO 2015) reported that PNG has about 33.5 million ha, or 72% of its land area, classified as forest; with the forests of New Guinea being the third largest remaining area of tropical forest after those in the Amazon and Congo basins (Novotny 2010). Since 1990, the total area of forest has not changed substantially; however, the area of primary forest has reduced by 13.73 million ha (FAO 2015). Papua New Guinea's forests are highly biologically diverse, and their conservation is a high priority (Brooks et al. 2006; Pollock et al. 2017).

Customary ownership of land and forests is enshrined in the PNG Constitution, applying to about 97% of all land (Turia et al. 2011) and operating in a variety of ways (Holzknecht 1996). Customary ownership and clan loyalties have supported food security in communities, but may restrict indigenous entrepreneurship in Pacific societies (Hughes 2003), and present major challenges for economic development (Bird et al. 2007b). Various institutional mechanisms have been established to involve landowners in forest exploitation decisions (Bird et al. 2007b), and many communities sell logging rights to generate income, as there are no operational mechanisms to generate income from forest conservation (Novotny 2010; Sillitoe 2014). The establishment of commercial forestry plantations depends on the ability of investors to negotiate long-term access to land from customary landowners; this is one reason why only around 62 000 ha of plantations has been established since the 1950s (Turia et al. 2011).

Papua New Guineans have traditionally included trees in their agricultural gardens (Bourke & Harwood 2009), and four distinct systems of customary agroforestry are discernible with numerous variations (Kanowski et al. 2014). Many of these systems incorporate commercially valuable trees — for example, in East New Britain, smallholders have incorporated fast-growing balsa trees into their farming systems as part of their livelihood strategies (Ghaffariyan et al. 2016). Utilisation and commercialisation of a variety of non-timber forest products, including indigenous nuts, gums, sandalwood and sago, have long been practiced at a small scale by local communities, but more could be done to develop and promote these products at national and international levels (Saulei & Aruga 1994).

There is a long history of concerns about the PNG forestry sector, including allocation of timber rights, levels of corruption, sustainability of timber harvesting, loss of national economic surplus, human rights abuses and the limited benefits accruing to customary landowners (Duncan 1994; Hughes 2003; CELCoR-ACF 2006; Shearman et al. 2009). Papua New Guinea's commercial forestry sector, which involves large scale export-oriented harvesting of natural forests, suffers from weak governance and over-exploitation (Laurance et al. 2011), an unstable policy environment and a poorly developed domestic wood processing sector (Hunt 2001).

For the PNG economy, the benefits derived from the forest sector fall into three components: (1) government revenue, (2) rural jobs and payments and (3) the provision of infrastructure and services (Bird et al. 2007a). Historically, about 90% of industrial timber harvested has been exported in log form, with the balance being processed domestically (FAO 2009), though the proportion processed domestically may now be 20% (Government of Papua New Guinea 2016). In 2010, the PNG Government received approximately PGK890 million (AU$367 million) in revenues from the forest industries (FAO 2015). Papua New Guinea's Medium Term Development Plan includes the challenging targets of

[2]Sourced from internal ACIAR records.

achieving 150 000 ha of plantations by 2030 and 800 000 ha by 2050, as well as having 100% of timber processed domestically by 2020 (Government of Papua New Guinea 2016).

ACIAR forestry research investments in Papua New Guinea

ACIAR investments in PNG comprise about one-fifth of the total number of forestry projects commissioned by ACIAR over three decades (Bartlett 2016a). From 1987 to December 2016, ACIAR has completed 20 forestry research projects in PNG (see Table 1), including four implemented as multi-country projects. These projects have covered five of ACIAR's forestry research themes (Bartlett 2016a), reflecting the nature of priorities identified by PNG, and ACIAR's long-standing preference to support research related to smallholder aspects of forest-based development. The research topics have included technical, social and policy aspects of smallholder and plantation forestry systems, including germplasm improvement; growth studies; value chain analysis; value-added processing of timber and non-timber products; and elements of forest inventory and yield modelling for natural forests.

While there is currently no documented evidence of economic benefits arising from ACIAR forestry projects in PNG, Fisher (2011) estimated potential benefits of AU$51 million from three projects related to the development of a new industry utilising the indigenous *Canarium indicum* L. (galip) nut. In a review of Australia's aid investments in rural development, Fargher and Kelly (2012) found that these projects had established a good foundation for growth of a new industry that would benefit PNG smallholders.

Methods

The methods for this case study follow those developed by Bartlett (2016b) to identify the relative success of selected research projects, and the three-phase methodology applied in a companion study by Bartlett et al. (2017) to identify factors that affect project success in Vietnam. A qualitative analysis was undertaken of information obtained from project records and from interviews with project staff. Ten of the 20 ACIAR forestry projects completed in PNG between 1992 and 2016 (Table 1) were selected for the case study, taking into account the following factors:

(1) focusing on medium to large research projects conducted entirely in PNG, including some projects that were part of a longer-term program, and ensuring representation of projects from the five different ACIAR research themes
(2) having adequate project records available for analysis and being able to locate researchers involved in a project for interview.

Phase 1: identification of project success factors

Thirty-three scientists who had worked as project leaders, PNG project coordinators or collaborating researchers on the selected projects were interviewed. They comprised 12 scientists from Australian agencies and 21 scientists from PNG agencies. Interviewees were asked a series of open-ended questions, including being asked to describe what they thought constituted success for an ACIAR project, and to nominate five factors that can enhance project success and five factors that can diminish project success. Other questions sought their views on aspects of the design, implementation and other contextual factors of specific projects that they had worked on. The research protocol was approved by the Australian National University Human Ethics Committee (Protocol No. 2014/051).

HyperRESEARCH[3] qualitative data analysis software was used to analyse interview response data thematically to establish what constitutes success, and participants' perspectives on those factors that enhance and those factors that diminish project success. The author reviewed the two lists of factors to identify complementary expressions of the same factor and then prepared concisely worded statements for each success factor. For example, the factor 'good leadership and effective project planning and oversight', considered to enhance success, and the factor 'poor leadership and inefficient project management', considered to diminish success, were collectively expressed as 'leadership and management'. The results were aggregated into two groups, of PNG and Australian participants, respectively, and the frequency of identification of each success factor was calculated for each group. The frequency data also enabled determination of the most important success factors, being those most frequently identified factors that together represented about three-quarters of the responses.

Phase 2: evaluation of relative success of the case study projects

Each project's relative success was evaluated using the score-card matrix methodology described in Bartlett (2016b), which enables comparative evaluations of multiple projects to be undertaken in a cost-effective manner from existing project records. A range of qualitative data drawn from ACIAR project records was analysed, including from project proposals, annual and final reports, mid-term and final reviews, adoption and impact assessments, project-related publications, and written correspondence between ACIAR and project staff. These data provided perspectives from project participants, research program managers and external reviewers of projects. A disadvantage of this methodology is that, unlike participatory evaluation methodologies, it does not engage users of the research in the evaluation.

Scores were assigned for four criteria related to research achievements (project design, results achieved, collaboration and publications) and for four criteria related to research impacts (capacity building outcomes, scientific outcomes, economic outcomes, and social and policy outcomes). Under this methodology, scores up to a maximum of ten were assigned for each of research achievements and research impacts. Scores of 0.0–5.0 were considered to be low achievements or low impacts; scores of 5.1–10.0 were considered to be high achievements or high impacts. This approach generates four different categories of project success: high achievements-high impacts, high achievements-low impacts, low achievements-low impacts and low achievements-high impacts.

[3]Researchware, Inc. http://www.researchware.com/ [accessed 13 June 2014].

Table 1. ACIAR completed Papua New Guinea forestry projects

ACIAR project code	Duration	Funding AU$ m	Research theme[a]	Focus of research
FST/1991/014	1992–96	1.29	T3	Nutrition and mycorrhizal requirements of tropical trees for plantation and agroforestry systems
FST/1994/033	1995–00	1.28	T6	New leucaenas for south-east Asian, Pacific and Australian agriculture
FST/1995/123	1997–98	0.16	T8	Testing the utility of the north Queensland rainforest growth and timber yield model in PNG
FST/1998/113	2000–05	0.67	T7	Development of a sustainable, community-based essential oil industry in the Western Province of PNG
FST/1998/115	2000–05	1.55	T3	Domestication of PNG's indigenous forest species
FST/1998/118	2001–05	0.84	T8	Planning methods for sustainable management of timber stocks in PNG's forests
FST/2002/010	2004–05	0.20	T3	Domestication and commercialisation of multi-purpose indigenous trees and shrubs for food and other products
FST/2003/049	2005–08	0.15	T5	Review of portable sawmills in the Pacific: identifying the factors for success
FST/2004/009	2005–08	0.63	T3	Facilitating the availability and use of improved germplasm for forestry and agroforestry in PNG
FST/2005/050	2005–06	0.15	T6	Exploring PNG agroforestry systems
FST/2004/050	2007–12	0.91	T6	Value adding to PNG agroforestry systems
FST/2004/055	2006–09	0.63	T3	Domestication and commercialisation of *Canarium indicum* in PNG
FST/2004/061	2007–11	0.78	T8	Assessment, management and marketing of goods and services from cutover native forests in PNG
FST/2006/048	2008–11	0.65	T7	Processing of *C. indicum* nuts: adapting techniques to benefit South Pacific farmers
FST/2006/088	2008–12	0.92	T3/T7	Promoting diverse fuelwood production systems in PNG
FST/2006/120	2008–11	0.68	T5	Increasing downstream value adding in PNG's forest and wood products industry
FST/2007/078	2009–15	1.06	T3	Development of a PNG timber industry based on community-based planted forests
FST/2009/016	2011–16	1.08	T3	Improving the PNG balsa value chain to enhance smallholder livelihoods
FST/2010/013	2012–16	0.48	T7	Developing markets and products for the Pacific and PNG *Canarium* nut industry
FST/2011/058	2012–13	0.11	T7	Facilitating the establishment of charcoal producer groups in PNG

Highlighted projects: projects analysed in the case study. [a]ACIAR forestry program research themes as described in Bartlett (2016a) (Theme 3, Domestication and silviculture of non-Australian trees; Theme 5, Value-added processing and treatment of wood; Theme 6, Agroforestry and community forestry; Theme 7, Non-timber forest products; Theme 8, Native forest management)
ACIAR, Australian Centre for International Agricultural Research; PNG, Papua New Guinea

Phase 3: identification of relationships between success factors and the level of relative success achieved by different projects

Four projects, representing two different success categories, were selected for a more detailed analysis to better understand the relationships between the identified success factors and a project's evaluated success. The features of the selected projects are shown in Table 2; further information on the type of research conducted in each project and the way in which various success factors influenced its level of success are presented in Appendix 1.

For each selected project, the ACIAR project records and interview responses from the project leader and two PNG participants were further analysed to identify any evidence of the way the identified success factors had enhanced or diminished success. Using these two sources of information, subjective ratings were assigned for the apparent influence of each of these success factors on the project's success. The following rating system of five categories was used:

(1) *Strongly enhances* — presence of factor appears to have strongly enhanced success
(2) *Enhances* — presence of factor appears to have enhanced success
(3) *Neutral* — no evidence that the factor enhanced or diminished success
(4) *Diminishes* — absence of factor appears to have diminished success
(5) *Strongly diminishes* — absence of factor appears to have strongly diminished success.

Results

Interpreting success in a collaborative research project

The views expressed by participants on what constitutes project success varied considerably, with about one-third of participants articulating factors that influence success rather than articulating what success meant to them. The thematic analysis enabled a common definition of success to be developed from participants' responses. A successful ACIAR forestry research project in PNG was perceived to be one which achieves its specified objectives and outputs, enhances the capacity of partners, facilitates ongoing scientific relationships and networks, and results in tangible scientific impacts and benefits for project stakeholders and local communities. About one-third of participants considered a successful project should have some evidence of adoption and impact by the end users of the research outputs; however, (Fisher 2011) found that many ACIAR forestry projects in PNG have achieved only limited impact.

Table 2. Projects for which relationships between success factors and project success categories were explored

Project success category				
Achievements	Impacts	Project number	Theme	Title of project
High	Low	FST/2009/016	T3	Improving the PNG balsa value chain to enhance smallholder livelihoods
High	Low	FST/2006/048	T5	Processing of *Canarium indicum* nuts: adapting techniques to benefit South Pacific farmers
Low	Low	FST/1998/115	T3	Domestication of PNG's indigenous forest species
Low	Low	FST/2006/120	T5	Increasing downstream value adding in PNG's forest and wood products industry

PNG, Papua New Guinea

Identification of success factors

The thematic analysis of participants' responses on the factors that can enhance or diminish project success identified 33 factors that were considered to enhance, and 34 factors that were considered to diminish, project success; when taken as a whole, there were 37 different factors identified that influence project success (Table 3). While most factors that diminish success were the converse of factors that enhance success, there were three factors identified that enhance success (alignment with national objectives, user champions and collaboration with international scientists), and four factors identified that diminish success (duration of project, donor influence on design, community or land disputes, and gender roles and empowering women), for which no converse factor was identified by participants.

The interview data comprised 606 responses related to individual success factors, of which 339 responses are from the 21 PNG participants and 267 responses are from the 12 Australian participants. The frequency of identification of the 37 success factors by PNG and Australian participants, for each factor considered to enhance or diminish project success, is shown in Figure 1. As shown in Figure 1, some factors are much more frequently identified than others, and for almost all the factors interviewees considered that the same factor could either enhance or diminish project success. The three most frequently identified factors, which together represented 22% of the responses, were: collaborative scoping and design (47 responses), funding facilities and equipment (44 responses), and leadership and management (42 responses). Sixteen of the success factors (Nos. 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 25 and 26) together represented 76% of the responses, and so can be considered as the most important factors affecting project success identified in this study.

Most of the success factors were consistently identified across the two groups (PNG and Australian), but some differences were apparent. Papua New Guinea participants considered factors such as effective communications and research networks, links to impact pathway and user benefits, continuation of research post project, and clarity of roles and responsibilities, as being more important than did the Australian participants. Australian participants considered factors such as publication and dissemination of results, strong culturally appropriate team relationships, time spent on in-country collaboration, continuity of partner institutions and team, and engagement with the private sector, as being more important than did the PNG participants.

Evaluation of the relative success of the forestry projects

The results of the evaluation of project achievements and project impacts for each of the ten forestry research projects are shown in Figure 2. The ten projects had different levels of apparent success, with scores ranging from 3 to 9 for research achievements and 1.5–4.5 for research impacts. All projects achieved much higher scores for research achievements than for research impacts, and no two projects achieved the same combination of scores for research achievements and research impacts. Even when projects received the same total evaluation score for research achievements (as was the case for FST/2009/016 and FST/2004/061), they received different scores for the constituent criteria. These results highlight both the variability between projects within a country and the usefulness of this evaluation methodology to compare the relative degrees of success within a group of projects.

Bartlett et al. (2017) demonstrated the utility of considering categories of project success based on combinations of the evaluation scores for research achievements and research impacts. Applying that approach to these ten projects results in two categories of project success (Fig. 3): four projects with low achievements and low impacts, and six projects with high achievements but low impacts. In this case study, there were no projects with high achievements and high impacts, and no projects with the unlikely combination of low achievements yet high impacts. The absence of any projects with high achievements and high impacts is in stark contrast to the findings from companion studies of other ACIAR forestry projects from Vietnam (Bartlett et al. 2017) and Indonesia (Bartlett 2018).

Evidence of success factors in selected projects

The author's assessment, derived from the interview responses and evidence from project records, of the apparent influence of each of the 37 success factors on the success of the four selected projects is shown in Table 4. This analysis provided a clear indication of the importance of many of the identified success factors that can be influenced during project design and project implementation.

For the two projects evaluated as having high achievements and low impacts, evidence existed that taking appropriate account of the success factors had contributed to enhanced success. In general, this pattern seemed to be stronger for the more frequently identified success factors than for those less frequently identified. For one of these two projects (FST/2009/016), the project team engaged the private sector and local communities as well as working with the government and academic research partners. For the two projects evaluated as having low achievements and low impacts, it was apparent that failing to take appropriate account of the success factors had contributed to the diminished project success. However, the pattern was not evident for two of the most commonly identified factors that can be influenced during project implementation: 'leadership and management', and 'strong, culturally appropriate team relationships'. This suggests that having effective leadership and management as well as strong team relationships are necessary but not sufficient to facilitate project success in PNG. For the identified success factors that are outside the control of a project, there was little evidence of any relationships between the success factors and the evaluated level of success in the four projects assessed. For example, the factor 'lack of continuity of partner institutions and individual team members' appeared to have contributed to diminished success in all four assessed projects, although perhaps more strongly in the two projects with low achievements and low impacts.

These relationships were reasonably consistent regardless of whether the assessment was based on information from the project records or from the interview responses. In some cases, evidence could not be found within the interview

Table 3. Participants' views of success factors

Factor no.	Success factors	Participants' views on factors that enhance success or diminish success	
		Enhance success	Diminish success
1	Collaborative scoping and design	Good collaboration with partners on scoping and the specifics and achievability of project design	Inadequate consultation with partners, incorrect assumptions and too ambitious or poorly focussed design
2	Skills mix and time allocations	Having appropriate skilled and experienced scientists with sufficient time allocations, including some full-time staff	Team with inappropriate skills mix, inexperienced or overcommitted scientists and no dedicated project staff
3	Funding, facilities and equipment	Adequate funding and other resources, including donor and partner contributions	Inadequate funding, facilities or equipment to undertake planned activities and delays in provision of funds to project activities
4	Scientists commitment, collaboration and focus	Dedicated and focused and accountable scientists and with collaborative team work	Scientists lacking interest, commitment or focus and poor collaboration within team
5	Team and technical capacity building	Supporting team and institutional capacity building, informal and formal study opportunities	Poor focus on capacity building of project partners
6	Mutual benefit of research topic	Selection of research issue with mutual benefits	Research does not provide mutual benefits for each country
7	Selection and commitment of partner institutions	Effective selection and ongoing commitment of project partners	Poor institutional support or functionality, changes in priorities or conflict with partners and having too many partners to coordinate
8	Site selection and scientific rigour of trials	Appropriate sites for research trials with good scientific design and stakeholder support	Inappropriate trial location or poor scientific discipline in trial establishment
9	Leadership and management	Good leadership and effective project planning and oversight	Poor leadership and inefficient project management
10	Strong, culturally appropriate team relationships	Respect of culture, patience and developing friendships	Poor relationships or misunderstandings within team and no mechanisms for resolving conflicts or misunderstandings
11	Time spent on in-country collaboration	Sufficient resourcing to enable adequate time of external researchers in country, with frequent visits by project leader and various project staff	Infrequent visits by project leader, lengthy gaps in visits from project staff, inadequate travel funds or other restrictions limiting travel
12	Effective communications and research networks	Good and regular communications within project and effective dissemination of knowledge	Poor communications between team members, unavailability and unreliability of public communications systems and failure to disseminate results to stakeholders
13	Links to impact pathway and user benefits	Results linked to stakeholder benefits	Poor communication of project results to users or lack of benefits for stakeholders from research
14	Implementation flexibility, monitoring and review	Flexibility to adapt activities and appropriate monitoring and review of progress, including a mid-term review process	Overly prescriptive outputs, no flexibility to adapt, poor monitoring, no mid-term review or lack of follow-up on review recommendations
15	Continuity of partner institutions and team	Continuity of key staff in partner institutions and with partner researchers	High turnover or non-replacement of project staff and changes of structures or leadership support within partner institutions
16	Duration of project	Not identified	Duration too short to implement activities and obtain results
17	Donor influence on design	Not identified	Donor finalising project or insisting on design elements not agreed to by all partners
18	Long-term research collaborations	Long-term relationships supported via follow on projects	Lack of follow on research projects
19	Continuation of research post-project	Agencies continue research after project, donor facilitates ongoing monitoring of trials or has a clear exit strategy	No funding available after project or no exit strategy
20	Alignment with national development objectives	Research relevant to national policies, priorities and programs	Not identified
21	Experience of project leader in country	Good understanding of local culture and operating environment	Naivety of project leader about local context
22	Trust within team	Trust between project participants	Lack of trust within team or of confidence with stakeholders
23	Local government and community support	Engaging with local government and communities to achieve good support but manage expectations	Poor collaboration or conflicts with local government or communities
24	Engagement with private sector	Effective engagement of private sector partners in conduct and adoption of research, including managing expectations	Lack of engagement with or support from private sector partners
25	Publication and dissemination of results	Joint involvement in scientific articles and effective dissemination of scientific and extension information	Ineffective dissemination of scientific or extension information
26	External factors: policies, markets, environmental, security	Supportive policies, established markets, good local security situation	External factors influencing research facilities, trials or markets and lack of appropriate supporting policies or unforeseen delays related to national elections or security problems affecting travel
27	Engagement of policy actors	Effective engagement of policy actors to translate findings into policy	Inability to engage policy makers to generate supportive policies
28	Willingness to adopt innovation	Farmers and communities willing and able to adopt and adapt innovations	Culture, finance or risk limit adoption of technologies
29	User champions	Engagement of farmer or industry champions	Not identified

(*Continued*)

Table 3. (Continued).

Factor no.	Success factors	Participants' views on factors that enhance success or diminish success	
		Enhance success	Diminish success
30	Collaboration with international scientists	Benefits from collaboration with international scientists	Not identified
31	Clarity of roles and responsibilities	Clear definition of roles, responsibilities and delivery expectations	Partner staff do not understand their roles or what is expected of them
32	Stakeholder and partner coordination	Appropriate mechanism to coordinate stakeholders and provide feedback	Lack of an advisory committee mechanism to discuss issues and promulgate results to key stakeholders
33	Provision of incentives	Payment of incentives to local staff and collaborators	No tangible or financial incentives to participate in project
34	Community or land disputes	Not identified	Disputes within community or about land tenure disrupt project
35	Corruption or misuse of funds	Appropriate management of project funding	Corrupt practices and misappropriation of project funding
36	Political support or interference	Supportive political and institutional environment	Unsupportive political environment or direct interference in project
37	Gender roles and empowering women	Not identified	Focusing on empowering women without understanding role of men

responses, perhaps because the open-ended project-specific questions did not directly ask how their identified success factors had influenced the project. In the case of oldest project (FST/1998/118), the comparative paucity of available project records made it difficult to assess the relevance of some success factors. It is nevertheless very clear that, for the project that received the lowest relative success score (FST/2006/120), most (23 out of 37) of the identified success factors were considered to have contributed to either diminished or strongly diminished project success.

Discussion

Papua New Guinea is a very challenging environment in which to deliver successful R4D projects, or for those projects to achieve impact. Papua New Guinea has some deep-rooted development constraints, including consistently weak government capacity for service delivery, maintaining law and order, an unstable political environment, widespread acceptance of corruption, poor infrastructure, and a firmly clan-based civil society (AusAID 2003; ADB 2012).

ACIAR supports collaborative research partnerships implemented through individual research projects. In many cases, these projects form part of a long-term program to address a R4D priority identified by the partner country. As such, there is an inherent duality in ACIAR's mission, by performing related roles as a research broker and funder as well as a research-led development facilitator (Nairn et al. 1998). However, almost invariably, ACIAR needs to work with and through others to achieve adoption of research findings and the intended broader development outcomes. When research is appropriate and the project delivers its planned outputs and the wider development environment facilitates adoption, ACIAR projects can bring large-scale benefits (Fargher & Kelly 2012), as evidenced by long-term support for Vietnam's smallholder-driven plantation forestry sector (Fisher & Gordon 2007). However, when the research is not embedded in an effective rural development strategy, which may include relevant private sector initiatives, or there are severe constraints to development, the development impacts from ACIAR projects are likely to be relatively small (Fargher & Kelly 2012).

Fisher (2011) concluded that there are various barriers to achieving adoption from ACIAR forestry projects in PNG, including weak governance, resistance to change, lack of extension services and infrastructure, inadequate supply of tree germplasm, and the long time frames to receive benefits. He also noted that ACIAR's delivery model is not well-suited to addressing governance issues and, for research on downstream processing, commitments to long-term funding and marketing support activities are needed. ACIAR's forestry program portfolio in PNG has sought to work with the breadth of forest sector actors — government agencies, companies, non-governmental and community organisations, landowner groups and champion farmers — and has progressively emphasised greater engagement with actors other than government, in recognition of the constraints on government agencies. In both the sampled and other projects, this approach has been relatively successful in some cases, and less so in others (Kanowski & Mulung 2017). The discussion below considers the lessons arising from this study's analysis in this context.

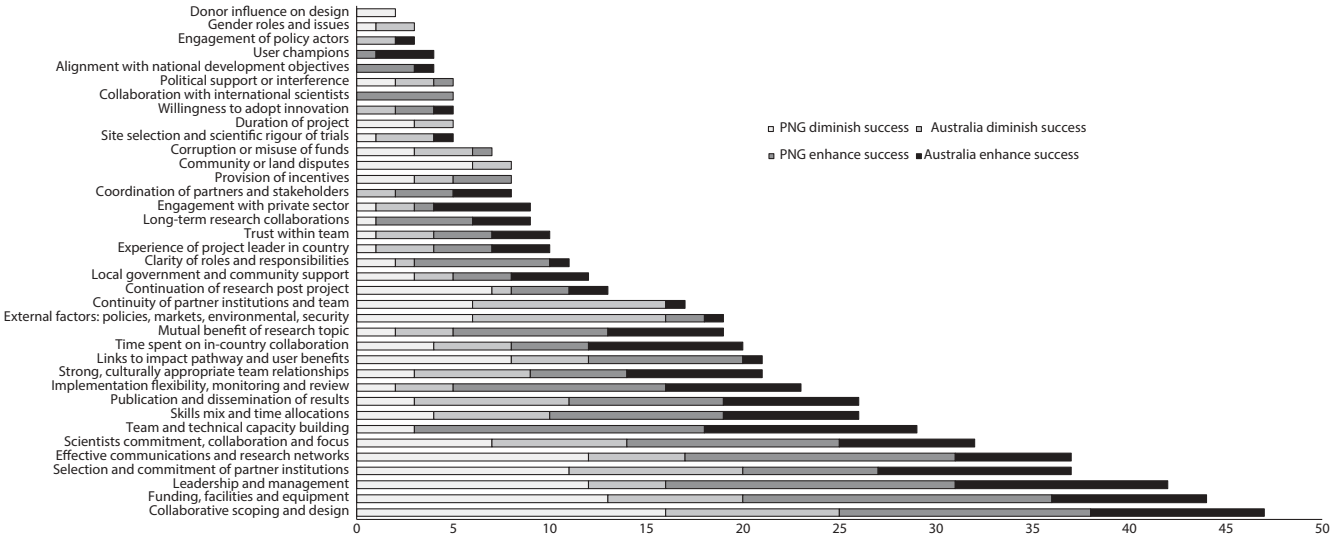

Figure 1. Frequency of identification of the 37 project success factors by the Papua New Guinea and Australian participants

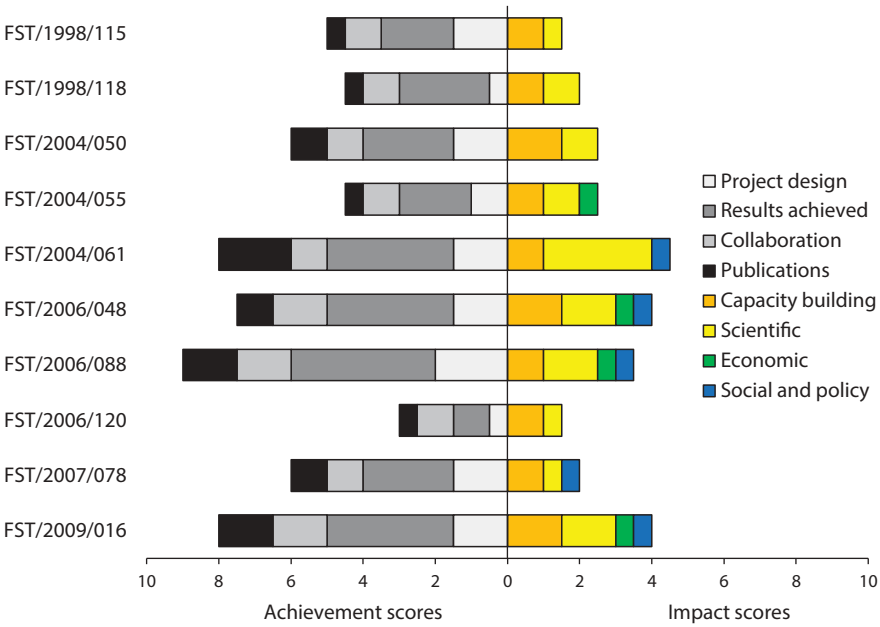

Figure 2. Evaluation of relative success of the ten Papua New Guinea forestry projects

In this study, six projects (60%) received scores of more than 5 for the evaluation based on research achievements, whereas no projects received scores of more than 5 for the evaluation based on research impacts. The absence of any projects evaluated as having high achievements and high impacts contrasts with the findings from companion studies of other ACIAR forestry projects from Vietnam (Bartlett et al. 2017) and Indonesia (Bartlett 2018). If success is defined in terms of high scores for both achievements and impacts, then none of these ten projects could be considered successful. That may well be too harsh a judgement of the outcomes of many of these projects. It would fail to recognise the challenging context in PNG for implementing R4D projects and the relatively low level of existing research capacity, as well as the incremental progress towards development goals that often occurs through a series of related projects. As noted by Fargher and Kelly (2012), research of the kind supported by ACIAR, which is pre-commercial in most instances and often of considerable duration, can only be expected to lead to significant direct impacts in a small proportion of cases.

An example of the general challenges for forestry research and the specific challenges for projects implemented in PNG can be seen in the three projects on domestication and breeding of high-value timber species that spanned a 15-year period. This research commenced in 2000 under project FST/1998/115, which received evaluation scores of 5 for achievements and 1.5 for impacts. It continued under project FST/2004/009 and subsequently under project FST/2008/078. The latter project concluded in 2015 and received evaluation scores of 6 for achievements and 2 for impacts in this study. This example of tree breeding research, which generally requires long-term programs, shows a modest increase in both achievement and impact between the first and most recent projects. Even so, the desired outcome and impact have not yet been achieved, because of the time required to assess performance of the various teak genotypes before

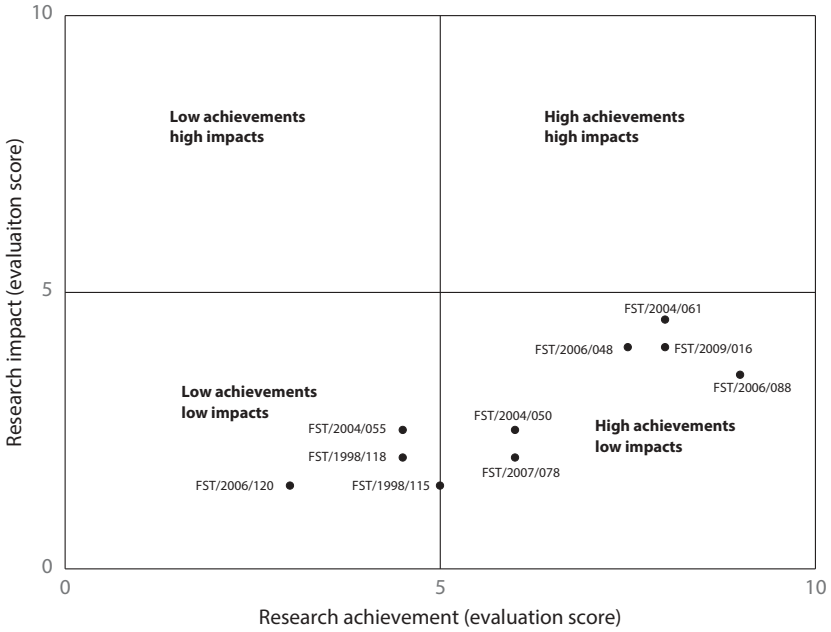

Figure 3. Project success categories based on combinations of research achievement and impact evaluation scores, and location of case study projects within those categories

widespread dissemination of germplasm can occur. When compared with similar ACIAR tree breeding research conducted in Vietnam over a similar period, there are much lower achievements and impacts, reflecting the different contexts under which these two programs were implemented.

Research on value-added processing of *C. indicum* nuts has been considered by other evaluators (Fargher & Kelly 2012) to be a good example of a R4D project successfully facilitating rural development. In this study, that project received evaluation scores of 7.5 for achievements and 4 for impact, as when it concluded in 2011 there was still not any commercial production of processed *C. indicum* nuts. Research has continued to the present under two further projects in an effort to achieve greater scale-up of benefits for smallholders and longer-term sustainability through private sector investment of commercial processing plants. After 11 years of research and development investment, *C. indicum* nuts are now being processed in a government-run pilot factory and sold in commercial outlets in East New Britain. However, the private sector still does not yet have sufficient confidence to invest in a large-scale processing plant. This demonstrates both the considerable challenges of commercialising new products in PNG and the necessity of taking a long-term view on success from forestry research investments.

A number of authors (Byron 2001; Pearce 2010; Baynes et al. 2015; Bartlett et al. 2017) have examined the factors that influence the success of forestry development initiatives, while Pearce (2010) examined project-level factors that affect the success of ACIAR projects. The findings of this study both confirm and supplement the findings from these previous studies. All 14 success factors relevant to ACIAR research projects identified by Pearce (2010) were identified in this study. The findings from two companion studies of forestry research projects in Vietnam (Bartlett et al. 2017) and Indonesia (Bartlett 2018), which respectively identified 22 and 30 success factors, are of particular relevance here. All of the success factors identified in those cases were again identified here, although their relative frequency differed, and a further seven success factors have been identified. In this study, over 80% of the factors identified as affecting project success, including 14 of the 16 most frequently identified factors (shown in bold text in Table 4), relate to either project design or project implementation. This finding that the great majority of the identified success factors relate to aspects that can be influenced during project design or project implementation is consistent with the findings from the two companion studies. Eleven of the 12 and all 13 of the most frequently identified success factors were related to project design or project implementation in the Vietnam and Indonesia studies, respectively. In contrast to the findings from those two studies, participants in this study considered three success factors (site selection and scientific rigour of trials, local government and community support, and engagement with private sector) to be less important to success in PNG forestry projects. This response contrasts to the observations made elsewhere in this article about the importance of engaging the private sector and local communities to improve project success in PNG.

The seven new success factors identified in this study were:

Clarity of roles and responsibilities (No. 31) — this reflects the need for the project leadership team to provide clarity to individual team members of the expectations regarding their role in project activities and the expected timelines for completing various activities.

Stakeholder and partner coordination (No. 32) — this reflects the lesson that, in projects where there are multiple partner organisations and/or key stakeholders who need to be engaged, it is beneficial to have an advisory committee or coordination forum that meets periodically.

Provision of incentives (No. 33) — this reflects an expectation of PNG partners and some stakeholders that they will receive financial incentives to participate in the project.

Community or land disputes (No. 34) — this reflects the situation in PNG whereby disputes within communities or about land ownership or use can impact adversely on project implementation.

Table 4. Expression of success factors within four projects with different evaluated levels of success

Project	FST/2009/016		FST/2006/048		FST/1998/115		FST/2006/120	
Evaluated level of success	**High A – Low I**		**High A – Low I**		**Low A – Low I**		**Low A – Low I**	
Response type	**IR**	**PR**	**IR**	**PR**	**IR**	**PR**	**IR**	**PR**
Factors that can be influenced during project design								
Collaborative scoping and design								
Funding, facilities and equipment								
Selection and commitment of partner institutions								
Skills mix and time allocations								
Mutual benefit of research topic								
Experience of project leader in country								
Duration of project								
Collaboration with international scientists								
Alignment with national development objectives								
Donor influence on design								
Factors that can be influenced during project implementation								
Leadership and management								
Effective communications and research networks								
Scientists commitment, collaboration and focus								
Team and technical capacity building								
Publication and dissemination of results								
Implementation flexibility, monitoring and review								
Strong, culturally appropriate team relationships								
Links to impact pathway and user benefits								
Time spent on in-country collaboration								
Local government and community support								
Clarity of roles and responsibilities								
Trust within team								
Engagement with private sector								
Coordination of partners and stakeholders								
Provision of incentives								
Corruption or misuse of funds								
User champions								
Engagement of policy actors								
Site selection and scientific rigour of trials								
Gender roles and empowering women								
Factors outside the project's control								
External factors: policies, markets, environmental, security								
Continuity of partner institutions and team								
Continuation of research post-project								
Long-term research collaborations								
Community or land disputes								
Willingness to adopt innovation								
Political support or interference								

Cell shading codes	
	Strongly enhanced
	Enhanced
	Neutral
	Diminished
	Strongly diminished

The 16 most frequently identified factors are shown in **bold**. FST/2009/016, FST/2006/048, FST/1998/115 and FST/2006/120 are the four projects

A, achievement; I, impact; IR, evidence from interview responses; PR, evidence from project records

Corruption or misuse of funds (No. 35) — this reflects a cultural practice in PNG whereby individuals not directly involved in a project seek payments, or those with management responsibilities misuse project funds.

Political support or interference (No. 36) — this reflects the situation whereby either politicians or senior officials can use their influence to assist or hinder project activities.

Gender roles and empowering women (No. 37) — this reflects cultural norms in PNG whereby men and women have different roles in families and communities, which can differ in different locations, and sometimes women's empowerment activities may cause social unrest.

It is possible that three of these newly identified success factors (Nos. 31, 32 and 37) could be equally relevant to collaborative research projects implemented in Vietnam or Indonesia, depending on the nature of the research being conducted and number of partners involved. However, other factors (i.e. Nos. 33–36) are highly likely to be more country-specific, but important in situations where salaries are low, corruption exists, or disputes and unrest are prevalent. The results related to the new success factor 'gender roles and empowering women' (No. 37) may be context-specific. In PNG, there are differences and disparities in the traditional roles of men and women in forest-related activities; in general, women have higher workloads related to agricultural activities, while men have greater roles in dispute resolution (Pamphilon et al. 2013). In this study, the success factor on gender roles and women's empowerment was identified as diminishing success by three participants, with each case being related to attempts to undertake women's empowerment activities without properly understanding gender roles within the participating communities.

These results illustrate how the factors that affect project success may be both common and different between countries. Differences are likely to be attributable to both differences in the nature of the research itself, and to the country-specific contexts within which research and adoption occur. This confirms the importance of having a flexible, evidence-based and context-dependent approach to identifying and managing the success factors, rather than having a predetermined list that is presumed to apply universally.

Conclusion

As PNG is likely to remain one of the most important countries for ACIAR's forestry program, it is important to build an evidence base about the success of individual projects and to better understand the factors that contribute to enhanced or diminished success of these projects over time. This need is consistent with the intent of the Paris Declaration on Aid Effectiveness (OECD 2005), and with AusAID (2003) findings about the importance of conducting further research into the contribution of Australian aid to PNG's development. As the agriculture, fisheries and forestry sectors will continue to contribute to the economic and social well-being of much of PNG's population well into the future (ADB 2012), it is important to ensure that the research needed to address the needs and constraints of these sectors is both well targeted and effective. The evaluation method and the findings on project success factors could assist research funders to better target and improve the effectiveness of future research investments in PNG.

This study has shown that, in comparison with similar studies of forestry projects in Vietnam and Indonesia, ACIAR's PNG forestry projects are less successful in terms of their achievements and their impacts. It is quite likely that this is related to the different contexts between these three countries but understanding the reasons for these apparent differences requires further research. The findings from this study provide some evidence of modestly increasing levels of relative success in successive projects within a thematic program of research, as well as a need for long-term programs if the primary goal is to achieve development impact. In addition, several factors are identified that contribute mainly to diminished project success. These findings are of particular significance for projects implemented in countries like PNG, in which aid effectiveness is similarly low.

As Feeny and Vuong (2017) noted, more detailed project-level data, on factors such as the calibre of leadership, the quality of project design and the extent of supervision, need to be collected in order to assess the importance of micro-level factors on project success. This study has contributed to this task, by broadening the understanding of the nature of success factors affecting collaborative forestry research projects implemented in developing countries. It also reveals that, while project participants identified many factors that influence project success, there was a good convergence of opinion about which are the most important factors. The findings on the nature of these success factors, and the finding that some of the factors are country-specific and context-specific, provide important insights that could help improve the effectiveness of future investments in both PNG and other countries in which it has proven difficult to deliver successful R4D projects.

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References

ACIAR. 2014. ACIAR strategic plan 2014–18. Canberra: Australian Centre for International Agricultural Research.

ACIAR. 2016. ACIAR annual report 2015–16. Canberra: The Australian Centre for International Agricultural Research.

ADB. 2012. Papua New Guinea: critical development constraints. Manila: Asian Development Bank.

AusAID. 2003. The contribution of Australian aid to Papua New Guinea's development 1975–2000. Canberra: Australian Agency for International Development (Evaluation and Review Series No. 34).

Babon A, Gowae GY. 2013. The context of REDD+ in Papua New Guinea: drivers, agents, and institutions. Bogor: Center for International Forestry Research (CIFOR).

Bartlett AG. 2016a. The evolution and impacts of ACIAR's forestry research program over three decades. Australian Forestry. 79:171–188.

Bartlett AG. 2016b. Evaluating relative success of donor-funded collaborative research projects. Research Evaluation. 25:405–415.

Bartlett AG. 2018. Factors affecting the success of collaborative forestry research in Indonesia. The European Journal of Development Research. doi:10.1057/s41287-018-0138-3

Bartlett AG, Kanowski PJ, Van Kerkhoff L, Byron RN. 2017. Identifying factors that influence the success of forestry research projects implemented in developing countries: case study results from Vietnam. Forestry. 90:413–425.

Baynes J, Herbohn J, Smith C, Fisher R, Bray D. 2015. Key factors which influence the success of community forestry in developing countries. Global Environmental Change. 35:226–238.

Bird N, Wells A, Van Helden F, Turia R. 2007a. Issues and opportunities for the forest sector in Papua New Guinea. PNG Forest Studies 3. London: Overseas Development Institute.

Bird N, Wells A, Van Helden F, Turia R. 2007b. What can be learnt from the past? A history of the forestry sector in Papua New Guinea. PNG Forest Studies 1. London: Overseas Development Institute.

Bourke RM, Harwood T. 2009. Food and agriculture in Papua New Guinea. Canberra: ANU E Press, The Australian National University.

Brooks TM, Mittermeier RA, Da Fonseca GAB, Gerlach J, Hoffmann M, Lamoreux JF, Mittermeier CG, Pilgrim JD, Rodrigues ASL. 2006. Global biodiversity conservation priorities. Science. 313:58–61.

Byron N. 2001. Keys to smallholder forestry. Forests, Trees and Livelihoods. 11:279–294.

Cadman T, Maraseni T, Ma HO, Lopez-Casero F. 2017. Five years of REDD+ governance: the use of market mechanisms as a response to anthropogenic climate change. Forest Policy and Economics. 79:8–16.

CELCoR-ACF. 2006. Bulldozing progress: human rights abuses and corruption in Papua New Guinea's large scale logging industry. Carlton: The Centre for Environmental Law and Community Rights and The Australian Conservation Foundation.

DFAT. 2017a. Australian Aid budget summary 2017–18. Canberra: Department of Foreign Affairs and Trade.

DFAT. 2017b. Papua New Guinea aid fact sheet. Canberra: Department of Foreign Affairs and Trade.

Duncan R. 1994. Melanesian forestry sector study. Canberra: Australian International Development Assistance Bureau.

FAO. 2009. Papua New Guinea Forestry outlook study. Working Paper No. APFSOS II/WP/2009/19. Bangkok: Food and Agriculture Organization of the United Nations: Regional Office for Asia and the Pacific.

FAO. 2015. Global Forest Resources Assessment 2015: desk reference. Rome: Food and Agriculture Organization of the United Nations.

Fargher J, Kelly D. 2012. From seed to scale-up: lessons learned from Australia's rural development assistance. Canberra: Office of Development Effectiveness.

Feeny S. 2005. The impact of foreign aid on economic growth in Papua New Guinea. The Journal of Development Studies. 41:1092–1117.

Feeny S, Vuong V. 2017. Explaining aid project and program success: findings from Asian development bank interventions. World Development. 90:329–343.

Fisher H. 2010. The biology, socioeconomics and management of the barramundi fishery in Papua New Guinea's Western Province. Canberra: Australian Centre for International Agricultural Research. ACIAR Impact Assessment Series Report No. 67.

Fisher H. 2011. Forestry in Papua New Guinea: a review of ACIAR's program. Canberra: Australian Centre for International Agricultural Research. ACIAR Impact Assessment Series Report No. 73.

Fisher H, Gordon J. 2007. Improved Australian tree species for Vietnam. Canberra: Australian Centre for International Agricultural Research. ACIAR Impact Assessment Series Report No. 47.

Fisher H, Winzenried C, Sar L. 2012. Oil palm pathways: an analysis of ACIAR's oil palm projects in Papua New Guinea. Canberra: Australian Centre for International Agricultural Research. ACIAR Impact Assessment Series Report No. 80.

Forest Trends. 2006. Logging, legality and livelihoods in PNG. Synthesis of official assessments of the large-scale logging industry, Volume I. Washington DC: Forest Trends.

Ghaffariyan MR, Jenkin B, Mitchell R, Brown M. 2016. Quantitative and qualitative assessment of timber harvesting residues: a case study of a balsa plantation in Papua New Guinea. Australian Forestry. 79:25–31.

Government of Papua New Guinea. 2009. Papua New Guinea Vision 2050. Port Moresby: National Strategic Plan Taskforce.

Government of Papua New Guinea. 2016. Medium Term Development Plan 2: 2016–17. Port Moresby: Department of National Planning and Monitoring.

Heinecke D, Dollery B, Fleming E. 2008. The Samaritan's dilemma: the effectiveness of Australian foreign aid to Papua New Guinea. Australian Journal of International Affairs. 62:53–71.

Høgh-Jensen H, Oelofse M, Egelyng H. 2010. New challenges in underprivileged regions call for people-centered research for development. Society & Natural Resources. 23:908–915.

Holzknecht H. 1996. Policy reform, customary tenure and stakeholder clashes in Papua New Guinea's rainforests. Rural Development Forestry Network Paper 19c. London: Overseas Development Institute.

Hughes H. 2003. Aid has failed the Pacific. Issue Analysis [Online], No. 33. Available from: http://www.cis.org.au/app/uploads/2015/07/ia33.pdf.

Hunt CE. 2001. Production, privatisation and preservation in Papua New Guinea Forestry Instruments for sustainable private sector forestry series. London: International Institute for Environment and Development.

Kanowski P, Holzknecht H, McGregor A. 2014. The potential of incorporating high-value tree species in Papua New Guinea agroforestry systems to enhance landowner livelihoods. Canberra: Australian Centre for International Agricultural Research. ACIAR Final Reports No. FR2014-06.

Kanowski P, Jenkin B. 2016. Improving the Papua New Guinea balsa value chain to enhance smallholder livelihoods. Canberra: Australian Centre for International Agricultural Research. ACIAR Final Reports No. FR2016-34.

Kanowski P, Mulung K. 2017. Adoption Study: FST/2004/050 Value-adding to PNG agroforestry systems. ACIAR Adoption Studies Reports – unpublished report to ACIAR. Canberra: Australian Centre for International Agricultural Research.

Laurance WF, Kakul T, Keenan RJ, Sayer J, Passingan S, Clements GR, Villegas F, Sodhi NS. 2011. Predatory corporations, failing governance, and the fate of forests in Papua New Guinea. Conservation Letters. 4:95–100.

Midgley S, Blyth M, Howcroft N, Midgley D, Brown A. 2010. Balsa: biology, production and economics in Papua New Guinea. Canberra: Australian Centre for International Agricultural Research. ACIAR Technical Reports No. 73.

Nairn ME, Castillo GT, Dun RB. 1998. Staying ahead: report of a review of the Australian Centre for International Agricultural Research. Canberra: Australian Centre for International Agricultural Research.

Novotny V. 2010. Rain forest conservation in a tribal world: why forest dwellers prefer loggers to conservationists. Biotropica. 42:546–549.

OECD. 2005. Paris declaration on aid effectiveness. Paris: Organisation for Economic Cooperation and Development.

Ofir Z. 2010. Commentary on 'The sorry state of M&E in agriculture: can people-centred approaches help?' IDS Bulletin. 41:26–27.

Ozarska B, Peki M, Gusamo B, Edwin P, Sapi J, Tsiritsi C, Niangu M, Cross G. 2013. Increasing downstream value adding in PNG's forest and wood products industry. Canberra: Australian Centre for International Agricultural Research. ACIAR Final Reports No. FR2013-18.

Pamphilon B, Mikhailovich K, Simeon L, Chambers B. 2013. Two-way learning: key gender lessons from participatory community workshops with smallholders in the Baiyer Valley and Kerevat areas of Papua New Guinea. Socioeconomic agricultural research in Papua New Guinea. Canberra: Australian Centre for International Agricultural Research. ACIAR Proceedings No. 141.

Pearce D. 2010. Lessons learned from past ACIAR impact assessments, adoption studies and experience. Canberra: Australian Centre for

International Agricultural Research. ACIAR Impact Assessment Series Report No. 69.
Pollock LJ, Thuiller W, Jetz W. 2017. Large conservation gains possible for global biodiversity facets. Nature. 546:141–144.
Saulei S, Aruga JA. 1994. The status and prospects of non-timber forest products in Papua New Guinea. Commonwealth Forestry Review. 73:97–105.
Shearman PL, Ash J, Mackey B, Bryan JE, Lokes B. 2009. Forest conversion and degradation in Papua New Guinea 1972–2002. Biotropica. 41:379–390.
Sillitoe P. 2014. Local perceptions of forest, conservation and logging in Papua New Guinea. Revue D'ethnoécologie. 6. doi:10.4000/ethnoecologie.1905
Turia R, Kaip D, Duega F. 2011. Papua New Guinea. In: Morehead A, editor. Forests of the Pacific islands: foundation for a sustainable future. Noumea: Secretariat of the Pacific Community.
UNDP. 2016. Human development report. New York: United Nations Development Programme.
Wallace HM, Poienou M, Randall B, Moxon J. 2010. Postharvest cracking and testa removal methods for *Canarium indicum* nuts in the Pacific. Acta Horticulturae. 880:155–159.

Appendix 1. Projects studied to explore the expression of success factors

FST/1998/115 'Domestication of Papua New Guinea's indigenous forest species'

This five-year project aimed to develop the use of indigenous forest tree species for reforestation and agroforestry activities by developing domestication processes for four high-value species (*Calophyllum euryphyllum* Lauterb., *Dracontomelon dao* (Blanco) Merr. & Rolfe., *Pometia pinnata* J. R. Forst. & G. Forst., and *Casuarina oligodon* L. Johnson) and preparing conservation strategies for two species (*Santalum macgregorii* F. Muell. and *Gyrinops ledermannii* Domke). Substantial capacity was built within Papua New Guinea (PNG) partner agencies and related research and tree seed infrastructure was strengthened. A seed handling manual was developed for 27 species.

The external review of the project found that the project attempted to achieve more than was reasonably possible given the complexity of the PNG biota and the prevailing social, technical and administrative environments. Collaboration was variable throughout the life of the project and very little dissemination of results occurred. Impacts were limited to capacity and some scientific impact. More than 10 years after the project concluded, seed from these domestication plantings was not widely available and the conservation strategy for the indigenous sandalwood strategy had not been implemented.

FST/2006/048 'Processing of *Canarium indicum* nuts: adapting techniques to benefit South Pacific farmers'

This three-year project aimed to develop post-harvest value-adding processes for the nutritious indigenous galip nut (from the *Canarium indicum* tree) that could be used by smallholder farmers and larger commercial enterprises. The design was informed by a scoping study and importantly the team included a specialist who had worked extensively on the development of the Australian macadamia industry. The project partnered with the Papua New Guinea (PNG) National Agricultural Research Institute (NARI), and a European Union aid project supported aspects of the development of a galip nut industry. There was very good collaboration within the team and a lot of capacity building of NARI staff through direct engagement with the Australian scientists.

The project's main results are summarised in Wallace et al. (2010). It achieved most of the planned outputs with a strong focus on the nut drying and processing research done at NARI in PNG. A range of processing methods was developed involving drying the kernel and utilising nut cracking technologies adapted from the macadamia industry. The major impacts related to capacity building and science, as the technologies could not be commercialised within the project's short timeframe.

FST/2006/120 'Increasing downstream value adding in Papua New Guinea's forest and wood products industry'

This three-year project aimed to provide the foundation for an enhanced domestic timber-processing industry in Papua New Guinea (PNG). The planned activities included exploring the development of products and designs based on solid wood and veneers, as well as the potential for value chains integrating timber from agroforestry systems and community forests with advanced processing facilities. It also included a significant focus on enhancing capacity in timber processing research and related training and education programs. The major outputs related to expanding the availability of research equipment and upgrading research and technical skills in partner organisations. The project has also produced technical outputs on mechanical and durability properties of some lesser known PNG timber species as well as an updated wood properties database. The project's results are summarised in Ozarska et al. (2013) and a 72-page book on the research outputs was prepared and distributed to partners.

The factors that reduced project success related to the project design and its implementation. The project was poorly designed with overly ambitious objectives for a three-year project and insufficient scoping and understanding of the situation in PNG regarding capacity, equipment, logistics, communications and willingness of partners to participate. Three years was inadequate for this type of research especially for a new collaboration, with dispersed in-country partners and inadequate research facilities. During implementation, there were numerous problems with lack of the availability of key equipment, slow arrival and installation of new equipment, poor communication infrastructure and significant staff turnover, including project leader and key roles in all partner organisations.

FST/2009/016 'Improving the Papua New Guinea balsa value chain to enhance smallholder livelihoods'

This four-year project aimed to enhance the value, value recovery and international competitiveness of the Papua New Guinea (PNG) balsa industry and optimise its benefits for smallholder growers. It included activities on smallholder decision-making and organisation, improving balsa germplasm and management, harvesting and transport systems, and product development and marketing. The design process included a significant scoping mission, published as an ACIAR technical report (Midgley et al. 2010). During project implementation, the project team engaged private sector partners and a training college and had good support from the local government and champion farmers.

The project was quite successful for a PNG project, with some good scientific, capacity, economic and social impacts already evident. Most of the planned activities were achieved and the project partners collaborated well. The project's results are summarised in Kanowski and Jenkin (2016) and five journal articles have been published. The breeding and silviculture activities will have a significant impact on the East New Britain balsa industry. A novel and award-winning balsa panel product represents a very significant innovation resulting from the project. A balsa training manual was produced and the partners delivered training to 116 farmers. The project was less successful with its smallholder survey and grower group activities, and the results of the policy research are yet to be adopted by the PNG Forest Authority.

PART 3: PRESENTING AND USING NEW KNOWLEDGE

Chapter 7. Understanding and evaluating success in international forestry research projects: experience from ACIAR projects in Vietnam, Indonesia and Papua New Guinea.

This chapter presents a synthesis of the results of the three country case studies (as presented in Chapters 4-6), including the overall findings on relative success of the 30 projects, the combined analysis of factors that affect success, and the relationships between the key success factors and relative success for selected projects from different success categories. It utilises the results from each case study, adds further comparative analysis from the combined data sets and presents a theoretical framework on factors that influence project success. It also discusses some of the implications of the evaluated differential success as well as the apparent influence of context on project success.

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Understanding and evaluating success in international forestry research projects: experience from ACIAR projects in Vietnam, Indonesia and Papua New Guinea

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SUMMARY

The success of research for development projects is of interest to project funders and recipients, and underpins project impact. This paper synthesizes results from case studies of collaborative forestry research projects in Vietnam, Indonesia and Papua New Guinea, where the relative success of projects was evaluated and the factors affecting project success investigated. Differences were found in the relative success of projects, between and within countries, and between related projects in a long-term program. Only one-quarter of the 30 projects had high achievements and high impacts; none of which occurred in Papua New Guinea. Interviews with 90 project participants identified 37 success factors that can enhance or diminish project success, of which 15 are considered generally applicable to research for development projects. The two most important success factors that could be addressed by research managers and project staff to improve project success were, respectively, collaborative scoping and design, and the scientists' commitment, collaboration and focus. Some relationships are apparent between relative success, the success factors and context at the national, local and project levels, including the importance of linking research to impact pathways.

Keywords: project success factors, forestry research evaluation, research for development, Vietnam, Indonesia, Papua New Guinea

Comprendre et évaluer les succès des projets de recherche en foresterie internationale: l'expérience des projets ACIAR au Vietnam, en Indonésie et en Papouasie Nouvelle Guinée

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Le succès de la recherche sur la question des projets de développement intéresse les fondateurs et les bénéficiaires desdits projets, et sous-tend l'impacts de ces derniers. Le papier fait la synthèse des projets de recherche forestière collaborative au Vietnam, en Indonésie et en Papouasie Nouvelle Guinée, où leur succès relatif a été évalué et où une investigation des facteurs les affectant a été menée. Une différence est notée quant au succès relatif des projets, entre les pays, ainsi qu'en leur cœur même, et entre les projets à long-terme ayant des points communs. Un quart seulement des 30 projets parvenait à obtenir de grands impacts et résultats; aucun en Papouasie Nouvelle Guinée. Des interviews de 90 participants à ces projets ont identifié 37 facteurs à succès capables de fortifier ou d'amoindrir le succès d'un projet, 15 d'entre ces facteurs étant considérés comme pouvant être généralement applicables à la recherche en projets de développement. Les deux facteurs à succès les plus importants qui pourraient être considérés par les directeurs de gestion et le personnel des projets pour renforcer le succès d'un projet étaient respectivement: un design et une évaluation de l'échelle à envisager collaboratifs et une prise en charge impliquée, une collaboration et une concentration réelle chez les scientifiques. Certaines relations sont apparentes entre le succès relatif, les facteurs à succès et leur contexte aux niveaux national, local et du projet proprement dit, sans oublier l'importance de relier la recherche au voies à emprunter pour obtenir un impact.

Comprensión y evaluación del éxito de los proyectos internacionales de investigación forestal: experiencia de los proyectos ACIAR en Vietnam, Indonesia y Papúa Nueva Guinea

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El éxito de los proyectos de investigación para el desarrollo es de interés para quienes los financian y los beneficiarios de los proyectos, y respalda el impacto que tienen. Este documento sintetiza los resultados de estudios de caso de proyectos de investigación forestal colaborativa en Vietnam, Indonesia y Papúa Nueva Guinea, para los que se evaluó el éxito relativo de los proyectos y se investigaron los factores que afectaron a su éxito. Se encontraron diferencias en el éxito relativo de los proyectos tanto dentro de los países como entre países, y entre proyectos relacionados en un programa a largo plazo. Sólo una cuarta parte de los 30 proyectos tuvo altos logros e impactos, y ninguno de estos ocurrió en Papua Nueva Guinea. Mediante entrevistas con 90 de los participantes en proyectos se identificaron 37 factores de éxito que pueden

aumentar o disminuir el éxito de los proyectos, de los cuales 15 se consideran aplicables de forma general a proyectos de investigación para el desarrollo. Los dos factores de éxito más importantes que podrían ser abordados por los gerentes de investigación y el personal del proyecto para mejorar el éxito del proyecto fueron, respectivamente, el alcance y el diseño de la colaboración, y el compromiso, la colaboración y el enfoque de los científicos. Se ponen de manifiesto las relaciones entre el éxito relativo, los factores de éxito y el contexto a nivel nacional, local y de proyecto, incluyendo la importancia de vincular la investigación con las vías de impacto.

INTRODUCTION

For many decades international development agencies have been funding rural development projects, including Research for Development (R4D) (sensu lato Høgh-Jensen *et al.* 2010) projects in agriculture, fisheries and forestry. R4D projects seek to develop the knowledge, technology and systems to improve food security, enhance livelihoods and sustainably manage natural resources (Greenland 1997, Dalrymple 2008) and cover the spectrum from strategic through applied to adaptive research. Collectively, such agricultural research investments have been shown to generate impressive economic benefits (Raitzer 2003, Maredia and Raitzer 2012, Lindner *et al.* 2013). However, the resulting economic benefits from agricultural research conducted in Southeast Asia have only been demonstrated for a minority of research areas such as rice improvement and integrated livestock management (Maredia and Raitzer 2012), and documented examples of successful development projects are relatively rare and often contested (Cook and Wei 2002). This highlights the importance improving the understanding of what causes differential success in R4D projects and of how the resulting innovations can lead to improved development outcomes.

Since the 1970s, there has been an increasing recognition of the role that forestry and forests industries can play in rural development (FAO 1978, Westoby 1979) and the reduction of poverty (Belcher 2005). Many donors traditionally included a proportion of forestry research projects in their forestry sector development programs; for example, in the late 1990s forestry research accounted for 15% of the United Kingdom Department for International Development's forestry investments (Hudson 2000). Such programs cover a broad spectrum of research themes, including the role and management of forests, agroforestry, utilisation and processing of forest products, and the provision of environmental services. Over time, a greater emphasis has been accorded to the social aspects of forestry systems (Bartlett 1992, Sikor 2006, Hajjar *et al.* 2013) and on understanding the dynamics of the impact pathway and the factors that determine whether or not research innovations are adopted by end users (Denning 2001).

Some forestry development assistance programs have achieved significant success, such as the enhanced management of community forests in Nepal (Carter *et al.* 2011) or the domestication of eucalypts in China which led to the development of new processing industries utilizing smallholder grown trees (Arnold *et al.* 2013). However, as Persson (2000) notes, the impacts from such forestry development programs on the management of existing forests versus the establishment of new fast growing plantations have been variable, often because their objectives are unclear or perceived in widely varying ways. Some of these programs suffer from problems on either the donor side, including being driven by prevailing attitudes or not taking a long-term view, or the receiving side, including shortage of resources, low human capacity and frequent changes of key personnel in forestry departments (Persson 2000).

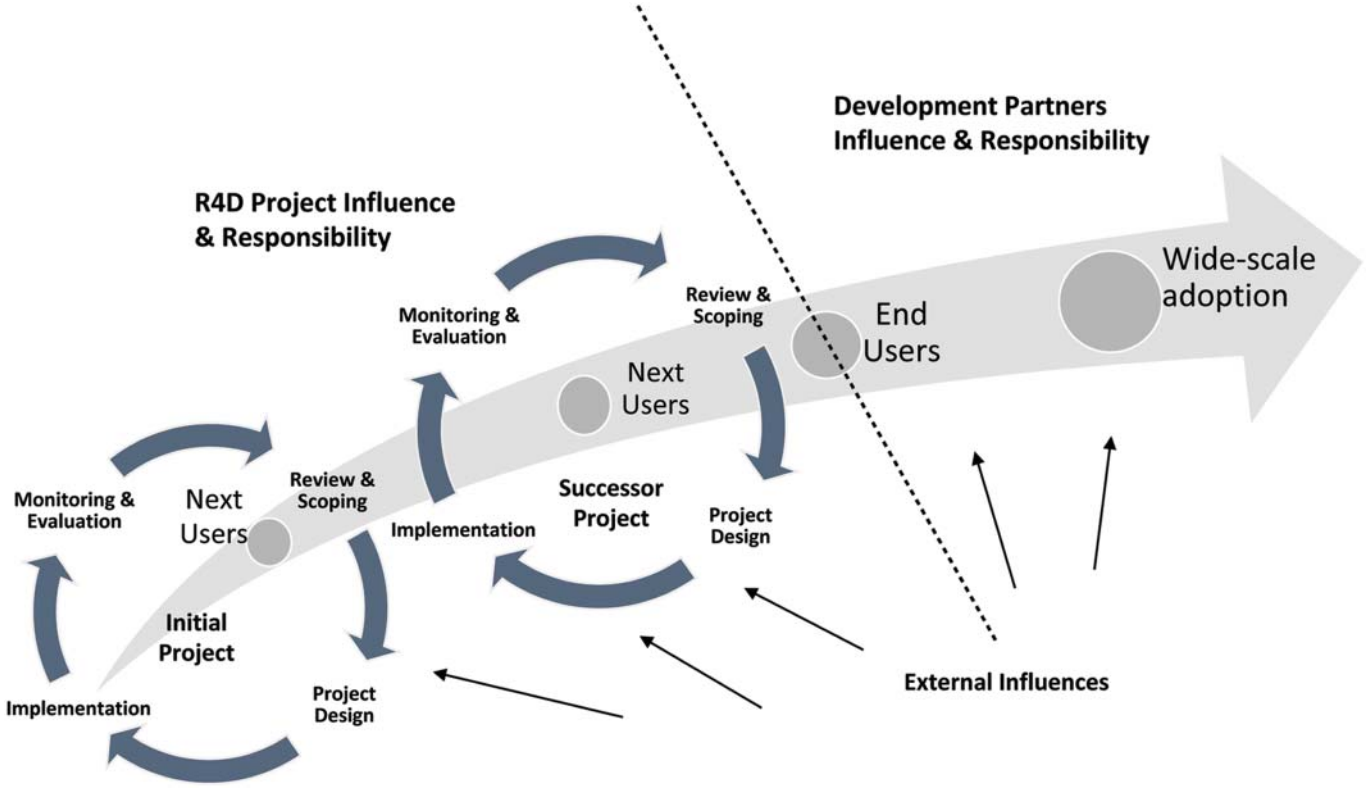
For 35 years, the Australian Centre for International Agricultural Research (ACIAR) has been brokering and investing in international agricultural research partnerships in the agriculture, fisheries and forestry sectors, to build knowledge to progress development objectives in partner countries (ACIAR 2017). Bartlett (2016a) described the strategic and operational components of the approach ACIAR uses for its R4D investments, which includes delivering most of its research through bilateral country programs and focusing its investments on research priorities identified by the partner country. Between 1984 and 2015, ACIAR commissioned 101 forestry projects in 29 countries, spanning ten research themes, with the greatest numbers of projects implemented in Indonesia (23 projects), Vietnam (20 projects) and Papua New Guinea (19 projects) (Bartlett 2016a).

ACIAR routinely conducts impact assessments of its investments and seeks to be a learning-oriented public sector organization, as it encourages learning within and from its research projects (Jarvie and Stewart 2018). Impact assessment studies of ACIAR's bilateral research investments, including its forestry projects, have demonstrated high returns but that much of the aggregated economic impact originated from a small number of highly successful projects (Lindner *et al.* 2013). However, other than a qualitative survey of 30 people involved in the design and delivery of its projects (Pearce 2010), ACIAR has not systematically studied the differing relative success of projects implemented in different countries or the factors to which the relative success of its projects might be attributed.

In the international development domain, very few studies have attempted to identify sets of factors critical to project success, and even fewer have attempted to explore the relationships between success factors and project success (Ika *et al.* 2012). Furthermore, the ability to improve project success is constrained by an inadequate understanding of why development projects will achieve success in one setting yet not in others (Ika and Donnelly 2017). In the forestry development sector, some knowledge exists on factors affecting the adoption of agroforestry research (Franzel *et al.* 2001), as well as on factors that influence the success of smallholder commercial forestry (Byron 2001, Macqueen 2013) and community forestry programs (Baynes *et al.* 2015).

This article adds to the existing knowledge by reporting a comparative analysis and synthesis of research from three case studies on evaluations of the relative success of ACIAR forestry research projects conducted in Vietnam (Bartlett

FIGURE 1 *Influence and responsibilities in the research for development continuum*



et al. 2017), Indonesia (Bartlett 2018a), and PNG (Bartlett 2018b), and of identification of the factors that have affected project success. This paper brings the whole dataset together to identify wider lessons and comparisons across these three countries, including exploring the influence of context on project success. It addresses three questions: what can be learned from evaluations of the relative success of forestry research projects implemented in different countries and covering different research themes; what are the factors that are considered by those associated with ACIAR's forestry research projects to affect their relative success; and what role does context play in understanding project success? The article contributes to our understanding of the meaning of success in international forestry research and distils lessons relevant to those responsible for funding, designing and implementing collaborative forestry research projects.

DEFINING AND EVALUATING SUCCESS IN RESEARCH PROJECTS

Within the project management literature, there is no consensus on a definition of project success or a means of assessing it (Ika 2009); different stakeholders have different perceptions of what success means (Davis 2017) and, as a result, success is often contested and controversial (McLeod *et al.* 2012). De Wit (1988) distinguished between project success, measured against project objectives, and project management success, measured against cost, time and quality performance criteria. Defining success in R4D programs and projects is complicated and challenging because research involves many unknowns, and often extended timeframes. As a result, in the R4D literature, most authors do not define precisely what they mean by project success.

To aid understanding of how and why development interventions work, there is a need to understand how the project's activities will lead to the desired results (Mayne and Johnson 2015). To do this, development practitioners often describe impact pathways and establish a program theory or theory of change (Blamey and Mackenzie 2007, Douthwaite *et al.* 2007). For individual R4D projects, the nature and extent of impacts generated will be partly dependent on where a project is situated on the impact pathway along the research to development continuum (see Figure 1), as well as the nature and effect of any external influences. Individual R4D projects, which often have a three to five year duration, conduct research and capacity building activities on a defined topic and produce a variety of outputs that are often of an intermediary nature. Therefore, multiple linked projects are often required to achieve the overall development goal for the topic or theme of research. In order to achieve impact, these R4D projects attempt to influence adoption of the project outputs by, what is known in ACIAR impact assessment terminology as, next users and end users (Davis *et al.* 2008). The next users in R4D projects are typically the participating scientists, smallholders, companies and extension officers whereas the end users are typically other smallholders, private sector companies and extension staff located beyond the project sites. However, in the context of ACIAR projects, the responsibility for promoting and facilitating wide-spread adoption of the resulting technologies and systems to the end users generally rests with national government agencies and other development partners.

Defining and comparing the success of different forestry projects faces many challenges. In R4D projects, the use of multi-disciplinary and trans-disciplinary research approaches, engaging a broader range of research participants and other stakeholders to make research more relevant and effective, have become more common (Belcher *et al.* 2016), making evaluation and consideration of project success more complicated. Defining success is also complicated by the fact that the nature of impacts from R4D projects, and the ability to measure them, differs between research areas (Maredia and Raitzer 2012). In addition, the contexts in which agroforestry projects operate is known to affect the extent of adoption of research findings to (Coe *et al*. 2014). Therefore context can be the key to uncovering the circumstances in which, and the reasons why, a particular intervention does or doesn't work. However, context is multifaceted, operates at a variety of levels, including political, social, organizational and individual, and may include factors that are outside the control of project implementers (Blamey and Mackenzie 2007). Forestry research presents some additional challenges to those of broader context of agricultural R4D programs. As Henderson (2000) noted, tree-based systems require longer timeframes to generate the desired products and hence the impacts, and there are ongoing methodological challenges in valuing non-market goods and services from forestry systems.

In this paper, the concept of success of a forestry research project follows the logic articulated by Pearce (2010), with two primary dimensions: the extent to which planned research outputs are achieved and adopted (achievements); and the extent of the impacts resulting from wider adoption, typically outside of the project and beyond its life (impacts). As part of this research process described below, this concept was tested with 90 scientists, who had been involved in 30 ACIAR forestry projects in three countries. From their responses, the following working definition of a successful ACIAR forestry project was developed: a project that uses high quality but flexible scientific methods to achieve planned outputs; enhances the capacity of partners; facilitates ongoing scientific relationships and networks; generates knowledge or technologies that can improve the system under investigation; and results in tangible scientific impacts and benefits for project stakeholders and local communities. This definition recognizes that, when judging the success of research projects, there are multiple dimensions to consider and individual projects may only result in partial or incremental improvements to the system being researched as part of a long-term program.

In order to understand what factors have enhanced or diminished project success, a method is needed for systematically evaluating and ranking success in multiple projects. Extensive literature exists on approaches to and findings from evaluation studies of Official Development Assistance (ODA) programs and projects. However, in a review of the four main approaches to evaluation, Bartlett (2016b) found that, depending on how they are applied, these approaches may not produce comparable assessments of relative success of projects or generate information that enhances understanding of why a project has been more successful than another. To address this methodological gap, Bartlett (2016b) developed a score-card methodology for evaluating the relative success of multiple research projects from existing project records, including consideration of project-generated and non-project-generated records. The methodology assesses a project's achievements and its impacts and enables comparisons of relative success for the evaluated projects. This methodology is consistent with approaches for assessing the societal relevance and quality of research (de Jong *et al.* 2011), by considering multiple dimensions of the research interaction, including collaboration and dissemination of knowledge, and not just the its impact.

Here, project success factors are defined as factors that can either enhance or diminish the success of research projects. They are considered in two categories: factors that those responsible for designing and implementing research projects can influence, and factors that, by their nature, are generally beyond a project's control. In this sense, project success factors are not indicators of project success, nor a blueprint for success, but rather factors that need to be considered and addressed appropriately by those developing and implementing research projects, taking into account the nature of the project and its operating context.

METHODS

The case studies

Three country case studies of ACIAR forestry projects, from Vietnam, Indonesia and Papua New Guinea (PNG), were used to evaluate the relative success of the projects and to identify the project success factors. The research used a mix of qualitative and quantitative methods, as described by Bartlett *et al.* (2017), involving three phases: evaluation by the author of the relative success of projects; identification by project researchers of success factors; and exploration by the author of relationships between the identified success factors and the evaluated relative success of projects. The case study results for Vietnam, Indonesia and PNG are described in detail by Bartlett *et al.* (2017), Bartlett (2018a) and Bartlett (2018b), respectively.

Each country case study comprised ten projects completed from 1998 to 2016, representing about half of the projects completed in each country. The nominal ACIAR investment for each group of ten projects was AUD 10.80m for Vietnam, AUD 8.48m for Indonesia, and AUD 9.10m for PNG. Collectively, the thirty selected forestry projects covered eight research themes (see Table 1) of the ten implemented under the ACIAR forestry program (Bartlett 2016a); two of the projects each covered two research themes. In the Vietnam study, the selected projects had a strong focus on domestication and improvement of Australian trees; in the Indonesian case study, about half of the projects were on forest health or agroforestry and community forestry; in the PNG case study, nearly half the projects were on domestication and silviculture of introduced trees, with a secondary focus on native forest management.

TABLE 1 *Nature of ACIAR forestry research themes relevant to this study and their representation in the three country case studies*

No.	Research Theme	Comments	Countries
T1	Domestication and improvement of Australian trees	Includes domestication and tree improvement principally for *Eucalyptus* and *Acacia*	Vietnam, Indonesia
T2	Silviculture for Australian trees	Includes research on establishment, spacing, site management, growth monitoring, thinning	Vietnam, Indonesia
T3	Domestication and silviculture of non-Australian trees	Includes supply of quality germplasm for native and exotic trees as well as silvicultural systems	Vietnam, PNG
T4	Forest health and biosecurity	Includes, pests, diseases and forest health systems	Vietnam, Indonesia
T5	Value added processing, timber manufacturing and treatment of wood	Includes wood science, wood processing and manufacturing, furniture and composite products	Vietnam, Indonesia, PNG
T6	Agroforestry and community forestry	Improving benefits from agroforestry systems and approaches to community forestry	Indonesia, PNG
T7	Non timber forest products	Includes research on growing, processing and adding value to non-timber forest products	PNG
T8	Native forest management	Includes yield modelling and improved management systems for native forests	PNG

As explained by Bartlett (2016b), evaluations of relative success were determined by considering the available evidence from internal and external ACIAR project records against standard evaluation questions for eight criteria. The internal project records utilized included: project documents; annual reports; mid-term reviews; final reports; and written correspondence between ACIAR and project staff. The external project records utilized included: end-of-project reviews; adoption studies and impact assessments; and project-related publications. This enabled a degree of triangulation within the evaluation by providing perspectives from project participants, research program managers, and external reviewers of projects. Scores were assigned by the author for four criteria related to research achievements: project design; results achieved; collaboration; and publications; and for four criteria related to research impacts: capacity building outcomes; scientific outcomes; economic outcomes; and social and policy outcomes. For each criterion, a score assigned, to the nearest 0.5, up to the maximum score allowed for the criterion. The types of evaluation questions, maximum scores and nature of the evidence sought are presented in Table 2. Scores to a maximum total of ten were assigned for research achievements and for research impacts and presented as a two dimensional matrix. Scores of 0.0–5.0 were categorised as low achievements or low impacts; scores of 5.1–10.0 categorised as high achievements or high impacts. This approach produces four categories of project success: high achievements-high impacts; high achievements-low impacts; low achievements-low impacts; and low achievements-high impacts. In this comparative analysis, the results from the three studies were compared and further analysis of the combined results undertaken to explore whether or not there were any apparent differences between the countries and research themes. Finally, some additional analysis was undertaken on examples of initial and successor projects to understand how relative success changes in related research projects.

To identify the project success factors, interviews were conducted with 90 Australian, partner country and international scientists who had participated in between one and six of the case study projects. For the Vietnam study, 24 scientists were interviewed, and for each of the Indonesia and PNG studies, 33 scientists were interviewed. They were selected using a purposive strategy because they had worked as project leaders, in-country project coordinators or collaborating researchers on one or more of the selected projects, and were still able to be contacted. They were interviewed individually by the author over a three year period using the same standard set of questions (see Bartlett *et al.* 2017), which asked them to describe what they thought constituted success for an ACIAR project, and to nominate five factors that can enhance, and five factors that can diminish, project success. Their views on aspects of the design and implementation of each project, and other contextual factors, were also sought. The interviewees had no knowledge of the author's evaluation scores for each of the case study projects.

In each study, the interview data were analysed to identify the factors that were considered to either enhance or diminish project success and concise statements of the success factors were prepared. HyperRESEARCH[1] qualitative data analysis software was used to code interview data and then to aggregate responses to specific questions into single reports and search the data for commonly used phrases and similar

[1] Researchware, Inc. – [http://www.researchware.com/ accessed 13/06/2014]

TABLE 2 *Evaluation questions, maximum scores and evidence guidance for the eight project evaluation criteria*

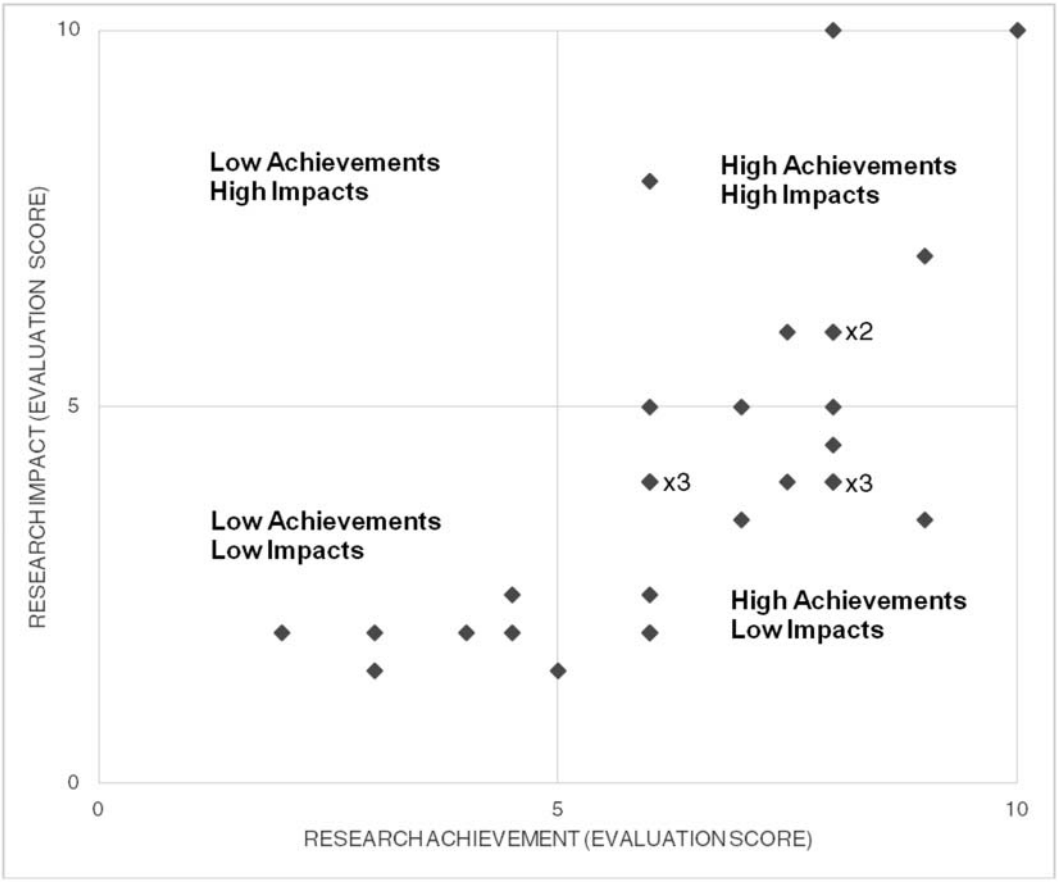
Criteria	Score	Evaluation Questions	Evidence Sought
Project Design	2	How well was the project designed in terms of specific activities to address objectives and to facilitate adoption?	Consideration of research strategy and nature of research and dissemination activities planned; Composition of project team; Level of funding provided and co-contributions from partners, and; Findings from any project reviews.
Results Achieved	4	What has been achieved in terms of completed activities and specified outputs?	Identification of the quality of actual achievements compared to planned outputs; Adaptation of methods and activities to enhance outcomes; Methods and level of dissemination of results, and; Findings from any end-of-project review.
Collaboration	2	How well did the project team collaborate in conducting the research and what new skills did the scientists gain?	Information about collaboration in correspondence and reports; Effectiveness of in-country coordination; Joint authorship of reports; and Level of networking developed and extent of within-project capacity building activities.
Publications	2	What is the relative magnitude and quality of publications produced?	Quality of information in Final Report, and; Amount and quality of project reports, including consideration of local language publications; Number of published journal articles; and Quality of website information.
Capacity Building	2	What is occurring as a result of the enhanced capacity?	Evidence of enhanced capacity of project scientists; Appraisal of how well these skills are being utilised, and; Local scientists contributions to scientific publications.
Scientific Outcomes	4	How has the body of scientific knowledge been enhanced and how is this knowledge being used?	Number of international journal publications and citations; Continuation of related research; Evidence of networking between scientists, and; Appraisal of scientific contributions to international development.
Economic Outcomes	2	Has the research led to improved livelihoods or facilitated economic development?	Indications of improved productivity, greater access to markets and higher prices for products; Indications of costs or losses avoided; Indications of greater employment levels or wages, and; Indications of new enterprises established.
Social and/or Policy Outcomes	2	What changes to the social circumstances of project beneficiaries or the enabling policy environment have occurred that the project has contributed towards?	Indications of enhanced social capital including strengthening of community institutions; Evidence of empowerment of women and disadvantaged groups; More equitable benefit sharing from common property resources, and; Evidence of new or changed policies or effective input to policy processes.

concepts. Individuals' responses to questions about each project's design and implementation were analysed as well as their responses on factors affecting project success. When respondents covered aspects of multiple factors in a single response, each aspect was identified, allocated to the most relevant factor and counted. When the respondents identified aspects related to the same factor in two or more responses, the aspect was counted only once, against the most relevant factor.

In this comparative analysis, the combined data of 1329 records of identified success factors were analysed to establish the overall identification frequency for each success factor, and areas of similarity and difference between the three studies. Using this frequency data, key success factors were then identified, being the group of most frequently identified factors whose combined identification frequencies represented 75% of the data. The use of frequency data to identify the key success factors was appropriate because the interview sample size was large (n = 90) and all interviewees had been asked the same questions, rather than varying the questions once thematic knowledge about success factors emerged from the first of the three case studies.

In each case study, after the evaluation of relative success of the projects, three projects were selected as representatives from the different project success categories to conduct a more in-depth study of the relationships between the evaluated level of success and the identified project success factors using both project records and the interview data. Analyses of data from the project records and interviews, were undertaken to explore the relationships between the success factors and the success of selected projects representing different categories of relative success. In this study, the results from a sub-set of seven of these projects, representing three categories of relative success and the three countries, were synthesized to identify any trends in the success factors that appeared to consistently influence project success. This analysis focused on the apparent relationships within two groups of the identified key success factors: those that can be influenced during project design, and those that can be influenced during project implementation.

FIGURE 2 *Distribution of relative success scores for 30 forestry research projects*



Analysis of context

As Blamey and Mackenzie (2007) have noted, context can be the key to uncovering the circumstances in which, and the reasons why, a particular intervention works or doesn't work. With respect to forestry R4D, while the importance of context in achieving adoption of forestry research innovations is recognized (Coe *et al.* 2014), there are limited studies on the influence of context reported in the literature. In addition, there are many dimensions to context in the realm of international development, including at the national-level, local-level and project-level dimensions. Three components of national level context are considered in this study: inclusion of forestry in the national development priorities; indicators of the level of national development; and indicators of capability of the national forestry research agency. A variety of composite indices, including UNDP's Human Development Index (HDI), have been used to compare performance of nations (Morse 2016), and to compare national context in evaluations of rural development projects (Zoomers 2005), although there is limited literature (van Kerkhoff and Berry 2016) on the use of multiple indices to aid the understanding of national context. In this study, the HDI, the World Bank's Ease of Doing Business Ranking and Transparency International's Corruption Perception Ranking, were used to compare each country's human and economic development.

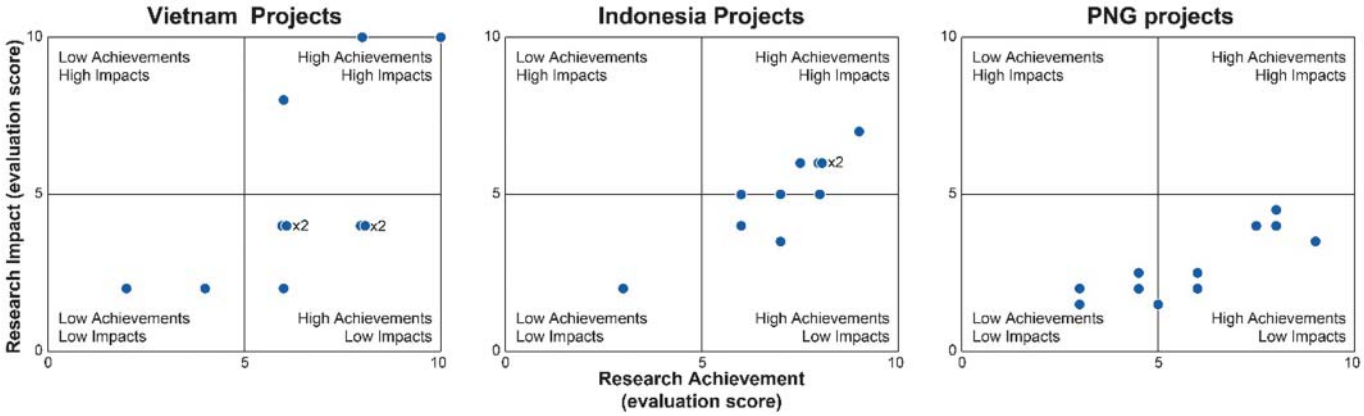
To compare the capability of the partner national research institutions, the author collected data, sourced from senior officers from the partner institutions, on the annual budget, number of staff and number of PhD qualified researchers for the national forest research agencies from Indonesia, Vietnam and PNG. Three elements of local-level context were examined: the leadership, commitment, culture and capacity of local partner institutions; the appropriateness of the forestry system being researched for the local social, economic and ecological circumstances; and other factors that affect the adoption of forestry innovations, such as extension systems, access to markets and conflicts within communities.

RESULTS

Relative success of the selected projects

The relative success evaluation scores of all 30 projects, plotted within the four project success categories, are presented in Figure 2. The evaluation method was effective in differentiating levels of success between projects: overall and within each case, there was considerable variation in evaluation scores, and only a small number of projects received identical scores. About one-quarter of the projects (7) were evaluated as high achievements and high impacts, about half (16) as

FIGURE 3 *Comparative analysis of relative success of forestry projects from Vietnam, Indonesia and PNG*



high achievements and low impacts, and the remaining one-quarter (7) as low achievements and low impacts. There were no projects evaluated as low achievements and high impacts.

Some similarities and some differences in the evaluation results were apparent between the three country case studies, as shown in Figure 3. The evaluations for Vietnam and Indonesia generated a similar pattern across three of the four project success categories, but the Vietnam projects exhibited greater variability in relative success scores. The results For PNG, quite different results were found. No projects were evaluated as high achievements and high impacts, and more projects were evaluated as low achievements and low impacts. These results suggest that the country context contributes to the different levels of relative success achieved by R4D programs.

The results of the relative success evaluations for all 30 projects grouped by different research themes are presented in Figure 4. As these projects covered eight research themes, there are only limited data to explore any differences in project success across these themes. The results indicate that, within each research theme, there is considerable variation in both the research achievement and research impact scores. For this sample of projects, projects related to domestication of Australian trees (Theme 1) generally demonstrated higher levels of impact than those in the other seven research themes. However, the results suggest that, overall for this sample of projects, the theme of research does not appear to have a strong influence on the relative success of a project.

Identification of success factors

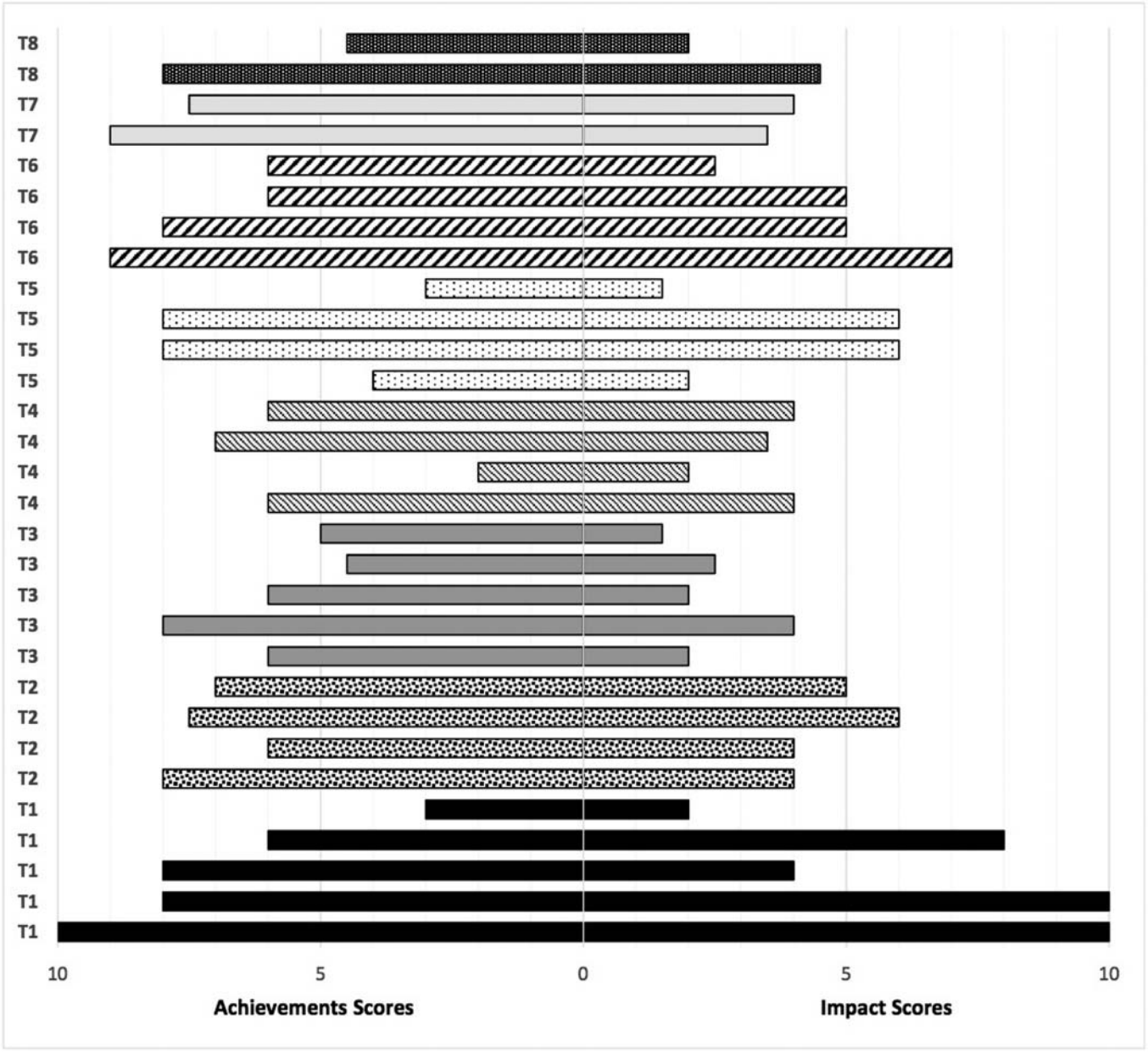
A total of 37 different success factors (see Table 3) were identified across the three case studies. In the PNG case, all 37 success factors were identified, whereas only 22 and 30 of these factors were identified in the Vietnam and Indonesia cases, respectively. There were also some success factors (e.g. engagement of the private sector) that were identified only in some countries or by some interviewees, due to variations in the nature of projects and operating contexts in the three case studies. For these reasons, trends evident in the data are more meaningful than the absolute importance of each success factor. Table 3 presents the data aggregated into four frequency categories to show the relative frequency with which each success factor was identified in each of the three case studies. There was generally good consistency across the three case study countries in the most frequently identified factors. However, for some factors, the relative frequency of identification differed between countries, and one factor (publication and dissemination of results) was not identified in the Vietnam case study. There were also some success factors that were only identified in the PNG case study; some of these maybe specific to the operating context in that country.

The frequency with which each of the 37 success factor was identified varied considerably, with some factors only identified by people involved in particular projects. The 15 key success factors (as shown in Figure 5) are most likely to be generally relevant to achieving success from collaborative forestry research projects. The 22 other success factors, while less frequently identified, are likely to be important to success in particular circumstances. For example, a research project that produces policy related outcomes is only likely to be successful if it pays attention to the factor on engagement of policy actors. Likewise, if instances of corruption and misuse of funds are not addressed where they emerge, the project is unlikely to be successful. About one-fifth of the identified success factors, while still needing to be considered, relate to aspects that are beyond the control of those who are responsible for designing and implementing projects.

Relationships between identified success factors and project success

The results of the synthesized analysis from the three case studies are presented in Table 4. There is some evidence of relationships between many of the identified success factors and the relative success that a project achieves, particularly in terms of the contrast between the extremes of high achievement-high impact and low achievement-low impact projects. For the two projects from Vietnam and Indonesia evaluated as having high achievements-high impacts, there was clear evidence that the way that most of the success factors had

FIGURE 4 *Relative success evaluation results for 30 projects across the eight research themes*



been addressed during project design and implementation had contributed to enhanced project success. For the three projects evaluated as having low achievements-low impacts, the evidence suggests that the lack of focus on some of the success factors had diminished project success. This pattern of evidence was stronger for factors that can be influenced during project design than for factors related to project implementation. For the two projects from PNG and Vietnam that had high achievements-low impacts (coincidently both having scores of 8 for achievements and 4 for impacts), the results were less clear. However it was evident from the interview data and project records that inadequate focus on some of the success factors, such as commitment of partner institutions and dissemination of results, had diminished the level of project success.

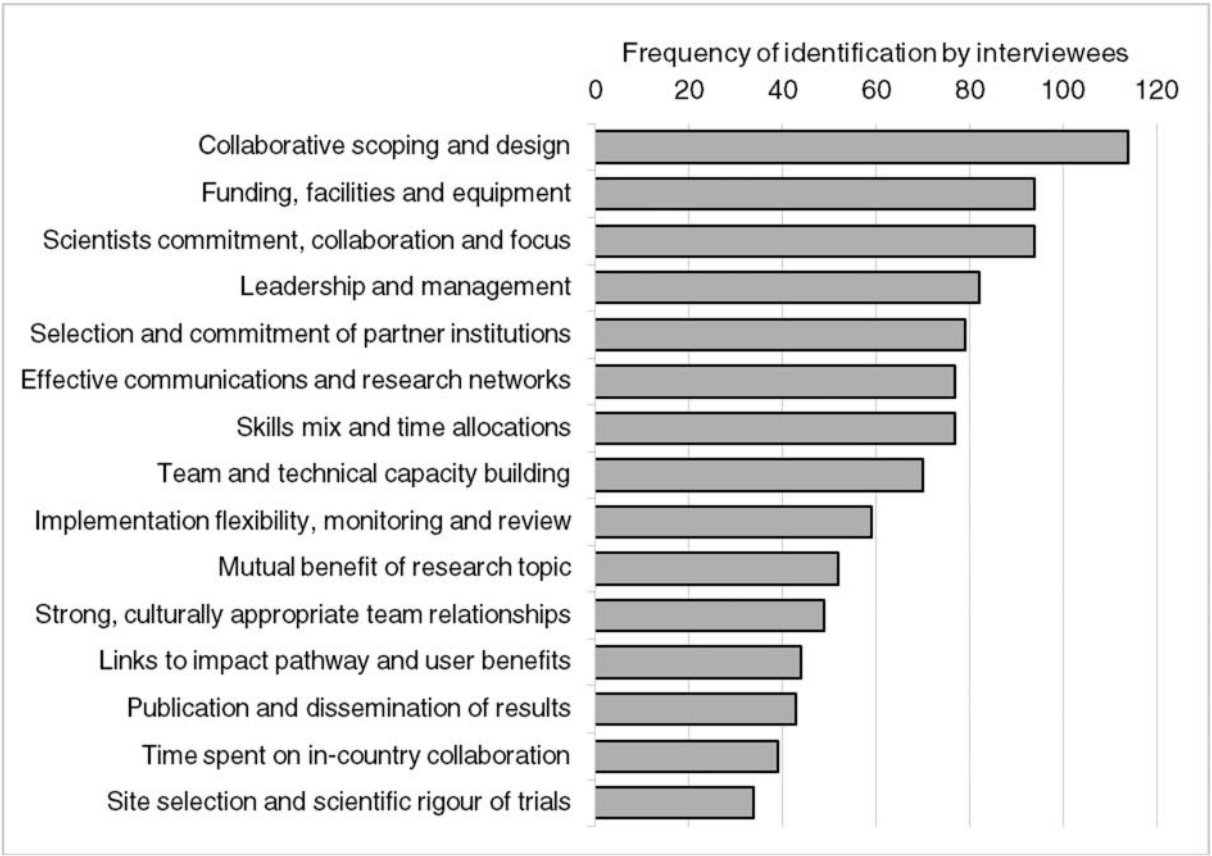
This analysis also shows that there are multiple success factors that need to be appropriately considered and addressed during project design and implementation for the project to be successful. It also shows that having a good focus on some success factors, such as "leadership and management" and "team and technical capacity building", while important are not in themselves sufficient to achieve success. In all three case studies, poor attention to the success factor "links to impact pathway and user benefits" contributed to the reduced success in projects evaluated as having low impacts. Clearly, for research projects to generate wide-scale impacts, both project design and project implementation need to take account of the expected impact pathway. Wherever possible, the project needs to make efforts to generate and disseminate research outputs that will bring benefits, such as new

TABLE 3 *Project success factors and their frequency of identification in the Vietnam, Indonesia and PNG case studies*

Success Factor	Vietnam	Indonesia	PNG
Collaborative scoping and design			
Funding, facilities and equipment			
Scientists commitment, collaboration and focus			
Leadership and management			
Selection and commitment of partner institutions			
Effective communications and research networks			
Skills mix and time allocations			
Team and technical capacity building			
Implementation flexibility, monitoring and review			
Mutual benefit of research topic			
Strong, culturally appropriate team relationships			
Links to impact pathway and user benefits			
Publication and dissemination of results			
Time spent on in-country collaboration			
Site selection and scientific rigour of trials			
Continuity of partner institutions and team			
Local government and community support			
External factors: policies, markets, environmental, security			
Engagement with private sector			
Continuation of research post project			
Trust within team			
Long term research collaborations			
Duration of project			
Experience of project leader in country			
Donor influence on design			
Willingness to adopt innovation			
Clarity of roles and responsibilities			
Alignment with national development objectives			
User champions			
Engagement of policy actors			
Coordination of partners and stakeholders			
Provision of incentives			
Community or land disputes			
Collaboration with international scientists			
Corruption or misuse of funds			
Political support or interference			
Gender roles and issues			

Identified ≥ 21 times	
Identified 11–20 times	
Identified 1–10 times	
Not Identified	

FIGURE 5 *Most frequently identified project success factors*



technologies or increased livelihoods, to the intended end users of the research. However, in most R4D projects some aspects of the impact pathway, such as the use of research findings by government extension workers, are beyond the direct control of the project.

DISCUSSION

Differential success of research projects

Impact assessment studies of projects from ACIAR's forestry program in Vietnam (Fisher and Gordon 2007), Indonesia (Lindner 2011) and PNG (Fisher 2011) have previously demonstrated substantial but variable economic impacts from these investments, and a study by Pearce (2010) identified 14 factors that contribute to project success. One of the key purposes of development evaluation is to improve performance of ongoing programs and their management (Rebien 1997, IDRC 2010). However, while these ACIAR impact assessments provided evidence of the collective economic returns from groups of projects, they do not readily facilitate improved understanding of how, or why, the success of either the groups of projects or the individual projects has differed.

This study identified two important components of differential success between projects. Firstly, within a country, the relative success of individual R4D projects varies considerably (see Figure 3). Secondly, different levels of success can be associated with programs of research projects implemented in different countries, even when the duration of collaboration and magnitude of funding provided are relatively similar.

Most projects in this study, including many with high research achievements, had low impact. To some extent this finding is consistent with the nature of forestry R4D projects, whereby the responsibility for wide-scale dissemination of findings lies with actors outside the project, many impacts are not evident at the time a project concludes, and many forestry systems require long timeframes to produce commercial products. However, it raises the issue of donors, such as ACIAR, appropriately considering the opportunities for a research project to have impact when funding new projects, noting that that the methods commonly used to do this, such as impact pathway analysis (Douthwaite *et al.* 2003) and theories of change (CGIAR 2012), have evolved in the past 15 years.

The study showed that part of the variation in success can be explained by the way the identified project success factors have been considered and addressed in project design and implementation. This highlights the importance of donors actively considering and managing those success factors that are relevant to a particular project during both the design and implementation phases of R4D projects. For the design phase, this study has shown that collaborative scoping and design involving all project partners is key to project success, as without this approach there is unlikely to be appropriate

TABLE 4 *Expression of 15 most frequently identified success factors within seven projects with different evaluated levels of success*

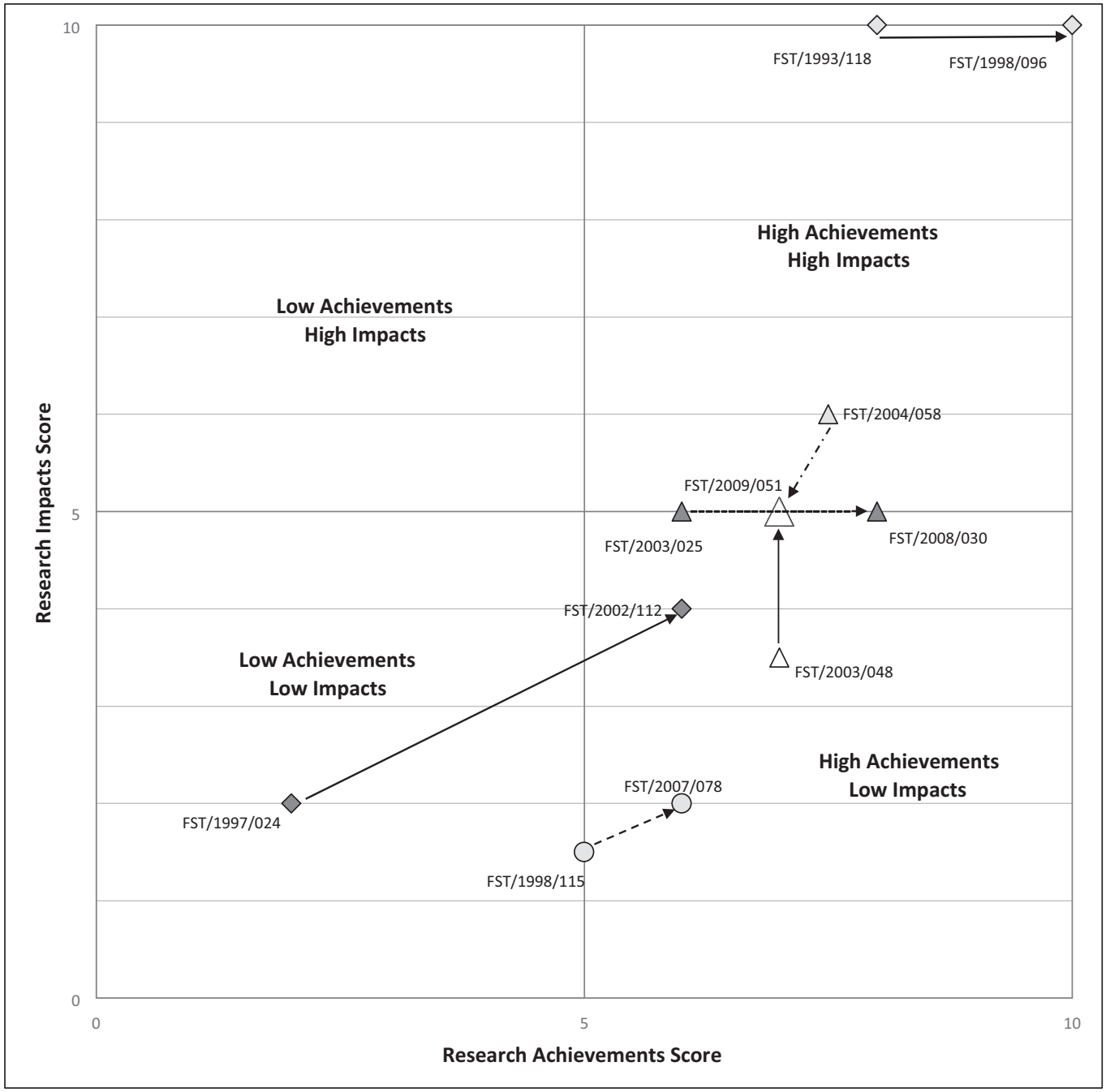
Relative Success Category	**High Achievement High Impact**		**High Achievement Low Impact**		**Low Achievement Low Impact**		
ACIAR Project Number	**FST/1998/096 Vietnam**	**FST/2005/177 Indonesia**	**FST/2006/087 Vietnam**	**FST/2009/016 PNG**	**FST/2001/021 Vietnam**	**FST/2000/122 Indonesia**	**FST/2006/120 PNG**
Factors That Can Be Influenced During Project Design							
Collaborative scoping and design							
Funding, facilities and equipment							
Selection and commitment of partner institutions							
Skills mix and time allocations							
Mutual benefit of research topic							
Factors That Can Be Influenced During Project Implementation							
Scientists commitment, collaboration and focus							
Leadership and management							
Effective communications and research networks							
Team and technical capacity building							
Implementation flexibility, monitoring and review							
Strong, culturally appropriate team relationships							
Links to impact pathway and user benefits							
Publication and dissemination of results							
Time spent on in-country collaboration							
Site selection and scientific rigour of trials							

Apparent Influence on Project Success	
Strongly Enhanced	
Enhanced	
Neutral	
Diminished	
Strongly Diminished	

ownership of the project and its results by the intended users. For the implementation phase, many of the identified success factors, including the effectiveness of capacity building, the links to impact pathways and the dissemination of results, will affect the extent of impact achieved by a project. Other studies (Rocheleau 1991, Dumont *et al.* 2017), identify the importance of engaging end users in agroforestry research to facilitate adoption. In this study, the results from some projects support this finding (Rohadi *et al.* 2012), while others highlight that in some locations farmers and landowners may not have the time or interest to conduct research or maintain project interventions, such as community nurseries, beyond the life of the project (Page *et al.* 2016).

With respect to the comparatively low success of projects in PNG, where there were no high achievement-high impact projects, it is unlikely that the identified success factors alone can explain this finding. However, some of the success factors (e.g. commitment of partner institutions and effective communications), which are universally difficult to address in PNG, will have contributed to the result. Rather, as identified by Ika and Donnelly (2017) in a study of capacity building projects in four developing countries, other high-level factors,

FIGURE 6 *Comparative analysis of relative success between related ACIAR forestry projects*[2]



including the contextual environment and beneficiary institution capability, may contribute to the different success in different countries.

Relative success of projects in longer-term programs

Most donors expect that with continued investment to support research on a priority topic, there will be increasing success in subsequent projects. In this study, there were six projects from which subsequent projects continued the research on a given or closely related topic and involved the same collaborating partners. In one of these, the subsequent project continued research on two topics previously conducted in two separate projects. The results of the evaluations of relative success of these related projects show that, contrary to expectations, the success of related projects can be quite variable (see Figure 6). Only two of the subsequent projects resulted in both improved achievements and improved

[2] Each ACIAR forestry project is identified by a unique project number (e.g. FST/2007/078) that indicates the relevant ACIAR research discipline (Forestry=FST), the year the project design commenced (2007) and a unique number (078).

TABLE 5 *Success factors relevant to project design and project implementation*

Factors relevant to project design	
Key Success Factors	**Other Success Factors**
Collaborative scoping and design	Donor influence on design
Mutual benefit of research topic	Alignment with national development objectives
Selection and commitment of partner institutions	Collaboration with international scientists
Skills mix and time allocations	Experience of project leader in country
Funding, facilities and equipment	Duration of project
Factors relevant to project implementation	
Key Success Factors	**Other Success Factors**
Leadership and management	
Scientists commitment, collaboration and focus	Clarity of roles and responsibilities
Strong, culturally appropriate team relationships	Trust within team
Time spent on in-country collaboration	
Effective communications and research networks	Coordination of partners and stakeholders
Team and technical capacity building	Provision of incentives
Site selection and scientific rigour of trials	Local government and community support; Gender roles and issues
Links to impact pathway and user benefits	User champions; Engagement with private sector; Engagement of policy actors
Implementation flexibility, monitoring and review	Corruption or misuse of funds
Publication and dissemination of results	

impacts compared to those from the precursor projects. One project, which continued research on management of tree diseases and on productivity of short-rotation plantations, that had been commenced under two separate projects, achieved lower scores for both achievements and impacts than were achieved in the precursor project on plantation productivity. Further analysis of the interview data indicated that ACIAR had combined the two different research themes into one project, but did not provide sufficient financial resources to support all the required research activities. These results demonstrate the importance of attending to key project success factors in project design and implementation, regardless of whether or not the project builds on a precursor project.

Factors that influence project success

The interviewees' views on the ways in which each of the 37 identified success factors (see Table 3) can either enhance or diminish project success have been described by Bartlett *et al.* (2017), Bartlett (2018a) and Bartlett (2018b). In the R4D domain, each project inevitably faces its own unique set of opportunities and constraints. Therefore, it is difficult to define which factors are unique and context-dependent, and those which may be more widely applicable. While all of the 37 identified success factors are important in certain circumstances, classifying them into more generic categories, such as key success factors and other success factors, more readily facilitates their consideration in future project design and implementation. The 30 success factors that can be influenced during project design and project implementation are shown in Table 5, disaggregated into two groups: key success factors – those which are high level and likely to be widely applicable to R4D projects, and other success factors – those which are either related to a key success factor or only likely to be applicable for some projects. This categorisation shows that there are five key success factors that need to be considered during the design of collaborative research projects and a further 10 key success factors that should be considered during project implementation, in order to increase the prospects of project success.

All 14 of the success factors identified by Pearce (2010) were re-identified in this study, however six new factors were identified among the 15 key success factors. One new factor, which was also the most frequently identified success factor, related to ensuring there is effective collaboration between partners during project scoping and design, while another related to the adequacy of funding for the planned research. Other new factors covered the importance of capacity building activities, the design and location of field trials, monitoring and review processes that support implementation flexibility, and the appropriate dissemination of research results.

In most cases, participants reported that if a success factor is appropriately considered and addressed, it will enhance the

TABLE 6 *Success factors that are outside the control of a research project*

Factors outside the project's control	
Success Factors related to the Research Institutions	**Success Factors related to the External Environment**
Continuity of partner institutions and team	External factors: policies, markets, environmental, security
Continuation of research post project	Willingness to adopt innovation
Long term research collaborations	Community or land disputes
	Political support or interference

success of the project, whereas if it is not appropriately considered and addressed, project success will be diminished. However, the study found that, for the success factor 'donor influence on design', divergent outcomes are possible, depending on the way in which the factor was addressed. Generally, project leaders expressed the view that donor interventions during the design process to broaden the skills within the project team or enhance the focus on particular activities improved the project's success. However, in two projects, donor interventions, related to combining two themes of research and/or substantially reducing funding without reducing the expected activities, reduced the project's success.

Across the three case study countries, there were seven success factors identified that are considered to be outside the control of the research project. Three of these relate to the participating research institutions and the others to the external operating environment (see Table 6). In this study, some of these factors – such as deteriorating security situation, political interference, ineffective policies or markets, and community or land disputes – significantly reduced the success of individual projects. While such factors may be very difficult to manage, it is important that both the project team and research funding agency are aware of them, and the constraints they pose to project implementation and impacts. In some situations, when these factors are identified, it may be appropriate to terminate or modify the project, particularly if the project's success is likely to be adversely impacted.

This new knowledge complements related knowledge on factors affecting adoption of forestry development initiatives, by providing more specific information on a wide range of factors relevant to the success of R4D forestry projects, which provide the knowledge and technical innovations needed in other forestry development initiatives. Franzel *et al.* (2001) examined some of the factors affecting enhanced scaling up of agroforestry systems, noting the need for a wider range of technical innovations and improved access to markets for agroforestry products. Byron (2001) identified four pre-requisite factors for successful smallholder plantation forestry, of which only viable production technologies are directly relevant to R4D projects. Macqueen (2013) proposed three enabling conditions for community forest enterprises and tested them in eight case studies, concluding that for these enterprises to be effective strong partnerships are needed between the communities, government, civil society and the private sector. Baynes *et al.* (2015), drawing on experiences from Mexico, Nepal and the Philippines, identified five interconnected factors that influence the success of community forestry programs, of which only addressing group governance issues and enhancing material benefits to group members can be influenced by development projects.

As previously identified by Byron (2001) and Macqueen (2013), this study has shown that for project interventions to be successful, multiple factors need to be appropriately addressed. While application of this knowledge could help reduce the risk of poor performing projects, it should not be used to preclude higher-risk R4D investments. In reality, some outcomes and impacts from R4D projects are unpredictable, others are context specific, and there is unlikely to be a definitive list of success factors that will guarantee the success of a project. Rather, it is more important to have a good understanding of the breadth of factors that can influence project success and then to have processes during project design and implementation to consider and appropriately address all success factors that may be relevant to the project.

What success factors contribute to differential success?

High achievement-high impact projects

This research identified seven projects that were evaluated as having high achievements and high impacts: three from Vietnam and four from Indonesia. As this is the category of project success most sought by donors, it is important to understand what factors contributed to the success of these projects. All three Vietnamese projects focused on domestication and breeding of tropical acacia and eucalypt trees and were conducted over a total period of ten years. The analysis of project records and interview data reported by Bartlett *et al.* (2017) showed that the key factors that contributed to their success were: having strong commitment and leadership within the Australian and Vietnamese partners; key Australian and Vietnamese researchers had 60–80 percent time commitments to the projects; a strong focus on capacity building; the Vietnamese partner sourced additional funding to extend project activities; and the improved tree germplasm was widely disseminated to farmers.

Two of the four Indonesian projects had a common research theme – timber furniture value chains and manufacturing, whereas the other two had different themes – teak agroforestry, and plantation productivity. Analysis of project records and interview data reported by Bartlett (2018a), showed that key factors contributing to their success were: having a collaborative design process and funding appropriately matched to planned activities; having good leadership

and collaboration between research partners; focusing on capacity building and dissemination of research findings; engaging local government and farmers in the agroforestry research, and with industry champions within the furniture industries; and having strong engagement of private sector companies in the plantation research.

Forestry and the associated forest industries are important in the economies of both these South-east Asian countries and, in both countries, smallholders are actively growing trees as part of their farming systems. The successful Vietnamese projects all addressed one research theme, involved the same team of researchers and relied on government systems to disseminate the improved germplasm. The successful Indonesian projects addressed several research themes, involved different teams of researchers, and engaged a wider group of stakeholders, including local government, the private sector and local farmers, Some of the commonalities from the successful projects across the two countries were having strong leadership, committed project teams, and focusing on both capacity building and dissemination of project outputs.

Low achievement-low impact projects

The study identified seven projects that were evaluated as having low achievements and low impacts: two from Vietnam, one from Indonesia and four from PNG. There are important lessons from some of these projects that may help avoid similar outcomes in the future. For the two Vietnamese projects, analysis of project records and interview data reported by Bartlett *et al.* (2017) showed that both projects had significant design faults. One project, researching the production of sawn wood from planted eucalypts, was poorly funded, and the choice of topic was driven by Australian perceptions of research priorities; in contrast, Vietnamese stakeholders were interested in veneer production, and hence there was no uptake of the research findings. The other project, which researched management of the insect pest *Hypsipyla* in five countries, had inadequate funding, poor integration of the genetics and silvicultural research in the trials, and did not publish the results of the research.

The Indonesian project involved the use of molecular markers for acacia tree breeding. Analysis of project records and interview data reported by Bartlett (2018a) showed it was poorly designed and too short in duration. The project design was overly ambitious with eight objectives and associated activities; and it was funded only for two years. Also, there were difficulties in attempting to establish a clonal breeding trial, none of the research was published, and there were no-follow on research activities.

The PNG projects covered three different research themes. Analysis of project records and interview data reported by Bartlett (2018b) showed that key factors contributing to the poor results were: poor project design; having too short a project duration; poor commitment and support from the partner institutions; low scientific capacity in the partner scientists; weak existing research and communications infrastructure; and a lack of interest within PNG in utilizing the modelling outputs.

While the thematic and geographic contexts of these seven projects were quite different, the most common contributor to their lack of success related to poor project design. Many of the projects were inadequately funded and of too short duration given the breadth of the planned research. Some projects had limited relevance to partner priorities or the country context, particularly in relation to how the results would be used by the partners.

The influence of context on project success

In this study, the exploration of the possible influence of context on project success primarily focused on the PNG case study because of the comparatively poorer success of the PNG forestry projects.

National-level context

Forests and forest industries are important to the national economies in all three countries and each country either includes forestry in its national development plan or has a forestry development strategy. However, in the case of PNG, having forestry recognized as a national development priority in its 2050 Vision (Government of Papua New Guinea 2009) has not helped enhance the adoption and impacts from forestry research. PNG's commercial forestry sector, which still involves large scale export-oriented harvesting of natural forests, continues to suffer from weak governance and over-exploitation (Laurance *et al.* 2011), its forestry agencies are inadequately funded, and many ACIAR forestry projects have achieved only limited impact (Fisher 2011).

The three selected human and economic development indicators all show different rankings for Indonesia, Vietnam and PNG, with Indonesia having the highest ranking and PNG having the lowest ranking for each indicator (see Table 7).

The results from the evaluations of relative success of projects from Indonesia and Vietnam were reasonably similar, while the PNG projects had much lower levels of relative success (see Figure 4). Indonesia and Vietnam are both considered to have a medium level of human development, with similar HDIs, but Indonesia's rankings in the business and corruption related indices are better than those for Vietnam. PNG is considered to have a low level of human development and it also has substantially poorer rankings in the business and corruption indices than either Indonesia or Vietnam. In this study, three of the Vietnamese tree breeding projects achieved highest level of impact of any of the 30 projects studied. This is likely to be due to factors such as: efficient tree germplasm distribution mechanisms, an entrepreneurial culture, and the strong markets for wood products (all somewhat related to ease of doing business). Therefore, in this study, these national development indices may help to explain the relevant national context in PNG, but are less useful for explaining any differences between Vietnam and Indonesia.

The data presented in Table 7 for the national forest research agencies from Indonesia, Vietnam and PNG, covering their annual budget, number of staff and number of PhD qualified researchers, suggests an apparent decrease in

TABLE 7 *Indicators of development status and forestry research capacity*

Country	Human & Economic Development Indicators			Government Forestry Research Agency Indicators		
	UNDP's HDI 2015	World Bank's Ease of Doing Business Ranking 2017 (x of 190)	Transparency International's Corruption Perception Ranking 2016 (x of 176)	Annual Budget (USD million)	Total staff (research & admin)	PhD qualified Researchers
Indonesia	0.689	68	90	21.22	1623	75
Vietnam	0.683	72	113	9.16	630	70
PNG	0.516	109	136	0.26	99	1

Sources:
http://hdr.undp.org/en/composite/HDI
http://www.doingbusiness.org/rankings
https://www.transparency.org/country

institutional capacity from Indonesia, to Vietnam to PNG. Both the Indonesian and Vietnamese institutions have similar numbers of PhD-qualified researchers, but the Indonesian institution has much more staff and funding. This may explain why the Indonesian projects generally had higher scores for research achievements than did the Vietnamese projects. In contrast to Indonesia and Vietnam, the PNG forestry research agency has significantly fewer staff, virtually no PhD-qualified researchers and an exceptionally low annual budget. This comparatively low research capability is likely to have contributed to the lower levels of success achieved in ACIAR's PNG forestry projects.

Local-level context

In Vietnam, where all projects were conducted through the same national research agency, some of the differences in relative success can be attributed to different levels of leadership and commitment in different sections of the agency. In PNG, some projects suffered when there was a change in leadership in the research agency and the new leader, who did not regard the ACIAR projects as a priority, directed staff onto other tasks. Also in PNG, there was a culture of providing personal financial incentives to undertake project activities which created considerable operational challenges and limited project effectiveness.

In Indonesia, where farmers used teak as the cash savings part of their livelihood strategies, there was strong interest in adoption of improved management of teak agroforestry systems, and similarly where pulp and paper companies had resource supply constraints, they willingly collaborated with the project and were quick to adopt improved site and plantation management practices. In PNG, a project on production of fuel wood from short rotation coppice systems was technically successful, but had limited impact because it was found that the local people preferred the appearance of fuel wood split from larger trees (Nuberg *et al.* 2017).

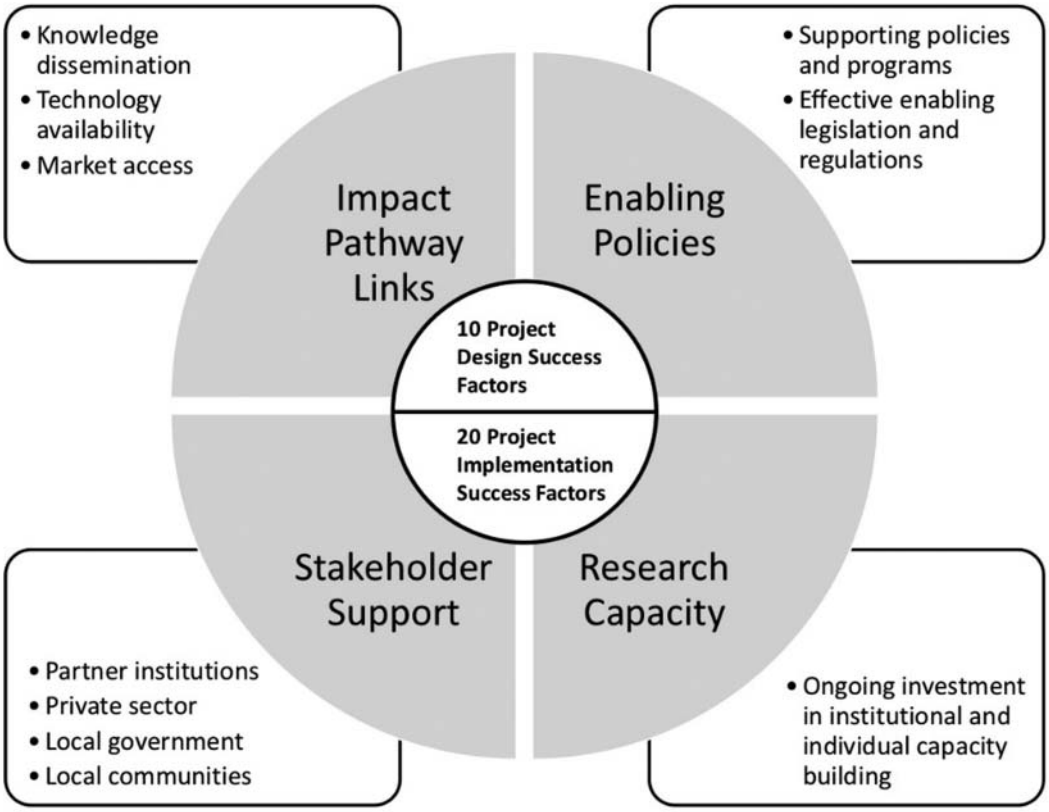
In many countries, adoption of research findings relies on having effective government extension systems, but these can vary at different locations within a country and in their effectiveness. In Vietnam, a project on *Acacia* silviculture found it difficult to engage local extension staff who had other priorities, whereas the adoption of improved *Acacia* germplasm was facilitated by extension staff and efficient germplasm distribution systems. In PNG, adoption of commercially-focused agroforestry systems was constrained in some locations due to poor infrastructure and poor access to markets and in others by conflicts within the communities.

Project-level context

At the project-level, context relates to the topic of research and its position along the research to development continuum, as well as to project leadership and duration, the capacity and commitment of individual scientists and the quality of the research methods. Evidence also exists that using innovative approaches to engage end users of the research, for example through rural resource centres where farmers get access to low-cost practical technologies and knowledge (Asaah *et al.* 2011), can enhance adoption if they are appropriate to the local context (Degrande *et al.* 2015). Research on control of forest pests and diseases is inherently more challenging and long-term than many other topics. In Indonesia research on control of root rot disease was unable to develop control methods after two four-year phases of research, while in Vietnam well designed research failed to find genetic resistance to the *Hypsipyla* shoot borer pest after two four-year projects. Neither of these pairs of projects were considered to be unsuccessful, even though both were evaluated as having had low impacts, as they had good achievements and generated scientific impacts. Research on improving access to improved germplasm for high-value tree species in Vietnam and PNG produced different levels of improved success between linked projects due to differences in institutional capability and germplasm dissemination systems.

Differences associated with the position of a research project on the research to development continuum are illustrated by two Vietnamese tree breeding projects. A more development-oriented project that resulted in production of improved clonal germplasm achieved high impact; whereas impacts were low and much more distant for a more blue sky research project on polyploidy, which generated good

FIGURE 7 *A theoretical framework for considering success in R4D projects*



scientific achievements. In PNG, the relatively weak technical capacity of many researchers, compared to those in in similar projects in Vietnam or Indonesia, meant that it was difficult to undertake many research tasks other than when Australian partner scientists were physically in country.

A theoretical framework for considering success in R4D projects

Making judgements about the success of an individual R4D project or making meaningful comparisons between different R4D projects, including similar projects implemented in different countries, is very challenging because of the great variation that exists in the local, regional and national contexts, within which different R4D projects operate. This study adds to the existing knowledge on this important topic by synthesizing the results from three case studies on relative success and project success factors, and then exploring some aspects of the influence of context on the observed results. Clear relationships have been demonstrated between the identified project success factors that can be influenced during project design and project implementation, and the evaluated relative success of a project.

To assist with understanding the relationships between the identified success factors and the observed relationships with project contextual factors, a theoretical framework has been developed (see Figure 7). The framework shows that the 10 success factors that can be influenced during project design and the 20 success factors that can be influenced during project implementation have a central influence on project success. However, these 30 success factors in themselves are not the only determinants of project success. Each R4D project is implemented within a broader and variable operating context, which may influence project success. While there are many external factors that contribute to the operating context, they are represented in this theoretical framework by four categories: enabling policies, research capacity, stakeholder support, and impact pathway links. Examples are provided of some of the specific aspects of each contextual category that can affect project success. Each of these four categories, while often being largely outside the control of a project, does need to be taken into account during the design, implementation and evaluation of R4D projects.

This theoretical framework is consistent with findings from other related research. To enhance the adoption of agroforestry research findings, Coe *et al.* (2014) identified the importance the importance of developing appropriate service delivery mechanisms, markets, and institutional contexts (impact pathway links) and co-learning amongst research, development and private sector actors (stakeholder support). Gritten *et al.* (2015) identified regulatory barriers that restrict enhanced livelihoods from the sale of timber and timber products from community forests in Cambodia, Nepal, and Vietnam (enabling policies). It also confirms findings by Clark *et al.* (2016) on factors that help ensure knowledge for sustainable development is useable, including coproduction

relationships between knowledge-making and decision-making (enabling policies) and the need for effective stakeholder collaboration (stakeholder support). This study identified the level of institutional and individual capacity amongst the developing country partner researchers as an additional aspect of context that can influence project success; confirming the finding of Ika and Donnelly (2017) about the importance of beneficiary institution capability to project success.

CONCLUSIONS

While there is a strong international resolve to significantly increase aid effectiveness and development performance (OECD 2005), few systematic comparisons of the success of different completed projects have been reported in the literature. Maryudi *et al.* (2012) highlighted the importance of having methodologies that enable cost-effective and timely evaluations of forestry programs implemented in different contexts. This study demonstrates the utility of Bartlett's (2016b) methodology for evaluating the relative success of R4D projects, including enabling comparisons of projects within and between countries. In hindsight, if ACIAR had utilized this methodology within its evaluation program in conjunction with impact assessments, it would have had improved understanding of the variability in performance of its projects within and between countries. Such knowledge could have been used to refine its processes for assessing the merits of individual project designs and to strengthen its capacity building activities in countries where project performance is generally poorer. There would be merit in these methods being utilised in other countries, with other R4D agencies, and for non-forestry research projects, to improve the knowledge base. The knowledge gained from such evaluations could be used to review and improve understanding of theories of change and to help those who are responsible for designing and implementing such projects to continuously improve the effectiveness of both research programs and individual projects.

The study, showed that the relative success of forestry research projects implemented in South-east Asian countries, such as Indonesia and Vietnam, is likely to be greater than it will be for similar projects implemented in Pacific countries, such as PNG. With respect to the different country contexts, the published national development indices may partially explain the observed differences in the overall relative success of projects in a country. However, it is more likely that differences in national forestry research institutional capability and the different ways that project success factors have been addressed within each country are the significant determinants of the observed differential success. An implication of this finding is that donors should consider the relative capability of partner institutions between countries when analysing results of multi-country evaluations of project success. The study also found that the success of individual projects differed considerably within each country, that follow-on projects do not always lead improved project success, and that, overall, only about one-quarter of the assessed projects were considered to have both high achievements and high impacts.

The identification of 37 factors that can influence the success of R4D projects considerably broadens the existing knowledge about success factors, previously limited to 14 factors (Pearce 2010). Newly identified factors, including the importance of collaborative scoping and design, monitoring and review processes, and the dissemination of findings, provide additional insights into how project success can be improved. This new knowledge, together with the evidence that most of the key success factors have apparent causal relationships with project success, offer important insights into improving the effectiveness of R4D projects. The study also showed that context is another important determinant of project success and that, at the national contextual level, the most apparent aspect related to differences in national research agency capability. The implication of this finding is that donors need to consider organizational capability both when designing projects and when comparing the results of inter-country evaluations. The relationships between context and the identified project success factors were found to be more evident at the local-level and project-level contextual dimensions. Further research is needed to improve understanding of why similar projects achieve quite different results in different locations.

Collectively, this new evidence provides important contributions towards understanding how to increase both aid effectiveness and development performance, which could be prospectively applied to future R4D projects. The new theoretical framework improves understanding of the relationships between the identified project success factors and context in achieving project success. While the case studies were confined to forestry research projects implemented in Vietnam, Indonesia and PNG, the results are likely to be more widely applicable to other agricultural, natural resource management and rural development related research projects. Addressing all 15 of the key success factors during project design and implementation will be an important foundation for increasing project effectiveness. The other identified success factors should also be routinely considered, taking account of the context and nature of the project, and where it is situated on the research for development continuum. This is particularly important in countries where there are known constraints to project success, and with follow-on projects in a longer-term program. Continuing to develop country-specific understanding of relevant project success factors across more countries can help researchers and funding agencies tackle the seemingly intractable challenges of achieving impact and supporting positive research and development outcomes.

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REFERENCES

ACIAR. 2017. ACIAR Corporate Plan 2017-21. Canberra, Australian Centre for International Agricultural Research: 28 pp.

ARNOLD, R.J., XIE, Y.J., MIDGLEY, S.J., LUO, J.Z. and CHEN, X.F. 2013. Emergence and Rise of Eucalypt Veneer Production in China. *International Forestry Review* **15**(1): 33–47.

ASAAH, E.K., TCHOUNDJEU, Z., LEAKEY, R.R.B., TAKOUSTING, B., NJONG, J. and EDANG, I. 2011. Trees, agroforestry and multifunctional agriculture in Cameroon. *International Journal of Agricultural Sustainability* **9**(1): 110–119.

BARTLETT, A.G. 1992. A review of community forestry advances in Nepal. *Commonwealth Forestry Review* **71**(2): 95–100.

BARTLETT, A.G. 2016a. The evolution and impacts of ACIAR's forestry research program over three decades. *Australian Forestry* **79**(3): 171–188.

BARTLETT, A.G. 2016b. Evaluating relative success of donor-funded collaborative research projects. *Research Evaluation* **25**(4): 405–415.

—. 2018a. Factors Affecting the Relative Success of Collaborative Forestry Research Projects in Indonesia. *The European Journal of Development Research*: 1–22.

BARTLETT, A.G. 2018b. Factors affecting the success of collaborative forestry research in Papua New Guinea. *Australian Forestry* **81**(2): 116–128.

BARTLETT, A.G., KANOWSKI, P.J., VAN KERKHOFF, L. and BYRON, R.N. 2017. Identifying factors that influence the success of forestry research projects implemented in developing countries: case study results from Vietnam. *Forestry* **90**(3): 413–425.

BAYNES, J., HERBOHN, J., SMITH, C., FISHER, R. and BRAY, D. 2015. Key factors which influence the success of community forestry in developing countries. *Global Environmental Change* **35**: 226–238.

BELCHER, B. 2005. Forest product markets, forests and poverty reduction. *International Forestry Review* **7**(2): 82–89.

BELCHER, B.M., RASMUSSEN, K.E., KEMSHAW, M.R. and ZORNES, D.A. 2016. Defining and assessing research quality in a transdisciplinary context. *Research Evaluation* **25**(1): 1–17.

BLAMEY, A. and MACKENZIE, M. 2007. Theories of Change and Realistic Evaluation: Peas in a Pod or Apples and Oranges? *Evaluation* **13**(4): 439–455.

BYRON, N. 2001. Keys to smallholder forestry. *Forests, Trees and Livelihoods* **11**(4): 279–294.

CARTER, J., POKHAREL, B. and PARAJULI, R.R. 2011. Two decades of community forestry in Nepal: what have we learned? Kathmandu, Nepal, Nepal Swiss Community Forestry Project: 90 pp.

CGIAR. 2012. Strategic overview of CGIAR Research programs Part I. Theories of Change and Impact Pathways. Rome, Italy, Independent Science and Partnership Council.

CLARK, W.C., VAN KERKHOFF, L., LEBEL, L. and GALLOPIN, G.C. 2016. Crafting usable knowledge for sustainable development. *Proceedings of the National Academy of Sciences* **113**(17): 4570–4578.

COE, R., SINCLAIR, F. and BARRIOS, E. 2014. Scaling up agroforestry requires research 'in' rather than 'for' development. *Current Opinion in Environmental Sustainability* **6**(0): 73–77.

COOK, S. and WEI, H. 2002. The Anomalous Nature of Development Success: A case study from China. *Development* **45**(3): 76–80.

DALRYMPLE, D.G. 2008. International agricultural research as a global public good: concepts, the CGIAR experience and policy issues. *Journal of International Development* **20**(3): 347–379.

DAVIS, J., GORDON, J., PEARCE, D. and TEMPLETON, D. 2008. Guidelines for assessing the impacts of ACIAR's research activities *ACIAR Impact Assessment Series Report No. 58*. Canberra, Australia, Australian Centre for International Agricultural Research: 120 pp.

DAVIS, K. 2017. An empirical investigation into different stakeholder groups perception of project success. *International Journal of Project Management* **35**(4): 604–617.

DE JONG, S.P.L., VAN ARENSBERGEN, P., DAEMEN, F., VAN DER MEULEN, B. and VAN DEN BESSELAAR, P. 2011. Evaluation of research in context: an approach and two cases. *Research Evaluation* **20**(1): 61–72.

DE WIT, A. 1988. Measurement of project success. *International Journal of Project Management* **6**(3): 164–170.

DEGRANDE, A., TCHOUNDJEU, Z., KWIDJA, A. and FONGANG FOUEPE, G. 2015. Rural Resource Centres: A Community Approach to Extension. *GFRAS Good Practice Notes for Extension and Advisory Services: Note 10*. Lindau, Switzerland, GFRAS.

DENNING, G.L. 2001. Realising the potential of agroforestry: Integrating research and development to achieve greater impact. *Development in Practice* **11**(4): 407–416.

DOUTHWAITE, B., ALVAREZ, S., COOK, S., DAVIES, R., GEORGE, P., HOWELL, J., MACKAY, R. and RUBIANO, J. 2007. The impact pathways approach: A practical application of program theory in research-for-development. *The Canadian Journal of Program Evaluation* **22**(2): 127–159.

DOUTHWAITE, B., KUBY, T., VAN DE FLIERT, E. and SCHULZ, S. 2003. Impact pathway evaluation: an

approach for achieving and attributing impact in complex systems. *Agricultural Systems* **78**(2): 243–265.

DUMONT, E.S., BONHOMME, S., PAGELLA, T.F. and SINCLAIR, F.L. 2017. Structured stakeholder engagement leads to development of more diverse and inclusive agroforestry options. *Experimental Agriculture*: 1–23.

FAO. 1978. Forestry for local community development. *Forestry Paper No. 7*. Rome, Food and Agriculture Organisation of the United Nations: 114 pp.

FISHER, H. 2011. Forestry in Papua New Guinea: a review of ACIAR's program. *ACIAR Impact Assessment Series Report No. 73*. Canberra, Australian Centre for International Agricultural Research: 71 pp.

FISHER, H. and GORDON, J. 2007. Improved Australian tree species for Vietnam. *ACIAR Impact Assessment Series Report No 47*. Canberra, Australian Centre for International Agricultural Research: 33 pp.

FRANZEL, S., COOPER, P. and DENNING, G.L. 2001. Scaling up the benefits of agroforestry research: Lessons learned and research challenges. *Development in Practice* **11**(4): 524–534.

GOVERNMENT OF PAPUA NEW GUINEA. 2009. Papua New Guinea Vision 2050. National Strategic Plan Taskforce. Port Moresby: 79 pp.

GREENLAND, D.J. 1997. International agricultural research and the CGIAR system—past, present and future. *Journal of International Development* **9**(4): 459–482.

GRITTEN, D., GREIJMANS, M., LEWIS, S., SOKCHEA, T., ATKINSON, J., QUANG, T., POUDYAL, B., CHAPAGAIN, B., SAPKOTA, L., MOHNS, B. and PAUDEL, N. 2015. An Uneven Playing Field: Regulatory Barriers to Communities Making a Living from the Timber from Their Forests–Examples from Cambodia, Nepal and Vietnam. *Forests* **6**(10): 3433.

HAJJAR, R., KOZAK, R.A., EL-LAKANY, H. and INNES, J.L. 2013. Community forests for forest communities: Integrating community-defined goals and practices in the design of forestry initiatives. *Land Use Policy* **34**(0): 158–167.

HENDERSON, J.S. 2000. Evaluating the impact of forestry research for development. *International Forestry Review* **2**(3): 191–199.

HØGH-JENSEN, H., OELOFSE, M. and EGELYNG, H. 2010. New Challenges in Underprivileged Regions Call for People-Centered Research for Development. *Society & Natural Resources* **23**(9): 908–915.

HUDSON, J. 2000. Forests and the United Kingdom's Department for International Development. *International Forestry Review* **2**(3): 156–157.

IDRC. 2010. IDRC Evaluation Strategy 2010–2015. Ottawa, International Development Research Centre.

IKA, L.A. 2009. Project success as a topic in project management journals. *Project Management Journal* **40**(4): 6–19.

IKA, L.A., DIALLO, A. and THUILLIER, D. 2012. Critical success factors for World Bank projects: An empirical investigation. *International Journal of Project Management* **30**(1): 105–116.

IKA, L.A. and DONNELLY, J. 2017. Success conditions for international development capacity building projects. *International Journal of Project Management* **35**(1): 44–63.

JARVIE, W. and STEWART, J. 2018. Conceptualizing learning in the public sector: the importance of context. *International Journal of Public Sector Management* **31**(1): 14–30.

LAURANCE, W.F., KAKUL, T., KEENAN, R.J., SAYER, J., PASSINGAN, S., CLEMENTS, G.R., VILLEGAS, F. and SODHI, N.S. 2011. Predatory corporations, failing governance, and the fate of forests in Papua New Guinea. *Conservation Letters* **4**(2): 95–100.

LINDNER, R. 2011. The economic impact in Indonesia and Australia of investment in plantation forestry research, 1987–2009. *ACIAR Impact Assessment Series Report No. 71*. Canberra, Australian Centre for International Agricultural Research: 89 pp.

LINDNER, R., MCLEOD, P. and MULLEN, J. 2013. Returns to ACIAR's investment in bilateral agricultural research. *ACIAR Impact Assessment Series No 86*. Canberra, Australian Centre for International Agricultural Research: 48 pp.

MACQUEEN, D. 2013. Enabling Conditions for Successful Community Forest Enterprises. *Small-scale Forestry* **12**(1): 145–163.

MAREDIA, M.K. and RAITZER, D.A. 2012. Review and analysis of documented patterns of agricultural research impacts in Southeast Asia. *Agricultural Systems* **106**(1): 46–58.

MARYUDI, A., DEVKOTA, R.R., SCHUSSER, C., YUFANYI, C., SALLA, M., AURENHAMMER, H., ROTCHANAPHATHARAWIT, R. and KROTT, M. 2012. Back to basics: Considerations in evaluating the outcomes of community forestry. *Forest Policy and Economics* **14**(1): 1–5.

MAYNE, J. and JOHNSON, N. 2015. Using theories of change in the CGIAR Research Program on Agriculture for Nutrition and Health. *Evaluation* **21**(4): 407–428.

MCLEOD, L., DOOLIN, B. and MACDONELL, S.G. 2012. A Perspective-Based Understanding of Project Success. *Project Management Journal* **43**(5): 68–86.

MORSE, S. 2016. Measuring the Success of Sustainable Development Indices in Terms of Reporting by the Global Press. *Social Indicators Research* **125**(2): 359–375.

NUBERG, I.K., MITIR, J.A. and ROBINSON, B. 2017. Short-rotation coppice agroforestry for charcoal small business in Papua New Guinea. *Australian Forestry* **80**(3): 143–152.

OECD. 2005. Paris Declaration on Aid Effectiveness. Paris, Organisation for Economic Cooperation and Development: 15 pp.

PAGE, T., LATA, A., JEFFREY, G., YELU, W., ROLLINSON, S., HOWCROFT, N., KULANG, S., WALDI, D., ZAMANG, L., RABBI, J., VINARUT, I., FAMIOK, S., SPENCER, D., ROME, G., OA, L. and GRAHAM, V.

2016. Development of a PNG timber industry based on community-based planted forests: design and implementation of a national germplasm delivery system. *ACIAR Final Reports No. FR2016-18*. Canberra, Australian Centre for International Agricultural Research: 87 pp.

PEARCE, D. 2010. Lessons learned from past ACIAR impact assessments, adoption studies and experience. *ACIAR Impact Assessment Series Report No 69*. Canberra, Australian Centre for International Agricultural Research.

PERSSON, R. 2000. Assistance to forestry": what have we learnt? *International Forestry Review* **21**(3): 218–224.

RAITZER, D.A. 2003. Benefit-cost meta-analysis of investment in Intenational Agricultural Research Centres of the CGIAR. Rome, Food and Agricultural Organisation of the United Nations: 45 pp.

REBIEN, C.C. 1997. Development Assistance Evaluation and the Foundations of Program Evaluation. *Evaluation Review* **21**(4): 438–460.

ROCHELEAU, D.E. 1991. Participatory research in agroforestry: learning from experience and expanding our repertoire. *Agroforestry Systems* **15**(2): 111–137.

ROHADI, D., ROSHETKO, J., PERDANA, A., BLYTH, M., NURYARTONO, N., KUSUMOWARDANI, N., PRAMONO, A., WIDYANI, N. and FAUZAN, A. 2012. Improving economic outcomes for smallholders growing teak in agroforestry systems in Indonesia. *ACIAR Final Reports No. FR2012-11*. Canberra, Australian Centre for International Agricultural Research: 64 pp.

SIKOR, T. 2006. Analyzing community-based forestry: Local, political and agrarian perspectives. *Forest Policy and Economics* **8**(4): 339–349.

VAN KERKHOFF, L. and BERRY, H. 2016. Serving the public good: Empirical links between governance and research investment in the context of global environmental change. *Ecological Economics* **125**: 101–107.

WESTOBY, J.C. 1979. Forest industries for socio-economic development. *Commonwealth Forestry Review* **58**(2): 107–116.

ZOOMERS, A. 2005. Three decades of rural development projects in Asia, Latin America, and Africa: Learning from successes and failures. *International Development Planning Review* **27**(3): 271–296.

PART 3: PRESENTING AND USING NEW KNOWLEDGE

Chapter 8. Conclusions.

This chapter presents the conclusions from my research. It utilises the synthesis results (presented in Chapter 7) and presents the key findings and academic and practical contributions for each of the eight research sub-questions (as presented in Chapter 1). It discusses the opportunities for using this knowledge to enhance success in research for development, both for ACIAR and its potential application beyond ACIAR. Finally, it identifies some further research needs and presents some personal reflections from this period of postgraduate study.

8. Conclusions

Research for development (R4D) is an important part of Overseas Development Assistance (ODA) programs, to which significant funding is committed bilaterally and multilaterally. Australia, through the Australian Centre for International Agricultural Research (ACIAR), currently spends about $115 million annually on R4D related to the agriculture, fisheries and forestry sectors of partner countries (ACIAR, 2017c), of which about $10 million is spent on bilateral forestry research projects. Since 2005, when the international community agreed to the Paris Declaration on Aid Effectiveness (OECD, 2005), there has been a commitment to increase monitoring and evaluation efforts to enable periodic qualitative and quantitative assessments of aid effectiveness. With the agreement of the 17 Sustainable Development Goals (SDG) and 169 associated targets within the 2030 Agenda for Sustainable Development (United-Nations, 2015), the international community also agreed to establish processes and indicators to facilitate reporting of progress. In particular, clause 74 (c) of the 2030 Agenda indicates that these processes will maintain a long-term orientation and identify the achievements, challenges, gaps and critical success factors of national and related development assistance programs. Globally, while progress is being made on improving the monitoring of development effectiveness (OECD/UNDP, 2016), these efforts focus on 10 high-level indicators of aid effectiveness rather than on the effectiveness of particular programs or projects.

Donor organizations, such as ACIAR, need the ability to comprehensively monitor and evaluate the effectiveness of the programs and projects that they fund, both to improve the effectiveness of their own programs and to contribute relevant information to these global and national SDG monitoring processes. Evaluations should seek to understand what works, what does not work, and why, so that policy makers can draw on these lessons to replicate, generalise and scale up the results from development interventions (Stern *et al.*, 2012). Many commentators, however, have highlighted the challenges of evaluating what does, or does not, work and why (Millstone *et al.*, 2010; Hall *et al.*, 2003; Cracknell, 1996), while Everitt and Mare (2012) explain the challenges of judging, and importance of valuing, research findings in development evaluations. Understanding and evaluating success in R4D projects is only one part of addressing improved effectiveness of ODA programs, but without such knowledge it may be difficult to progress the broader aid effectiveness agenda in a meaningful way.

This postgraduate research explored the principal research question *"What constitutes success, and what factors influence it, in forestry research for development projects?"* and aimed to make both academic contributions to knowledge and practical contributions towards improving the effectiveness of R4D projects. As this research has generated significant new knowledge relevant to this research question, the findings are discussed in some detail in Sections 8.1 and 8.2. Section 8.1 covers the findings for the overall research question and the first seven of the eight research sub-questions.

Section 8.2 discusses how this knowledge might be used by ACIAR and other ODA organisations that fund research for development projects.

8.1. Research findings and contributions

At the highest level, the principal research question was answered by determining that, for R4D projects, success needs to consider both research achievements and research impacts, and through the identification of 37 factors that can enhance or diminish project success. It is important to note that success can be expressed in terms relevant to the perspective of the researchers who implemented the projects, or in terms of how the research funder views the results of an evaluation of the project's relative success.

However, the research has shown that both the research sub-questions and the answers are more complex than this, and that research project success can vary between and within countries. To explore and explain this result further, the main findings and their academic and practical contributions for the first seven of the research sub-questions are discussed below.

Research Sub-Question 1: What is ACIAR's approach to development research and how has its forestry program evolved over three decades?

This questioned was answered in two parts and both parts are explained in detail in the journal article presented as Chapter 2 of this thesis (Bartlett, 2016b). Firstly, I identified that ACIAR's approach to funding and managing R4D projects involves both strategic and operational components, which included:

- Commissioning research projects that address research priorities identified by the partner country as collaborative partnerships between Australian or international scientists and scientists in the partner country;
- Employing research program managers with a strong technical knowledge and experienced in research management and international development;
- Conducting technical, social and policy research, but limiting extension activities to those related to proof of concept or understanding of adoption processes;
- Identifying clear research questions and objectives linked to research activities, articulating the impact pathways and conducting an ex-ante impact assessment;
- Allowing flexibility in project implementation, with project leaders managing within the broad design, and supporting activity variations to improve outcomes;
- Conducting adoption studies and impact assessments of projects and programs several years after completion to establish achievements, lessons learned and the impacts.

Secondly, I prepared a review of what type of research the ACIAR's forestry program has supported and how the program has evolved in the three decades between 1984 and 2015. ACIAR had commissioned 101 forestry research projects in 29 countries, spanning ten research themes. In relation to how the ACIAR forestry program had evolved over three decades, I made a number of findings. In each decade, projects were implemented in between 15 and 17 countries, with the greatest numbers of projects implemented in Indonesia, Vietnam and Papua New Guinea (PNG). The number of organisations leading projects grew from four in the first decade to sixteen in the third decade. I identified ten different research themes that had been supported and found considerable changes in nature of the projects and number of research themes covered over the three decades. The number of research themes grew from three in the first decade to ten in the third decade; over time, there were more projects related to agroforestry, community forestry, silviculture of non-Australian trees and value-added processing. In reviewing the published impact assessment studies, I found that ACIAR's bilateral research investments, including its forestry projects, had demonstrated high returns, but that much of the aggregated economic impacts originated from a small number of highly successful projects (Lindner et al., 2013). From this review, I realised that the forestry program apparently had achieved greater economic impact in Indonesia and Vietnam than it had in PNG, but there was no explanation of why this was the case.

These findings are primarily contributions to knowledge, as the topic had not been previously analysed or published. The publication I prepared on the evolution of ACIAR's forestry program, provides the first comprehensive review of this $100 million investment by Australia to support international forestry research over a 30-year period. The findings will help those interested in R4D to understand both how ACIAR operates and how it differs from other rural development organisations. They also speak to the broader need to develop and apply methodologies for comparatively evaluating R4D projects to enable better understanding of why project success varies.

Research Sub-Question 2: What constitutes 'success' in ACIAR's forestry research projects?

As reported in Chapters 5 and 7, the research found that defining success in R4D programs and projects is complicated and challenging (McLeod et al., 2012), and there is no consensus on a definition of project success or a means of assessing it (Ika, 2009). From the literature and the conduct of the research, I developed an understanding that the concept of success can mean different things to different stakeholders and also have different dimensions, for example technical, social, economic or political success. In addition, in the context of R4D projects, there are additional challenges related to whether or not the research can generate a solution to a problem, and on how success should be judged in initial and subsequent projects that form part of a long-term research program.

Given these challenges and the need for a common understanding of what success might mean in ACIAR forestry projects, as discussed in Chapter 3, I adopted the logic articulated by Pearce (2010),

because of its relevance to ACIAR projects. Under Pearce's logic, success considers two primary dimensions: the extent to which planned research outputs are achieved and adopted ("achievements"); and the extent of the impacts resulting from wider adoption, typically outside of the project and beyond its life ("impacts").

During the conduct of the three case studies (as reported in Chapters 4-6), I tested this logic on how to define success with 90 scientists who had been involved in ACIAR forestry projects. From the analysis of their interview responses, I developed a working definition of a successful ACIAR forestry project, and thereby answered a key part of research sub-question 2. Therefore, from the perspective of the researchers who have implemented ACIAR forestry projects, a successful project is considered to be one that: "uses sound but flexible scientific methods to achieve planned outputs; enhances the capacity of partners; generates knowledge or technologies that can improve the system under investigation; facilitates ongoing scientific relationships and networks; and results in tangible scientific impacts and benefits for project stakeholders and local communities". The first three components of this working definition related to research achievements, and the other two components relate to research impacts. Therefore, my research validated the legitimacy of Pearce's (2010) logic amongst the participating research scientists.

I also used this logic in the development of a methodology for evaluating the relative success of multiple R4D projects and subsequently found that it generated very useful results that enabled comparison of the success of different projects, and in doing so further assisted understanding what constitutes success in these types of projects. When interpreting the results of relative success evaluations to judge project success, I found it useful to consider where the evaluation scores 'fitted' in the four project success categories (as shown in Figure 1.2 of Chapter 1), and the project's position in the research to development continuum (as shown in Figure 1.1 of Chapter 1). This methodology also allows comparison of projects at different stages of longer-term research programs, which is a feature of both ACIAR's and other R4D agencies' approach, and thereby assists evaluators to make informed decisions about the apparent success of both early- and later-phase projects.

From the perspective of ACIAR, or the funder of the R4D projects, those projects that were evaluated as having high achievements and high impacts could be considered most successful. Those projects with high achievements but low impacts generally could be considered partially successful, although in making such a judgement, it would be important to consider both whether or not the project had met its stated objectives and what would be a reasonable expectation of impact from the project; this in turn would depend on where it sat on the research for development continuum. In the unlikely situation of a project having low achievements but high impact, the project would be considered partially successful, though consideration would need to be made on whether the project team had decided to concentrate efforts on the successful component to maximise the effectiveness of the

project investment. Projects evaluated as having low achievements and low impacts would be considered unsuccessful.

These are important academic contributions because of the lack of clarity in the literature on what constitutes success in R4D projects. They could be used and refined by other researchers studying the contributions of R4D projects to aid effectiveness, as well as to national development programs.

Research Sub-question 3: How can the relative success of multiple research projects be systematically evaluated in a cost effective manner?

The most surprising finding from this component of the research was the lack of a practical methodology, amongst the existing family of development evaluation methodologies, to evaluate the relative success of large numbers of R4D projects. As reported in Chapter 3, to address this methodological gap, I developed and published a new score-card methodology (Bartlett, 2016a). An important feature of this new methodology is that it enables a project's success to be evaluated from consideration of existing project-generated and non-project-generated records. In evaluating success, the methodology gives equal importance to a project's achievements and its impacts, and it enables comparisons of relative success of the evaluated projects, by graphing the two resulting scores for achievements and impacts. I found this approach to be much more useful than aggregating the two scores because, with R4D projects, the time taken to achieve impact can vary considerably and, usually, is not under the direct control of the project team.

Therefore, this research has found that the relative success of multiple research projects can be systematically evaluated in a cost-effective manner by using a score card evaluation methodology that examines four criteria related to research achievements and four criteria related to research impacts. In conducting my research, I found that the new methodology was cost-effective and timely to apply as, on average, I was able to evaluate two projects per day and did not require travel to the sites where the projects had been implemented. I found that it was effective in differentiating success between projects and it could be readily used to compare groups of projects from one country or programs of projects from different countries. Using the methodology, I was able to compare the success of two related projects from a longer-term program, and thereby to discover that success does not always increase in subsequent projects. By graphing the evaluation scores from the two dimensions the variation in relative success of different country programs can be easily compared. This approach, as shown in Figure 8.1 (reproduced from Chapter 7).

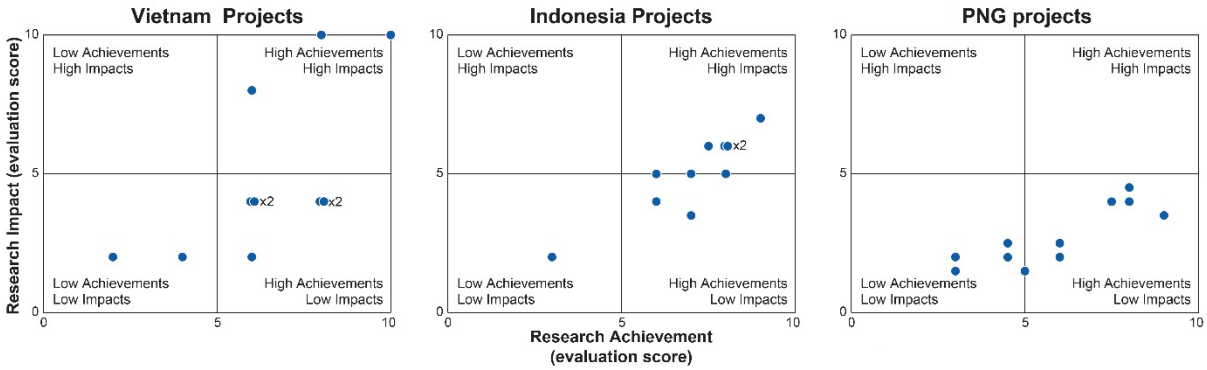

Figure 8.1. Results from evaluations of relative success from groups of projects from three different countries.

The development of this new evaluation methodology makes a major contribution to academic knowledge, in a domain where there are large numbers of researchers and evaluation specialists operating. It addresses a clear and important gap in the family of evaluation methods that are currently used in international development, and it is particularly relevant to evaluations of R4D projects. It could be readily used by any agency that funds or implements R4D projects, when they want to conduct comparisons of the relative success of large numbers of projects. Such projects may have addressed different research themes, been implemented in different situations within and between countries, and been completed for different periods of time. The criteria and weighting in the score-card methodology also could be adapted for use by other agencies wanting to compare the success of multiple projects funded under their Official Development Assistance program, or for comparisons across agencies.

While the methodology has some apparent benefits over other evaluation methodologies, it also has some limitations, which mean that its application will not be appropriate in some circumstances. As it relies on the use of existing project records, it places limited emphasis on the views of users in creating research demand, or the utility of the results from the projects being evaluated. When this aspect is considered important by those commissioning an evaluation, a participatory evaluation methodology may be more appropriate. Because the methodology relies on existing documentation of impacts, in situations where these have not been well documented, it will be difficult to determine the evaluation scores against the four impact criteria.

Research Sub-question 4: How does relative success of forestry research projects vary within and between countries?

Through the conduct of the three case studies (as reported in Chapters 4-6), involving 30 completed forestry research projects, and the synthesis of the results (as reported in Chapter 7), I identified that the relative success of these projects varied considerably as portrayed diagrammatically in Figure 2.

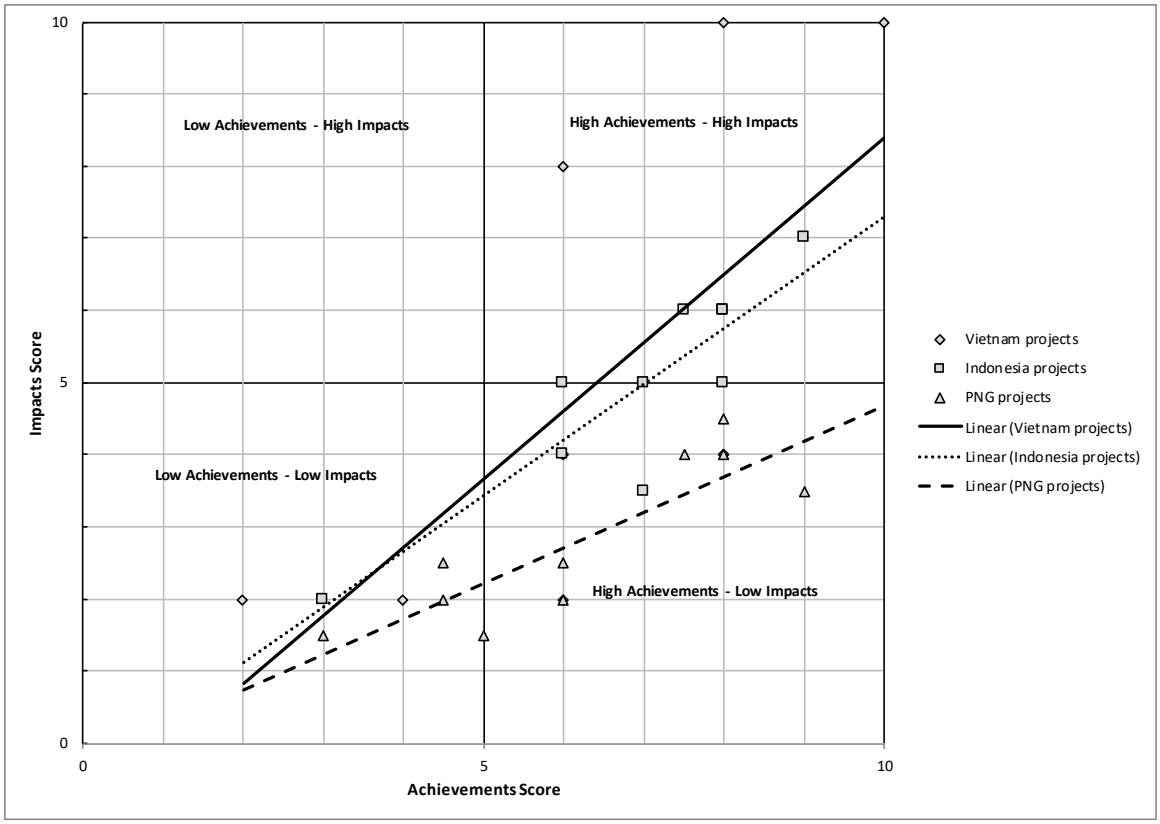

Figure 8.2. Results from evaluations of the relative success of forestry research projects implemented in Vietnam, Indonesia and PNG.

From this research, I have identified five important components of the ways in which project success varies within and between countries:

Firstly, in all three countries and collectively, I found that the relative success of individual R4D projects varied considerably and only a small number of projects received identical evaluation scores. Of the 30 projects evaluated, as shown in Figure 8.2, about one-quarter of the projects (7) were evaluated as having high achievements and high impacts, about half (16) had high achievements and low impacts, and the remaining one-quarter (7) had low achievements and low impacts. In this research, there were no projects evaluated as having low achievements and high impacts, though this is conceptually possible in a R4D project that generates one highly successful output from a range of research activities.

Secondly, I found that different levels of success can be associated with programs of research projects implemented in different countries, even when the duration of collaboration and magnitude of funding provided are relatively similar. This finding is shown diagrammatically in Figure 8.2, by the three 'lines of best fit' for the evaluation scores for each group of ten projects, implemented in Vietnam, Indonesia and PNG. Given the sample size, these 'lines of best fit' are not intended to be interpreted quantitatively; rather, they assist in providing a visual impression of the pattern of evaluation results in and between the case studies. An important finding from this research is that ACIAR's forestry program in PNG has been much less successful than its programs in Vietnam and Indonesia,

reaffirming the findings of my review of the ACIAR forestry program (see Chapter 2). I found that PNG to be the only country without any high achievement-high impact projects, and that 40% of the projects implemented over a 16-year period were evaluated as low achievement-low impact. This finding is important because of the strategic importance of PNG in ACIAR's corporate strategy (ACIAR, 2017b) and the relative magnitude of ACIAR's investments in the PNG forestry program, compared to those of other countries. This finding is consistent with, and adds to, findings from an impact assessment study of eight projects and two scoping studies from ACIAR's PNG Forestry Program (Fisher, 2011), which concluded that the program's achievements had been mixed, and with limited success in fostering adoption of policy-related outputs.

Thirdly, across the 30 evaluated projects that covered eight themes of forestry research in the three case study countries, I found that the theme of the research did not have a strong influence on the relative success of projects. However, for some research themes, such as 'domestication of Australian trees' and 'agroforestry and community forestry systems', I found that it may be possible to achieve comparatively greater impact, provided effective dissemination mechanisms exist.

Fourthly, in situations where multiple projects were implemented within the one national research institution, I found that some projects achieved greater success than others. I found that this was due to differences in project leadership, and differences in the capacity and commitment of researchers within the various project teams.

Fifthly, in longer-term programs involving multiple linked projects, I found that the evaluated relative success of subsequent projects does not always increase and, in fact, it can be quite variable. In this research, there were six projects for which there were subsequent linked projects, where both the precursor and the subsequent project were evaluated (see Figure 6 in Chapter 7). I found that only one-third of the subsequent projects resulted in both improved achievements and improved impacts, compared to those from the precursor projects. In one pair of linked projects, I found that the subsequent project achieved lower scores for both achievements and impacts than did the precursor project.

These five findings make both academic contributions to knowledge and practical contributions towards improving the effectiveness of R4D projects. The academic contributions include the evidence presented on the different levels of success achieved, within and between countries, by forestry projects implemented in Vietnam, Indonesia and PNG, particularly the comparatively poorer success of the PNG program; and the evidence about the variability of relative success outcomes between precursor and subsequent projects in a linked program of research. Other more general studies of aid effectiveness have found that the probability of aid projects and programs being successful in PNG and the Pacific is significantly less than in Asia (Feeny and Vuong, 2017). However, my research includes the first published study that clearly documents this comparatively

lower level of success in PNG. The practical contributions include assisting evaluation practitioners to understand the utility of the new methodology for evaluating relative success of multiple projects, and providing organisations that fund R4D projects, such as ACIAR, with information to identify what changes need to be made to project design and implementation to improve the prospects of success of future projects in PNG. While my research only evaluated forestry projects, the findings could also be relevant to some or all of the other ACIAR research programs in PNG. This is potentially very significant, because PNG currently receives more ACIAR financial support than any other country (ACIAR, 2017c). It is also likely that this finding could be equally relevant to other R4D and ODA programs implemented in PNG.

Research Sub-question 5: What are the factors that affect the relative success of ACIAR's forestry research projects and which factors are considered to be most important?

As presented in Chapter 7, my research has identified a total of 37 success factors across the three case study countries, each of which has the potential to either enhance or diminish the success of a project. Of the total list of 37 success factors, 30 are relevant to aspects of project design or implementation, while the other seven factors relate to issues that are beyond the control of a project. The 37 identified project success factors are shown in Table 8.1 (reproduced from Chapter 8).

Participants in the PNG case study identified 37 success factors, and those in the Vietnam and Indonesia case studies identified 22 and 30 factors, respectively. While each of the 37 success factors will be important in some projects, as previously presented in Chapter 7, my research found that 15 of these factors can be regarded as 'key success factors', as collectively they made up three-quarters of all factors identified by the scientists from the case study projects. Figure 8.3 (reproduced from Chapter 7) shows the 15 key success factors together with their frequency of identification in my research.

Factors relevant to project design	
Key Success Factors	**Other Success Factors**
Collaborative scoping and design	Donor influence on design
Mutual benefit of research topic	Alignment with national development objectives
Selection and commitment of partner institutions	Collaboration with international scientists
Skills mix and time allocations	Experience of project leader in country
Funding, facilities and equipment	Duration of project
Factors relevant to project implementation	
Key Success Factors	**Other Success Factors**
Leadership and management	
Scientists commitment, collaboration and focus	Clarity of roles and responsibilities
Strong, culturally appropriate team relationships	Trust within team
Time spent on in-country collaboration	
Effective communications and research networks	Coordination of partners and stakeholders
Team and technical capacity building	Provision of incentives
Site selection and scientific rigour of trials	Local government and community support; Gender roles and issues
Links to impact pathway and user benefits	User champions; Engagement with private sector; Engagement of policy actors
Implementation flexibility, monitoring and review	Corruption or misuse of funds
Publication and dissemination of results	
Factors outside the project's control	
Success Factors related to the Research Institutions	**Success Factors related to the External Environment**
Continuity of partner institutions and team	External factors: policies, markets, environmental, security
Continuation of research post project	Willingness to adopt innovation
Long term research collaborations	Community or land disputes
	Political support or interference

Table 8.1. The 37 identified project success factors, classified by categories of potential influence and whether they are 'key' or 'other' success factors

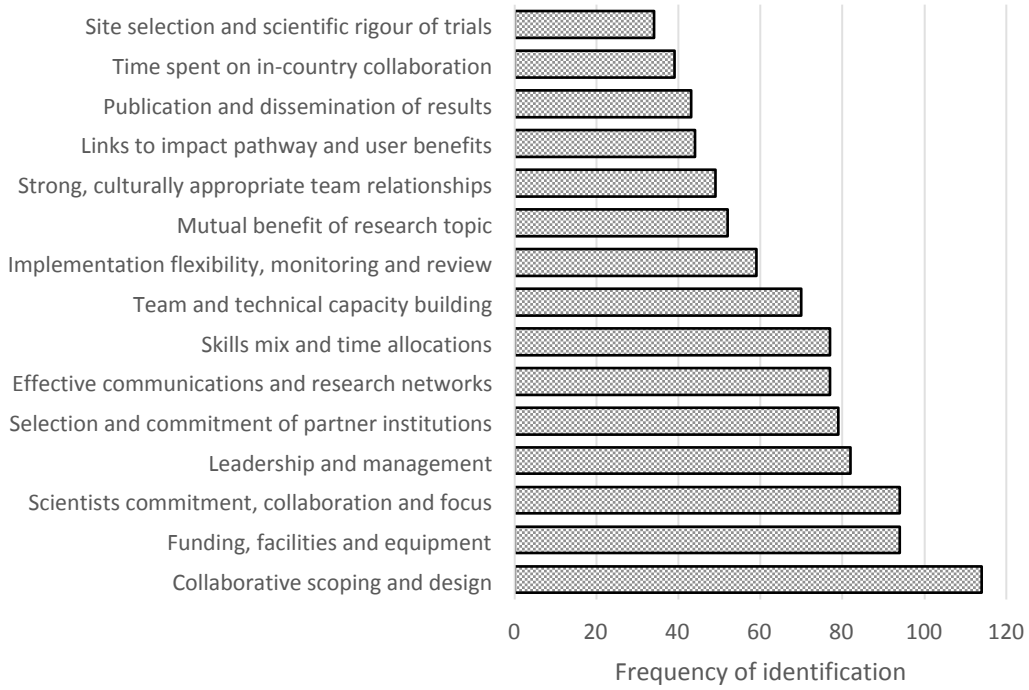

Figure 8.3. The fifteen key success factors by frequency of identification

The identification of 37 project success factors, relevant to R4D projects, makes a significant contribution to academic knowledge and complements knowledge gained from other studies of forestry development programs. This includes related knowledge on factors affecting adoption of agroforestry research (Franzel et al., 2001), as well as on factors that influence the success of smallholder forestry (Byron, 2001) and community forestry programs (Baynes et al., 2015). Prior to my research, the only other comparable study of factors contributing to success in R4D projects was that undertaken for ACIAR by Pearce (2010). That study interviewed 30 people, drawn from those who manage or implement projects across the ACIAR portfolio, and identified 14 project success factors, of which only six were frequently identified. This research interviewed 90 people and identified 37 factors, with 15 of them being frequently identified, thereby adding substantially to this important knowledge base. Pearce's study used a different approach to that developed here in describing the success factors, often combining elements relevant to project design and project implementation into the one factor, which makes a direct comparison of the two studies difficult. However, close examination of the wording of Pearce's 14 success factors shows, perhaps unsurprisingly, that all aspects described in those factors have been re-identified in my research. Therefore the most interesting contribution to knowledge from this study is the new factors that have emerged, particularly those that I have identified as key success factors.

In relation to project design, my research identified two important new factors. The first, which was also the most frequently identified success factor, related to ensuring there is effective collaboration between partners during project scoping and design. The second related to ensuring the project is

provided with adequate funding for the specified research activities, including ensuring key researchers have sufficient time allocations on the project to implement the planned research activities. In relation to project implementation, my research identified four important new factors. The first factor covers the importance of both team and technical capacity building activities, while the second involves ensuring there is careful selection of sites for any field trials and appropriate scientific rigour in their design. The third new factor covered the importance of allowing the project team to have some flexibility to make changes during project implementation, while having effective monitoring and review processes during the life of the project. The fourth new factor related to ensuring the research results were disseminated, including through publications, extension materials and policy briefs, with these being prepared, where relevant, in local languages.

This enhanced understanding of success factors relevant to R4D projects provides those responsible for designing and implementing such projects with important practical insights which they could use to increase aid effectiveness and development project performance. This is further discussed under the eighth research sub question.

Research Sub-question 6: Are there causal relationships between the identified success factors and the evaluated relative success of individual projects?

As discussed in Chapters 4-6, my research in each case study found that there is some evidence of causal relationships between many of the identified success factors and the relative success that a project achieved. From the synthesised analysis of seven projects from three project success categories (as presented in Chapter 7), I found these causal relationships to be particularly evident in terms of the contrast between projects evaluated as high achievement-high impact and those evaluated as low achievement-low impact. For two high achievement-high impact projects, from Vietnam and Indonesia, I found clear evidence that the way that most of the 15 key success factors had been addressed during project design and implementation had contributed to enhanced project success. For three projects evaluated as low achievement-low impact, the evidence suggested that a lack of focus on some of the success factors had diminished project success. I found that this pattern of evidence to be stronger for factors that can be influenced during project design than for those that can be influenced during project implementation. I also found that having a focus on key success factors, such as ‘leadership and management’ and ‘team and technical capacity building’, while important, is not sufficient to achieve success. Another important finding from my research is that poor attention to the success factor ‘links to impact pathway and user benefits’ contributed to the reduced success in all projects evaluated as having low impacts, even those that were considered to have high research achievements.

This evidence enables me to conclude that the observed variation in project success can be partially explained by the way the identified project success factors had, or had not, been considered and addressed during project design and project implementation. This finding is an important contribution

to knowledge, as there are currently no other published studies that demonstrate causal relationships between these factors and the success of forestry research projects. It is also of practical importance to R4D agencies as it provides clear evidence of how appropriate consideration and application of these factors can lead to enhanced project success.

Research Sub-question 7: What are the common and the country-specific lessons about project success and what role does context play in understanding project success?

My research has generated some important lessons about project success that are likely to be universally applicable in R4D projects, as well as some lessons that may be specific to particular countries or types of research projects. In relation to the common lessons about project success, I found that 15 success factors were almost universally important across Vietnam, Indonesia and PNG, regardless of the nature of the individual research projects. One of these factors, 'publication and dissemination of results', was not specifically identified by researchers in the Vietnam case study; the reason for this is not clear; it may be that they focused on dissemination rather than publication. In the interviews, many researchers spoke about the importance of generating results that would benefit farmers who grew trees, which requires that the research results are disseminated. Therefore, this success factor is also likely to be a common requirement for project success.

In relation to country-specific lessons about project success, the key finding from my research was that project success is considerably more difficult to achieve in PNG than it is in Vietnam or in Indonesia. Further, three of the identified project success factors from the group that I classified as 'other success factors' were only identified in one country. Because they related to aspects of the operating context in that country, they can be considered to be country-specific factors.

In my research, most of the less-frequently identified success factors were identified in the Indonesian and PNG case studies. I consider only three of these factors to be country specific, as most related to the specific nature of the projects for which they were identified. The three country specific success factors were: 'local government support' (in Indonesia, where local governments were responsible for policy and regulatory aspects of forestry); 'community or land disputes' (in PNG, where customary law applies to forest and agricultural lands); and 'provision of incentives' (in PNG, where there was a culture of expecting financial benefits from working on development projects).

These common and country specific lessons are of practical importance for any agency that funds R4D or other development-oriented projects in the case study countries of Vietnam, Indonesia and PNG; and are likely to apply more widely, in similar R4D contexts. In some situations, these country-specific factors may be able to be appropriately addressed, so that they don't inhibit the success of projects. In other situations, they may give donors and research, or project, managers cause to reconsider whether or not a project should proceed.

As Ofir (2010) noted, there is a need for a deeper understanding of the context and essential conditions for success to achieve successful implementation and sustained impacts from agricultural research projects. While not being the main focus of my research, I also found that context, which has national-level, local-level and project-level dimensions, can affect project success. I found the influence of context was most evident in the PNG case study, where project success was much lower than in Vietnam or Indonesia. My research identified that published national development indices only partially explained the observed differences, but that some other aspects of national-level context had contributed to the lower level of success. These included the comparably low capability of the PNG research institutions, the lack of political support for forestry, some aspects of PNG culture, and the lack of extension systems. I found that the relationships between context and project success factors were more evident at the local-level and project-level dimensions of context. For example, in PNG, the culture of providing personal financial incentives to undertake project activities, and the difficulties in accessing markets for forestry products in some locations, both limited project success. In Indonesia, where pulp and paper companies had resource supply constraints, the private sector actively collaborated with ACIAR projects directed at addressing elements of these constraints, and quickly adopted improved site and plantation management practices, thereby enhancing project success.

My research makes an academic contribution to improved understanding of the interplay between context, project success factors and the relative success of R4D projects implemented in PNG, which is currently very poorly documented in the literature. This contribution provides some useful insights, but needs substantial further research to generate practical recommendations that could be widely adopted by funders of research and development projects in PNG. This need is further discussed in Section 8.3.

8.2. Opportunities to improve success in research for development

The new knowledge and understanding about success in R4D projects resulting from my research has a much wider relevance and applicability, to other organisations that fund these types of projects. While the case studies were confined to forestry research projects implemented in Vietnam, Indonesia and PNG, the findings on project success are likely to be more widely applicable to other agricultural, natural resource management and rural development related research projects.

Research Sub-Question 8: How could the improved understanding of project success be utilised by research for development programs?

As my research was focused primarily on the research for development projects funded by ACIAR, my results also focus primarily on the potential application within ACIAR. However, I also reflect on how the results could be used more broadly. Donors that facilitate collaborative R4D projects in developing countries, such as ACIAR, could use the results from my research prospectively in both

their project evaluation and their project design and implementation processes to improve the prospects of success for individual projects. This could be achieved by placing a greater emphasis on considering the relevance of each of the 37 success factors to a project, and then ensuring that, for each of the relevant factors, appropriate actions are taken to address it during both project design and implementation. Finally, if the methods used in my research were applied to R4D projects implemented in other countries and also for non-forestry research projects in Vietnam, Indonesia and PNG, additional knowledge would be gained and used to continuously improve the effectiveness of both research programs and individual projects.

The answers to this research sub-question are further discussed in the following four sub-sections. I focus primarily on the opportunities for ACIAR, but offer some suggestions for the potential application beyond ACIAR.

Opportunities from enhancing knowledge about relative success

The new methodology for evaluating the relative success of R4D projects and the enhanced knowledge on project success factors could be utilised by donors and funding organisations, such as ACIAR, to improve the success of the projects they fund. It allows organisations that fund a significant number of projects, to draw empirically-grounded lessons from the substantial data that exists in project reports, ex- post evaluations and other assessments; and thereby to improve the overall effectiveness of their contributions towards the achievement of the globally-agreed Sustainable Development Goals. The following discussion

This information from the evaluations could be used as one input to strategic decision making about future research investments, such as what proportion of its budget to allocate to different geographic regions, countries or research disciplines. Likewise, it could better inform strategic decisions on the conduct of more expensive external economic impact assessment studies, that ACIAR routinely conducts. Having the ability to purposely select projects from a range of relative success categories for inclusion in impact assessment studies would help overcome any perceived bias of only selecting better performing projects for these studies, and enable better targeting of these studies. For example, the comparatively poor performance of ACIAR's forestry program in PNG signals a need for in-depth impact assessments to generate more detailed understanding of the effectiveness of these investments and the factors that hinder project success.

As an example, ACIAR currently spends about $0.4 million annually on monitoring and evaluation of its research investments (ACIAR, 2017c), much of which is expended on impact assessment studies conducted by external evaluation specialists. While these studies are an important part of assessing the economic and non-economic returns from ACIAR's investments, they have only been conducted on about 10 percent of ACIAR's completed projects (Lindner et al., 2013). In this research, the relative success of two projects could be evaluated in a day using the new methodology and the existing

project records. Therefore, ACIAR could evaluate the relative success of all projects completed in a year (an estimated 60 projects) for an estimated annual staff cost of $30,000.

Systematically collecting data on individual project success, would be a very useful investment for ACIAR both for facilitating learning and improving operational performance. As ACIAR has a significant portfolio of project investments in PNG, it would be particularly beneficial to broaden the understanding about the relative success of such projects, across different scientific disciplines and partner agencies. While it is likely that there will always be some relatively unsuccessful projects in a portfolio of investments, improved knowledge on how to reduce the proportion of low achievement-low impact projects would be particularly useful.

There are two other ways that information on relative success of individual projects could be used to improve operational performance of new and existing projects. The first would be during the design of a follow-on project that is part of a longer-term program of research on a priority topic. Conducting an evaluation of the relative success of the precursor project would provide information on the strengths and weaknesses against the eight criteria that determine relative success, which could then be considered in the design of the subsequent project. The second would be during the implementation of an existing project, in which a preliminary evaluation of relative success would be conducted during the project's mid-term review, and the findings used to inform decisions on changes to the planned activities to enhance the prospects of greater success at the end of the project.

Opportunities to utilise the knowledge about project success factors

The new knowledge of the 37 project success factors is of real practical importance to those responsible for designing and implementing R4D projects, as 30 of them can be influenced during these two project phases. As concluded in Chapter 7, addressing all 15 of the key success factors identified in my research during project design and implementation would be a good basis for increasing project effectiveness. Because the context and nature of R4D projects vary, I recommend that the other 22 success factors should also be routinely considered for application in relevant situations, in order to improve project success. I consider this to be particularly important in countries where there are known constraints to project success, and with follow-on projects in a longer-term program.

The enhanced knowledge on project success factors will be of particular relevance to R4D funding organisations, such as ACIAR, as they design and implement future R4D projects. The appropriate approach for utilizing this knowledge would be to will be to routinely consider the relevance of all 37 factors early in the project design process. Then, for the 15 key success factors and any others considered to be relevant, the agency should take appropriate action to address them in both the project design and during the implementation of the projects. A factor such as 'collaborative scoping and design', while being critical to ACIAR's collaborative R4D model, may apply equally to less-

formally collaborative modes of international R4D. In order to maximize the use of this knowledge, R4D project funders will need to convey the knowledge to, and work collaboratively with, all of its project leaders. In the longer-term, as additional data becomes available on differential success of various country programs, R4D funders could identify lists of country-specific success factors. These could then be used to ensure that project designs take better account of any success factors known to be important in the country in which the project will be implemented.

Two of the newly identified key success factors from this research could significantly increase the likelihood of project success, if they were to be more consistently applied by R4D funders. The first is 'collaborative scoping and project design', which my research found to be the success factor most frequently identified by project researchers, and for which there was clear evidence of a strong causal relationship with the evaluated level of success of a project. My research clearly shows that collaborative R4D projects will have a greater likelihood of success if there is strong ownership by all of those who are to be involved; and, to be most effective, the collaboration has to commence at the beginning of the design process. Many R4D funders, including ACIAR, do not routinely fund collaborative scoping missions or collaborative design discussions with in-country partners, yet they do spend money on reviewing project designs. For example, in the case of ACIAR, it is estimated that about $10,000 per project is spent on its in-house and external reviews of the proposed design for a project investment of about $2 million. By adopting a policy of funding, say, an equivalent amount for collaborative discussions between the project partners on the project design, ACIAR could likely reduce the number of low achievement-low impact projects.

The second important newly identified key success factor is 'implementation flexibility, monitoring and review', for which two aspects are worthy of some discussion. The first is the importance of always conducting participatory reviews midway through a project's life. During the conduct of the interviews for this research, one of the most illuminating comments related to the importance of conducting mid-term reviews of all projects. In response to an interview question related to what could have been done differently in a project, a Vietnamese researcher made the following comment: "We should have had a mid-term review". This researcher had worked on six different ACIAR projects and made the comment in relation to the least successful of these projects. Mid-term reviews provide the research funder and the project team opportunities to address any weaknesses or deficiencies in the project design and also to re-focus efforts onto the most promising activities, both of which will undoubtedly enhance project success. The second aspect relates to enhancing efforts on monitoring and evaluation within projects. This is a complex but important area which my research found generally was not being done well enough in the case study projects. To address this issue, R4D funders such as ACIAR would need to increase the capacity of project researchers to undertake effective monitoring and evaluation activities, and to identify specific funding in project budgets for these activities.

Opportunities to improving the performance of country programs

To support the claim that this research methodology can be used to identify, understand and ultimately improve the effectiveness of R4D, or other development, programs within a country, it is informative to further consider my findings from the least-well performing country, PNG. In doing so, I consider how the findings could be used by ACIAR and then by Australia's broader Official Development Assistance (ODA) program in PNG. These issues are important because, as Australia's closest neighbour and a former colony, PNG holds a strategically important position in Australia's Foreign Affairs portfolio.

This research generated two findings that are of particular importance for ACIAR's PNG country program, in which ACIAR currently invests more than for any other country program. These findings were that the PNG forestry program was substantially less successful than similar programs in Vietnam and Indonesia, and that none of the evaluated PNG forestry projects were found to have had high achievements and high impacts. In 2016-17, ACIAR invested a total of $13.075 million in its PNG research projects, which represented 16.7 percent of ACIAR's expenditure on bilateral research projects in that financial year (ACIAR, 2017c). ACIAR's current PNG country program includes projects funded from seven of ACIAR's research disciplines, including those from the forestry program (ACIAR, 2017a) and its recently published corporate plan indicates that it will enhance its focus on PNG and the Pacific Islands over the next five years (ACIAR, 2017b).

Given the findings from my research, ACIAR could, and should, conduct evaluations of the relative success of completed projects from the other research disciplines that operate in PNG. The results of such evaluations would help ACIAR to better understand the effectiveness of its total investment in PNG. It would also provide evidence of any difference in the success of the various disciplinary programs it funds in PNG, as well as on whether there are any completed PNG projects that have resulted in high achievements and high impacts. Without such information, it will be difficult for ACIAR to objectively decide how it can most effectively increase its focus in PNG, or to establish which of its disciplinary programs and individual projects need improvement. Developing more consistent and comparable data on the success of individual PNG projects could also assist ACIAR to demonstrate that the performance of its PNG country program is improving over time.

As PNG is likely to remain one of the most important countries for ACIAR's forestry program, it will be important for ACIAR to add to the evidence base about the success of these projects over time. This could include additional efforts to better understand how the success factors, identified in this research, actually enhance or diminish the success of individual projects in PNG. It could also include additional research that focussed on the effectiveness of actions taken to address particular success factors, including those identified in this research as PNG-specific, that are known to have diminished success in PNG projects.

8.3. Potential for application of the approach in contexts beyond ACIAR

The approach used in this research involved two methods: evaluation of the relative success of a group of projects from existing information using the newly-developed score-card evaluation methodology; and analysis of interview data to identify factors that have influenced the degree of success of the projects. Both these methods have the potential for wider application, within the international development context and also for improving the outcomes from other programs involving large numbers of projects.

Because of its cost-effectiveness, the new methodology for evaluating relative success of multiple projects could become a transformational evaluation tool for international development organizations. It has three particular advantages over other evaluation methodologies: it is comparatively rapid to apply; it utilizes existing project records, making it easy to apply to large numbers of projects, including those that may have been completed some time ago; and it doesn't require specialist expertise to apply. The methodology could be used by any R4D organisation to develop a comprehensive database on the success of all of its research investments, enabling comparisons of the effectiveness of different research investments across the whole research portfolio. Systematically collecting data on project success on a continual basis, both within and between countries, would be a very useful investment for both facilitating learning and improving operational performance. Over time, as more and more comparable data on project success in different contexts becomes available, this knowledge will help R4D funding organisations to better understand how and why some projects are more successful than others, and then to identify measures to improve project success.

Organisations like the CGIAR centres, such as the World Agroforestry Centre (ICRAF) and the Centre for International Forest Research (CIFOR), which also implement international forestry research projects, could utilise the evaluation methodology to develop a better understanding of the relative success of their projects in different countries, and/or how the approaches and requirements of different donors have affected project success. Both ICRAF and CIFOR have major roles in the implementation of the CGIAR Research Program -Forests, Trees and Agroforestry – which 'seeks to enhance the role of forests in confronting some of the most important challenges of our time: climate change, poverty and food security'. If, for example, these organisations wished to evaluate how their completed projects had contributed to these three categories of impacts, the criteria in the impacts dimension of the score-card evaluation methodology could be adapted to reflect these desired impacts. Evaluating some 50 to 60 projects on this basis should give a good indication of how effective various projects had been in these terms, and whether or not changes were needed in the focus of future investments to achieve the desired outcomes.

This research's finding of comparatively low relative success of ACIAR forestry projects in PNG also has potential relevance to Australia's overall ODA program in PNG. Currently, there is almost no published information about the effectiveness of Australia's ODA investments in PNG, despite some 21 percent of Australia's total country and regional ODA funding being provided to PNG (DFAT, 2017a). The only published evaluation of Australia's aid program in PNG was conducted fifteen years ago (AusAID, 2003), and it was undertaken as a rapid assessment of the contributions of Australian aid to PNG's development between 1975 and 2000. That report did not present any comparative information on aid effectiveness between the various sectors within the PNG aid program or with other Australian country-based aid programs. While the methodology to evaluate relative success in this thesis was specifically designed for use with R4D projects, the score card approach used in this methodology could, and should, be adapted to enable systematic and comparable evaluations of the relative success of other ODA programs and projects to be undertaken. Doing so would simply require deciding the relevant criteria to be used in assessing project achievements and project impacts for each category of ODA investment, and then conducting the evaluations on a sufficient number of projects to give meaningful results. Without such an analysis, it is difficult to see how any claims about the effectiveness of Australia's very large ODA program in PNG could be substantiated.

A similar approach could be used by government agencies to evaluate the effectiveness of large grant programs related to natural resource management, which also often require a lengthy timeframe to achieve the desired impact, For example, in 2018 under the National Landcare Program, the Australian Government implemented a program of small grants of between $5,000 and $50,000 to community, environment and other groups to deliver natural resource management activities that improve the quality of the local environment. At the conclusion of a grant, the grantee is required to report against the objectives and outcomes of the project. If the agency wanted to assess the overall effectiveness of the small grants program, it could adapt the criteria in the score card evaluation methodology and use the submitted grant completion reports to evaluate the relative success of each project. As the National Landcare Program addresses multiple environmental problems where improved impact from investments is desired, the impacts categories could be adapted to reflect desired impacts related to reductions in loss of vegetation or soil erosion as well as improvements in control of pests or management of fire regimes.

In relation to wider application of the knowledge of project success factors, R4D organisations could adapt the list of 37 success factors to their situation by asking staff or project leaders to rank the importance of each of the identified factors, taking into account their organisational and operational contexts. They could also ask the same people to identify whether there were any other factors that they considered to be important to achieving success in their projects. Using organisation-specific success factors, the organisation would need to evaluate the relative success of a range of its projects,

and then determine whether or not causal relationships existed between the identified project success factors and the evaluated levels of success of the projects.

8.4. Further research needs

While – as discussed above – my research has made some significant contributions towards improving the understanding of how the success of R4D projects implemented by many international and national research organisations, could be improved, I also consider that additional research is needed on this important topic. Firstly, I suggest that R4D funding organisations should support additional research to improve understanding of differences in the success of R4D programs implemented in different countries. While it is likely that additional research could also improve understanding of differences in project success within countries, I suggest there is a more urgent need to better understand the differences in success between countries, because virtually no published information exists on this topic.

Understanding how success differs in research programs implemented by different research disciplines, such as forestry, fisheries, livestock and crops, within a particular country would also be very useful. To achieve this, organisations such as ACIAR could conduct additional case studies on the relative success of completed projects from other research disciplines. Ideally, each case study would consist of a sufficiently large sample, such as 10 completed projects from one research discipline conducted in a country, as used in this study. This would enable ready comparison with the three case studies undertaken in this research. ACIAR could implement this type of research now, as the information needed for these evaluations already exists in its project records.

Given the specific findings about the comparatively lower success of ACIAR's forestry program in PNG, ACIAR could consider applying my research methods to examine the success of projects across its entire R4D portfolio in PNG. Then, by focusing more detailed review on those projects that were assessed as more successful, a clearer understanding could be gained of the factors that enable success in the PNG context, and how factors that constrain success have been addressed in that context. Such knowledge could then be applied consistently to all new ACIAR research investments in PNG.

Finally, an area in which I consider there is a need for new research is how to distinguish between projects that involve poorly conceived research and those involving well-conceived research that doesn't address the research problem or produce widely adoptable outputs. Additional research could be undertaken to refine and test the methodology for evaluating relative success, to improve its capability to distinguish between these two categories of what otherwise may be considered to be poor project success.

8.5. Reflections

This section provides some personal reflections on the conduct of this research over the past six years, during which I sought to balance part-time study with full-time employment. It covers some operational issues as well as some conceptual issues.

Operational

Conducting research on the factors that affect success in research for development projects has been a very interesting journey. This has enabled me to continue my philosophy of trying to improve the knowledge and practice in the different forestry positions I have held during my career. The added advantage in this case is that this new knowledge can be used to improve both the lives of people and the management of natural resource systems in the countries in which ACIAR operates, and more broadly through the publication of the findings in the academic literature.

Having commenced the research with a very clear idea of what I wanted to study and an expectation that I would be able to use or adapt an existing methodology to evaluate the success of case study projects, I was somewhat taken aback when it became clear that there was no existing evaluation methodology that could readily be used for this purpose within the constraints of postgraduate study. However, this unexpected challenge presented me with two very important opportunities. The first was the opportunity to make a substantive contribution to development evaluation by developing and publishing a new methodology that enables the relative success of multiple projects to be evaluated in a cost-effective manner. The second was the opportunity to broaden my knowledge of evaluation theory and to develop a degree of expertise in the evaluation of research for development projects. Although some referees of the papers I submitted were sceptical about the legitimacy of my methodology compared to the established methodologies, I was able to adequately address their concerns. I found the acceptance for publication by four international journals of the manuscripts related to the design and use of this methodology to be a very powerful motivator in my work.

Undertaking a PhD as ‘Research by Compilation’ has some significant benefits as well as some challenges. Some of the benefits include being able to ‘parcel’ the research writing into discrete journal articles, that once completed did not need to be continually revised, as well as having some of the findings rigorously and independently reviewed and then published while the research was still being conducted. The challenges include having to write thesis chapters within the word limits imposed by various journals, and having virtually no control over how long different journals take to conduct their review and approval processes.

Balancing part-time study with full-time work is very challenging. This research could not have been completed without having a very strong passion for the research topic and the ability to utilise the emerging findings to enhance the projects in my R4D program. Having the ability to put research knowledge into action is a very positive motivator. The strong support of my employer for this

research was also critical. My employer granted me block study periods each year. These study blocks were essential as it was during these periods that most the substantive analysis and writing occurred. As part of my employment, I regularly travelled to Vietnam, Indonesia and PNG and this provided me with the opportunity to meet and interview the partner country scientists who had work on the case study projects. Finally, I needed to be well organised and disciplined to ensure that I focussed on the most important tasks and made the necessary progress each year.

At the end of this academic journey, I feel very satisfied that I was able to complete the research in six and a half years, while working full time, and in doing so make some significant contributions to the domain of evaluating R4D programs, which appears to be under-represented in the literature. Almost every R4D project is different to any other project, which makes it difficult to categorically identify what factors affect project success in what circumstances. While I did not appreciate it at the start of this research, the absence of a simple, cost-effective mechanism for systematically comparing the relative success of multiple R4D projects was probably a major reason why so little research has been done previously on this important topic. It is therefore very satisfying to have been able to use my skills and experience to address this gap in evaluation methodologies.

Conceptual

Project success is potentially an elusive dream. Firstly, there are many possible criteria for project success and, secondly, at least in the domain of research for development, it is not possible for every project to achieve a high level of success. By its very nature, research involves a degree of uncertainty and risk. What I have done in this research is to produce a working definition of a successful ACIAR forestry research project and, importantly, to develop a framework with four success categories that can be used to guide judgements about project success.

Understanding the factors that affect project success is very important, but so is understanding how best to use this knowledge. Several aspects of this merit further reflection. Firstly, the knowledge is not intended to be a ‘blueprint’ to guarantee the success of R4D projects. While it is encouraging that this research has both confirmed and expanded the existing knowledge, it is unlikely that it has identified all the factors that can affect project success. Clearly, this important area of knowledge would benefit from additional research. Secondly, it is very unlikely that the identified success factors could be used as definitive indicators of project success, because it would be extremely difficult to measure many of them. Thirdly, while the application of this knowledge on success factors could help reduce the risk of poor performing projects, it is not intended that it be used in a way that might preclude higher-risk R4D investments. In reality, some outcomes and impacts from R4D projects are unpredictable and others are context specific. Therefore, the factors that are able to be influenced by those responsible for design and implementation of these projects are only part of the reasons for project success. Research agencies and managers need to have both a good understanding of the

breadth of the factors that can influence project success, and of processes during project design and implementation, to consider and appropriately address those factors that are relevant to the project.

The power and potential usefulness of the new methodology for evaluating the relative success of R4D projects only really became apparent towards the conclusion of this research. The more I spoke to other R4D practitioners about this new methodology and the results it was producing, the more enthusiastic I became about its value. I also sensed their enthusiasm for such a method, as many of these practitioners have knowledge about projects that have been more or less successful, and views about why this is the case. What they have lacked previously was a way of systematically comparing the success of these different projects. A less common, but equally important, aspect of their enthusiasm came from seeing the diagrammatic representations of the different results from the different case study countries. These colleagues could see the potential to use this new understanding both to inform future investment decisions and to consider different approaches that might enhance project success in the poorer performing countries. At the end of this research, I feel that an important new seed has been sown among these practitioners in their ways of thinking about approaches to project development and management. Time will tell how influential it becomes.

Undertaking this research has introduced me to the concept of evaluative thinking and the potential for this approach to enhance the way international development agencies operate, and to inform the effectiveness of their R4D programs (Carden and Earl, 2007). While I do not claim that my research was fully consistent with 'evaluative thinking', it was similarly results-oriented, reflective and questioning, and used emerging evidence to guide future actions.

Finally, I am confident that the methodology developed in this study, applied and refined over time, has the potential to substantially improve the design and implementation of R4D projects and programs in developing countries, and thereby enhance the contributions from such projects towards achievement of the globally-agreed Sustainable Development Goals.

8.6. References (Chapter 8 only)

ACIAR, 2017a. *ACIAR Annual Operational Plan 2017-18*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/files/aop_2017_web_lr.pdf

ACIAR, 2017b. *ACIAR Corporate Plan 2017-21*, Australian Centre for International Agricultural Research, Canberra.

ACIAR, 2017c. *Annual Report 2016-17*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/publication/ar2016-17

AusAID, 2003. *The contribution of Australian aid to Papua New Guinea's development 1975–2000*, Australian Agency for International Development (AusAID), Canberra. Available at: https://www.oecd.org/countries/papuanewguinea/35402503.pdf

Bartlett, A. G., 2016a. Evaluating relative success of donor-funded collaborative research projects, *Research Evaluation,* **25**(4): 405-415. Available at: 10.1093/reseval/rvw009

Bartlett, A. G., 2016b. The evolution and impacts of ACIAR's forestry research program over three decades, *Australian Forestry,* **79**(3): 171-188. Available at: 10.1080/00049158.2016.1184603

Baynes, J., Herbohn, J., Smith, C., Fisher, R. and Bray, D., 2015. Key factors which influence the success of community forestry in developing countries, *Global Environmental Change,* **35**: 226-238. Available at: http://dx.doi.org/10.1016/j.gloenvcha.2015.09.011

Byron, N., 2001. Keys to smallholder forestry, *Forests, Trees and Livelihoods,* **11**(4): 279-294. Available at: 10.1080/14728028.2001.9752396 (accessed 2015/05/29).

Carden, F. and Earl, S., 2007. Infusing evaluative thinking as process use: The case of the International Development Research Centre (IDRC), *New Directions for Evaluation,* **2007**(116): 61-73. Available at: 10.1002/ev.243

Cracknell, B. E., 1996. Evaluating Development Aid: Strengths and Weaknesses, *Evaluation,* **2**(1): 23-33. Available at: 10.1177/135638909600200103

DFAT, 2017a. *Australian Aid Budget Summary 2017–18*, Department of Foreign Affairs and Trade, Canberra. Available at: http://dfat.gov.au/about-us/corporate/portfolio-budget-statements/Documents/2017-18-australian-aid-budget-summary.pdf

Everitt, A. and Mare, A. L., 2012. Evaluating as a means to achieve development ends, *Journal of International Development,* **24**(5): 556-570. Available at: 10.1002/jid.2849

Feeny, S. and Vuong, V., 2017. Explaining Aid Project and Program Success: Findings from Asian Development Bank Interventions, *World Development,* **90**: 329-343. Available at: http://doi.org/10.1016/j.worlddev.2016.10.009

Fisher, H., 2011. *Forestry in Papua New Guinea: a review of ACIAR's program*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/publication/ias073

Franzel, S., Cooper, P. and Denning, G. L., 2001. Scaling up the benefits of agroforestry research: Lessons learned and research challenges, *Development in Practice,* **11**(4): 524-534. Available at: 10.1080/09614520120066792

Hall, A., Rasheed Sulaiman, V., Clark, N. and Yoganand, B., 2003. From measuring impact to learning institutional lessons: an innovation systems perspective on improving the management of international agricultural research, *Agricultural Systems,* **78**(2): 213-241. Available at: 10.1016/s0308-521x(03)00127-6

Ika, L. A., 2009. Project success as a topic in project management journals, *Project Management Journal,* **40**(4): 6-19. Available at: 10.1002/pmj.20137

Lindner, R., McLeod, P. and Mullen, J., 2013. *Returns to ACIAR's investment in bilateral agricultural research*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/publication/IAS086

McLeod, L., Doolin, B. and MacDonell, S. G., 2012. A Perspective-Based Understanding of Project Success, *Project Management Journal,* **43**(5): 68-86. Available at: 10.1002/pmj.21290

Millstone, E., Van Zwanenberg, P. and Marshall, F., 2010. Monitoring and Evaluating Agricultural Science and Technology Projects: Theories, Practices and Problems, *IDS Bulletin,* **41**(6): 75-87. Available at: 10.1111/j.1759-5436.2010.00185.x

OECD, 2005. *Paris Declaration on Aid Effectiveness*, Organisation for Economic Cooperation and Development, Paris. Available at: http://www.oecd.org/dac/aideffectiveness/43911948.pdf (accessed 16/09/2012).

OECD/UNDP, 2016. *Making Development Co-operation More Effective: 2016 Progress Report*, OECD/UNDP, Paris. Available at: http://dx.doi.org/10.1787/9789264266261-en

Ofir, Z., 2010. Commentary on 'The sorry state of M&E in agriculture: can people-centred approaches help?', *IDS Bulletin,* **41**(6): 26-27.

Pearce, D., 2010. *Lessons learned from past ACIAR impact assessments, adoption studies and experience*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/files/node/13202/lessons_learned_from_past_aciar_impact_assessments_87432.pdf (accessed 16/09/2012).

Stern, E., Stame, N., Mayne, J., Forss, K., Davies, R. and Befani, B., 2012. *Broadening the Range of Designs and Methods for Impact Evaluations*, Department of International Development

London, United Kingdom. Available at: https://www.gov.uk/government/publications/broadening-the-range-of-designs-and-methods-for-impact-evaluations-working-paper-38

United-Nations, 2015. *Transforming our world: the 2030 Agenda for Sustainable Development*, United Nations General Assembly, New York. Available at: http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E

9. References

This section presents a consolidated listing of all the references listed in individual chapters of the thesis. The reference listing was prepared using Endnote bibliography software and formatted according to the ANU Fenner School of Environment and Society's requirements, using the Endnote style Harvard – FSES. During the process of combining all the 'chapter' reference lists and reformatting to the Endnote Harvard-FSES style, a few issues were identified. This style does not deal well with some types of references, e.g. papers in proceedings, Government documents or legislation, or with instances where multiple articles from one author in one year are quoted in different orders in different chapters. I did my best to resolve as many of these issues as possible (often with workaround solutions), but for a few references there are still minor problems. Nevertheless it does represent a complete listing of all the references used in this thesis.

9. References

ACIAR, 2008. *ACIAR Corporate Plan 2008-12*, Australian Centre for International Agricultural Research Canberra. Available at: http://aciar.gov.au/files/node/10113/2011_12_revision_of_aciar_corporate_plan__40419.pdf

ACIAR, 2013. *Forestry Research Program Strategy*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/files/node/2032/forestry_program_strategy_010213_pdf_12610.pdf

ACIAR, 2014a. *ACIAR Annual Operational Plan 2014-15*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/files/aciar_aop_2014-15.pdf

ACIAR, 2014b. *ACIAR Strategic Plan 2014-18*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/publication/cp027

ACIAR, 2016. *ACIAR Annual Report 2015–16*, The Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/files/16242_aciar_annual_report_2016_web.pdf

ACIAR, 2017a. *ACIAR Annual Operational Plan 2017-18*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/files/aop_2017_web_lr.pdf

ACIAR, 2017b. *ACIAR Corporate Plan 2017-21*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/files/aciar_corporate_report_2017_final_web.pdf

ACIAR, 2017c. *Annual Report 2016-17*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/publication/ar2016-17

ADAB, 1981. *Australian Centre for International Agricultural Research*, Australian Development Assistance Bureau, Canberra. Available at: https://trove.nla.gov.au/work/25565276?q&versionId=30797716

ADB, 2012. *Papua New Guinea: Critical development constraints*, Asian Development Bank (ADB), Manila, Philippines. Available at: https://www.adb.org/sites/default/files/publication/29776/png-critical-development-constraints.pdf

Allen Consulting Group, 2012. *The economic, social and environmental impacts of the Coopertative Research Centres program: a report to the Department of Industry, Innovation, Science, Research and Tertiary Education*, The Allen Consulting Group Pty. Ltd., Canberra. Available at: http://www.acilallen.com.au/projects/5/research-and-development/68/the-economic-social-and-environmental-impacts-of-the-cooperative-research-centres-program

Alston, J. M. and Pardey, P. G., 2001. Attribution and other problems in assessing the returns to agricultural R&D, *Agricultural Economics,* **25**(2-3): 141-152. Available at: 10.1111/j.1574-0862.2001.tb00195.x

Amat J.P., Bôi Phùng Tùu, Robert A. and Hùu, N. T., 2010. Can fast growing species form high-quality forests in Vietnam, examples in Thù'a Thiên-Huê province *Bois et Forêts des Tropiques,* **No. 305**(3): 67-76. Available at: http://bft.cirad.fr/revues/notice_en.php?dk%5B%5D=557802&submit=Show+the+detail

Armytage, L., 2011. Evaluating aid: An adolescent domain of practice, *Evaluation,* **17**(3): 261-276. Available at: 10.1177/1356389011410518

Arnold, E., 2012. Understanding long-term impacts of R&D funding: The EU framework programme, *Research Evaluation,* **21**(5): 332-343. Available at: 10.1093/reseval/rvs025

Arnold, R. J., Xie, Y. J., Midgley, S. J., Luo, J. Z. and Chen, X. F., 2013. Emergence and Rise of Eucalypt Veneer Production in China, *International Forestry Review,* **15**(1): 33-47. Available at: 10.1505/146554813805927200 (accessed 2014/12/30).

Aru, R., Nichols, J. D., Grant, J. C., Leys, A. J., Glencross, K., Sethy, M., Convery, K. and Viranamangga, R., 2012. Constraints to Whitewood (Endospermum medullosum) Plantation Development on Santo Island, Vanuatu, *International Forestry Review,* **14**(4): 414-423. Available at: 10.1505/146554812804715928 (accessed 2014/12/30).

Asaah, E. K., Tchoundjeu, Z., Leakey, R. R. B., Takousting, B., Njong, J. and Edang, I., 2011. Trees, agroforestry and multifunctional agriculture in Cameroon. *International Journal of Agricultural Sustainability* **9**(1): 110-119. Available at: https://www.tandfonline.com/doi/abs/10.3763/ijas.2010.0553

Astbury, B., 2013. Some reflections on Pawson's Science of Evaluation: A Realist Manifesto, *Evaluation,* **19**(4): 383-401. Available at: 10.1177/1356389013505039

AusAID, 2003. *The contribution of Australian aid to Papua New Guinea's development 1975–2000*, Australian Agency for International Development (AusAID), Canberra. Available at: https://www.oecd.org/countries/papuanewguinea/35402503.pdf

Babon, A. and Gowae, G. Y., 2013. *The Context of REDD+ in Papua New Guinea: Drivers, agents, and institutions*, Center for International Forestry Research (CIFOR), Bogor, Indonesia. Available at: http://www.cifor.org/nc/online-library/browse/view-publication/publication/4153.html

Bakewell, O. and Garbutt, A., 2005. *The use and abuse of the logical framework approach*, SIDA, Stockholm. Available at: http://pdf2.hegoa.efaber.net/entry/content/909/the_use_and_abuse_SIDA.pdf

Bantilan, M. C. S., Chandra, S., Mehta, P. K. and Keatinge, J. D. H., 2004. Dealing with diversity in scientific outputs: implications for international research evaluation, *Research Evaluation,* **13**(2): 87-93. Available at: 10.3152/147154404781776491

Bartlett, A. G., 1992. A review of community forestry advances in Nepal, *Commonwealth Forestry Review,* **71**(2): 95-100.

Bartlett, A. G., 2016a. Evaluating relative success of donor-funded collaborative research projects, *Research Evaluation,* **25**(4): 405-415. Available at: 10.1093/reseval/rvw009

Bartlett, A. G., 2016b. The evolution and impacts of ACIAR's forestry research program over three decades, *Australian Forestry,* **79**(3): 171-188. Available at: 10.1080/00049158.2016.1184603

Bartlett, A. G., 2018a. Factors affecting the relative success of collaborative forestry research projects in Indonesia. *The European Journal of Development Research*. Available at: https://doi.org/10.1057/s41287-018-0138-3

Bartlett, A. G., 2018b. Factors affecting the success of collaborative forestry research in Papua New Guinea. *Australian Forestry,* **81**(2): 116-128. Available at: https://doi.org/10.1080/00049158.2018.1462546

Bartlett, A. G., 2018c. Understanding and evaluating success in international forestry research projects: experiences from ACIAR projects in Vietnam, Indonesia and Papua New Guinea *International Forestry Review,* **20** (3) 274-295.

Bartlett, A. G., Kanowski, P. J., van Kerkhoff, L. and Byron, R. N., 2017. Identifying factors that influence the success of forestry research projects implemented in developing countries: case study results from Vietnam, *Forestry,* **90**(3): 413-425. Available at: 10.1093/forestry/cpw067

Baynes, J., Herbohn, J., Smith, C., Fisher, R. and Bray, D., 2015. Key factors which influence the success of community forestry in developing countries, *Global Environmental Change,* **35**: 226-238. Available at: http://dx.doi.org/10.1016/j.gloenvcha.2015.09.011

Befani, B. and Mayne, J., 2014. Process Tracing and Contribution Analysis: A Combined Approach to Generative Causal Inference for Impact Evaluation, IDS Bulletin, 45(6): 17-36. Available at: 10.1111/1759-5436.12110

Belcher, B., 2005. Forest product markets, forests and poverty reduction, *International Forestry Review,* **7**(2): 82-89.

Belcher, B. and Palenberg, M., 2018. Outcomes and Impacts of Development Interventions: Toward Conceptual Clarity, American Journal of Evaluation: 1098214018765698. Available at: 10.1177/1098214018765698 (accessed 2018/08/30).

Belcher, B. M., Rasmussen, K. E., Kemshaw, M. R. and Zornes, D. A., 2016. Defining and assessing research quality in a transdisciplinary context, *Research Evaluation,* **25**(1): 1-17. Available at: 10.1093/reseval/rvv025

Bevege, I., 2005. *Supplying forest services from natural forests and plantations: can we meet the challenge?*, ATSE Crawford Fund, Parliament House, Canberra. Available at: http://ageconsearch.umn.edu/record/124403

Bird, N., Wells, A., van Helden, F. and Turia, R., 2007a. *Issues and opportunities for the forest sector in Papua New Guinea*, Overseas Development Institute, London. Available at: https://www.odi.org/publications/74-issues-and-opportunities-forestry-sector-papua-new-guinea

Bird, N., Wells, A., van Helden, F. and Turia, R., 2007b. *What can be learnt from the past? A history of the forestry sector in Papua New Guinea*, Overseas Development Institute, London. Available at: https://www.odi.org/publications/72-history-forestry-sector-papua-new-guinea

Blamey, A. and Mackenzie, M., 2007. Theories of Change and Realistic Evaluation: Peas in a Pod or Apples and Oranges?, *Evaluation,* **13**(4): 439-455. Available at: 10.1177/1356389007082129

Blumfield, T., Bacon, G., Lyons, K., Walters, P., Tutua, S. and Moveni, R., 2013. *Improving silvicultural and economic outcomes for community timber plantations in Solomon Islands by interplanting with Flueggea flexuosa and other Pacific agroforestry species*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/publication/fr2013-09

Boland, D. J., 1989. *Trees for the tropics: growing Australian multipurpose trees and shrubs in developing countries*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/files/node/11821/mn10_pdf_14878.pdf

Boland, D. J. and Turnbull, J. W., 1989. 'Australian Tree Species for Fuelwood and Agroforestry in China, Kenya, Thailand and Zimbabwe',in Boland, D. J. (ed) *Trees for the Tropics: growing Australian multipurpose trees and shrubs in developing countries.*, Vol. Chapter 1, Australian Centre for International Agricultural Research, Canberra, pp. 13-20.

Booth, T. H. and Jovanovic, T., 2012. Assessing vulnerable areas for Puccinia psidii (eucalyptus rust) in Australia, *Australasian Plant Pathology,* **41**(4): 425-429. Available at: 10.1007/s13313-012-0130-x

Booth, T. H., Old, K. M. and Jovanovic, T., 2000. A preliminary assessment of high risk areas for Puccinia psidii (Eucalyptus rust) in the Neotropics and Australia, *Agriculture, Ecosystems & Environment,* **82**(1–3): 295-301. Available at: http://dx.doi.org/10.1016/S0167-8809(00)00233-4

Bourke, R. M. and Harwood, T., 2009. *Food and Agriculture in Papua New Guinea*, ANU E Press, The Australian National University, Canberra.

Bozeman, B. and Youtie, J., 2017. The Strength in Numbers: The New Science of Team Science, Princetown University Press, Princetown, New Jersey.

Brawner, J., Japarudin, Y., Lapammu, M., Rauf, R., Boden, D. and Wingfield, M. J., 2015. Evaluating the inheritance of Ceratocystis acaciivora symptom expression in a diverse Acacia mangium breeding population, *Southern Forests: a Journal of Forest Science,* **77**(1): 83-90. Available at: 10.2989/20702620.2015.1007412 (accessed 2015/03/20).

Brooks, T. M., Mittermeier, R. A., da Fonseca, G. A. B., Gerlach, J., Hoffmann, M., Lamoreux, J. F., Mittermeier, C. G., Pilgrim, J. D. and Rodrigues, A. S. L., 2006. Global Biodiversity Conservation Priorities, *Science,* **313**(5783): 58-61. Available at: http://www.jstor.org/stable/3846588

Brophy, J. J. and Doran, J. C., 1996. *Essential oils of tropical Asteromyrtus, Callistemon and Melaleuca species* Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/files/node/2098/mn40_pdf_17114.pdf

Brundrett, M., Bougher, N., Dell, B., Grove, T. and Malajczuk, N., 1996. *Working with Mycorrhizas in Forestry and Agriculture*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/files/node/2241/mn32_pdf_66358.pdf

Brundrett, M., Dell, B., Malajczuk, N. and Gong, M., 1995. *Mycorrhizal research for forestry in Asia*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/files/node/2282/pr62_pdf_27047.pdf

Buizer, M., Ruthrof, K., Moore, S. A., Veneklaas, E. J., Hardy, G. and Baudains, C., 2015. A Critical Evaluation of Interventions to Progress Transdisciplinary Research, Society & Natural Resources, 28(6): 670-681. Available at: 10.1080/08941920.2014.945058

Buxton, M., 2011. The payback of 'Payback': challenges in assessing research impact, *Research Evaluation,* **20**(3): 259-260. Available at: 10.3152/095820211X13118583635837

Byron, N., 2001. Keys to smallholder forestry, *Forests, Trees and Livelihoods,* **11**(4): 279-294. Available at: 10.1080/14728028.2001.9752396 (accessed 2015/05/29).

Byron, N., 2014. *The acacia economy of Viet Nam: Unpublished report for ACIAR*, Australian Centre for International Agricultural Research,

Cadman, T., Maraseni, T., Ma, H. O. and Lopez-Casero, F., 2017. Five years of REDD+ governance: The use of market mechanisms as a response to anthropogenic climate change, *Forest Policy and Economics,* **79**: 8-16. Available at: http://dx.doi.org/10.1016/j.forpol.2016.03.008

Carden, F., 2004. Issues in assessing the policy influence of research, *International Social Science Journal,* **56**(179): 135-151. Available at: 10.1111/j.0020-8701.2004.00480.x

Carden, F., 2013. Evaluation, Not Development Evaluation, *American Journal of Evaluation,* **34**(4): 576-579. Available at: 10.1177/1098214013495706

Carden, F. and Earl, S., 2007. Infusing evaluative thinking as process use: The case of the International Development Research Centre (IDRC), *New Directions for Evaluation,* **2007**(116): 61-73. Available at: 10.1002/ev.243

Carnegie, A. J., Lidbetter, J. R., Walker, J., Horwood, M. A., Tesoriero, L., Glen, M. and Priest, M. J., 2010. Uredo rangelii, a taxon in the guava rust complex, newly recorded on Myrtaceae in Australia, *Australasian Plant Pathology,* **39**(5): 463-466. Available at: 10.1071/AP10102

Carter, J., Pokharel, B. and Parajuli, R. R., 2011. *Two decades of community forestry in Nepal: what have we learned?*, Nepal Swiss Community Forestry Project, Kathmandu, Nepal. Available at: https://www.cabdirect.org/cabdirect/abstract/20123063082

CGIAR., 2012. Strategic overview of CGIAR Research programs Part I. Theories of change and impact pathways. Rome, Italy, Independent Science and Partnership Council. Available at:

https://ispc.cgiar.org/publication/strategic-overview-crps-part-i-theories-change-and-impact-pathways

Clark, W. C., van Kerkhoff, L., Lebel, L. and Gallopin, G. C., 2016. Crafting usable knowledge for sustainable development. *Proceedings of the National Academy of Sciences* **113**(17): 4570-4578. Available at: http://www.pnas.org/content/pnas/113/17/4570.full.pdf

Cartwright, N., 2010. What are randomised controlled trials good for?, *Philosophical Studies,* **147**(1): 59-70. Available at: 10.1007/s11098-009-9450-2

CELCoR-ACF, 2006. *Bulldozing progress: Human rights abuses and corruption in Papua New Guinea's large scale logging industry*, The Centre for Environmental Law and Community Rights and The Australian Conservation Foundation, Carlton, Australia.

CGIAR, 2005. *Science for agricultural development: Changing contexts, new opportunities*, CGIAR Science Council Secretariat, Rome, Italy. Available at: https://cgspace.cgiar.org/bitstream/handle/10947/3893/agm05_stake_science_agdev_execsum.pdf?sequence=1&isAllowed=y

CGIAR, 2012. *Strategic overview of CGIAR Research programs Part I. Theories of Change and Impact Pathways*, Independent Science and Partnership Council, Rome, Italy. Available at: https://ispc.cgiar.org/publication/strategic-overview-crps-part-i-theories-change-and-impact-pathways

CGIAR Standing Panel on Impact Assessment, 2006. *Natural resources management research impacts: evidence from the CGIAR.* , Consultative Group on International Agricultural Research, Rome. Available at: https://cgspace.cgiar.org/handle/10947/4200

Chambers, R. and Ghildyal, B. P., 1985. Agricultural research for resource-poor farmers: The farmer-first-and-last model, *Agricultural Administration,* **20**(1): 1-30. Available at: 10.1016/0309-586x(85)90063-9

Chambers, R. and Jiggins, J., 1987a. Agricultural research for resource-poor farmers Part I: Transfer-of-technology and farming systems research, *Agricultural Administration and Extension,* **27**(1): 35-52. Available at: 10.1016/0269-7475(87)90008-0

Chambers, R. and Jiggins, J., 1987b. Agricultural research for resource-poor farmers part II: A parsimonious paradigm, *Agricultural Administration and Extension,* **27**(2): 109-128. Available at: 10.1016/0269-7475(87)90021-3

Clement, F. and Amezaga, J. M., 2009. Afforestation and forestry land allocation in northern Vietnam: Analysing the gap between policy intentions and outcomes, *Land Use Policy,* **26**(2): 458-470. Available at: http://dx.doi.org/10.1016/j.landusepol.2008.06.003

Coe, R., Sinclair, F. and Barrios, E., 2014. Scaling up agroforestry requires research 'in' rather than 'for' development, *Current Opinion in Environmental Sustainability,* **6**(0): 73-77. Available at: http://dx.doi.org/10.1016/j.cosust.2013.10.013

Commonwealth of Australia, 1982. *Australian Centre for International Agricultural Research Act, 1982*, Commonwealth of Australia, Australia. Available at: http://www.comlaw.gov.au/Details/C2014C00533/Download

Conlin, S. and Stirrat, R. L., 2008. Current Challenges in Development Evaluation, *Evaluation,* **14**(2): 193-208. Available at: 10.1177/1356389007087539

Cook, S. and Wei, H., 2002. The Anomalous Nature of Development Success: A case study from China., *Development,* **45**(3): 76-80.

Cooke, B. and Kothari, U., 2001. *Participation, the New Tyranny?*, Zed Books, London.

Corbishley, J. and Pearce, D., 2007. *Growing trees on salt-affected land*, Australian Centre for International Agricultural Research, Canberra. Available at: https://www.aciar.gov.au/node/9111

Coryn, C. L. S., Noakes, L. A., Westine, C. D. and Schröter, D. C., 2011. A Systematic Review of Theory-Driven Evaluation Practice From 1990 to 2009, *American Journal of Evaluation,* **32**(2): 199-226. Available at: 10.1177/1098214010389321

Cossalter, C. and Pye-Smith, C., 2003. *Fast-wood forestry: myths and realities*, Center for International Forestry Research, Bogor, Indonesia. Available at: https://www.cifor.org/library/1257/fast-wood-forestry-myths-and-realities/

Cracknell, B. E., 1988. Evaluating development assistance: a review of the literature, *Public Administration & Development (1986-1998),* **8**(1): 75-75. Available at: http://search.proquest.com/docview/194678619?accountid=8330

Cracknell, B. E., 1996. Evaluating Development Aid: Strengths and Weaknesses, *Evaluation,* **2**(1): 23-33. Available at: 10.1177/135638909600200103

Cullen, A. E., Coryn, C. L. S. and Rugh, J., 2011. The Politics and Consequences of Including Stakeholders in International Development Evaluation, *American Journal of Evaluation,* **32**(3): 345-361. Available at: 10.1177/1098214010396076

Cunningham, A. B., Ingram, W., Daos Kadati, W., Howe, J., Sujatmoko, S., Refli, R., Liem, J. V., Tari, A., Maruk, T., Robianto, N., A., S., Ndun, Y., Made Maduarta, I., Sulistyohardi, D. and Koeslutat, E., 2011. *Hidden economies, future options: trade in non-timber forest products in eastern Indonesia*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/publication/tr077

Dale, R., 2003. The logical framework: An easy escape, a straitjacket, or a useful planning tool?, *Development in Practice,* **13**(1): 57-70. Available at: 10.1080/0961452022000037982 (accessed 2014/12/28).

Dalrymple, D. G., 2008. International agricultural research as a global public good: concepts, the CGIAR experience and policy issues, *Journal of International Development,* **20**(3): 347-379. Available at: 10.1002/jid.1420

Davies, R., 2004. Scale, Complexity and the Representation of Theories of Change, *Evaluation,* **10**(1): 101-121. Available at: 10.1177/1356389004043124

Davis, J., Gordon, J., Pearce, D. and Templeton, D., 2008. *Guidelines for assessing the impacts of ACIAR's research activities* Australian Centre for International Agricultural Research, Canberra, Australia. Available at: https://www.aciar.gov.au/node/9611

Davis, J. and Lubulwa, G., 1995. *An overview of ACIAR's economic evaluation activities with a forestry program focus*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/files/node/307/wp18.pdf

Davis, K., 2017. An empirical investigation into different stakeholder groups perception of project success, *International Journal of Project Management,* **35**(4): 604-617. Available at: https://doi.org/10.1016/j.ijproman.2017.02.004

de Janvry, A., Dunstan, A. and Sadoulet, E., 2011. *Recent Advances in Impact Analysis Methods for Ex-post Impact Assessments of Agricultural Technology: Options for the CGIAR*, CGIAR Independent Science and Partnership Council Secretariat, Rome. Available at: https://ispc.cgiar.org/publications/recent-advances-in-ia-methods

de Jong, S. P. L., van Arensbergen, P., Daemen, F., van der Meulen, B. and van den Besselaar, P., 2011. Evaluation of research in context: an approach and two cases, *Research Evaluation,* **20**(1): 61-72. Available at: 10.3152/095820211X12941371876346

de Jong, W., Sam, D. D. and Hung, T. V., 2006. *Forest rehabilitation in Vietnam: histories, realities and future*, Center for International Forestry Research (CIFOR), Bogor, Indonesia. Available at: http:/www.cifor.org/id/online-library/browse/view-publication/publication/2106.html

de Wit, A., 1988. Measurement of project success, *International Journal of Project Management,* **6**(3): 164-170. Available at: https://doi.org/10.1016/0263-7863(88)90043-9

Deaton, A., 2010a. Instruments, Randomization, and Learning about Development, *Journal of Economic Literature,* **48**(2): 424-455. Available at: http://dx.doi.org/10.1257/jel.48.2.424

Deaton, A., 2010b. Understanding the Mechanisms of Economic Development, *The Journal of Economic Perspectives,* **24**(3): 3-16. Available at: 10.2307/20799151

Degrande, A., Tchoundjeu, Z., Kwidja, A. and Fongang Fouepe, G. 2015. Rural Resource Centres: A Community Approach to Extension. *GFRAS Good Practice Notes for Extension and Advisory Services: Note 10*. Lindau, Switzerland, GFRAS.

Delahais, T. and Toulemonde, J., 2012. Applying contribution analysis: Lessons from five years of practice, *Evaluation,* **18**(3): 281-293. Available at: 10.1177/1356389012450810

Denning, G. L., 2001. Realising the potential of agroforestry: Integrating research and development to achieve greater impact, *Development in Practice,* **11**(4): 407-416. Available at: 10.1080/09614520120066693

DFAT, 2017a. *Australian Aid Budget Summary 2017–18*, Canberra. Available at: http://dfat.gov.au/about-us/corporate/portfolio-budget-statements/Documents/2017-18-australian-aid-budget-summary.pdf

DFAT, 2017b. *Papua New Guinea Aid Fact Sheet*, Department of Foreign Affairs and Trade, Canberra. Available at: http://dfat.gov.au/about-us/publications/Documents/aid-fact-sheet-papua-new-guinea.pdf

DFID, 2013. *International Development Evaluation Policy*, UK Department for International Development, London. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/204119/DFID-Evaluation-Policy-2013.pdf

Diallo, A. and Thuillier, D., 2004. The success dimensions of international development projects: the perceptions of African project coordinators, *International Journal of Project Management,* **22**(1): 19-31. Available at: https://doi.org/10.1016/S0263-7863(03)00008-5

Dieters, M., Newby, J., Cramb, R., Sexton, G., McNamara, S. and Johnson, M., 2014. *Enhancing on-farm incomes through improved silvicultural management of teak in Luang Prabang Province of Lao PDR*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/files/final_report_fst-2004-057.pdf

Doran, J. C. and Turnbull, J. W., 1997. *Australian Trees and Shrubs: species for land rehabilitation and farm planting in the tropics*, Australian Centre for International Agricultural Research, Canberra.

Douthwaite, B., Alvarez, S., Cook, S., Davies, R., George, P., Howell, J., Mackay, R. and Rubiano, J., 2007. The impact pathways approach: A practical application of program theory in research-for-development, *The Canadian Journal of Program Evaluation,* **22**(2): 127-159.

Douthwaite, B., Kuby, T., van de Fliert, E. and Schulz, S., 2003. Impact pathway evaluation: an approach for achieving and attributing impact in complex systems, *Agricultural Systems,* **78**(2): 243-265. Available at: 10.1016/s0308-521x(03)00128-8

Dumont, E. S., Bonhomme, S., Pagella, T. F. and Sinclair, F. L. 2017. Structured stakeholder engagement leads to development of more diverse and inclusive agroforestry options. *Experimental Agriculture*: 1-23. Available at: https://doi.org/10.1017/S0014479716000788

Duncan, R., 1994. *Melanesian Forestry Sector Study*, Australian International Development Assistance Bureau, Canberra.

Ekboir, J., 2003. Why impact analysis should not be used for research evaluation and what the alternatives are, *Agricultural Systems,* **78**(2): 166-184. Available at: 10.1016/s0308-521x(03)00125-2

Evenson, R. E. and Gollin, D., 2003. Assessing the impact of the green revolution, 1960 to 2000 *Science,* **300**(5620): 758-762. Available at: Retrieved from https://search-proquest-com.virtual.anu.edu.au/docview/213596303?accountid=8330

Everitt, A. and Mare, A. L., 2012. Evaluating as a means to achieve development ends, *Journal of International Development,* **24**(5): 556-570. Available at: 10.1002/jid.2849

Eyles, A., Beadle, C., Barry, K., Francis, A., Glen, M. and Mohammed, C., 2008. Management of fungal root-rot pathogens in tropical Acacia mangium plantations, *Forest Pathology,* **38**(5): 332-355. Available at: 10.1111/j.1439-0329.2008.00549.x

FAO-IUFRO-CIFOR, 1997. *New arrangements for forest science*, Available at: http://www.cifor.org/library/110/new-arrangements-for-forest-science-discussion-paper-prepared-for-the-intergovernmental-panel-on-forests-fourth-session-new-york-feb-97/

FAO, 1978. *Forestry for local community development*, Food and Agriculture Organisation of the United Nations, Rome. Available at: http://www.fao.org/docrep/t0692e/t0692e00.htm

FAO, 1981. *Forestry and rural development*, Food and Agicultural Organization of the United Nations, Rome. Available at: http://www.fao.org/docrep/016/ap357e/ap357e00.pdf

FAO, 1985. *Tree growing by rural people*, Food and Agricultural Organisation of the United Nations, Rome. Available at: http://www.fao.org/docrep/x5861e/x5861e00.htm

FAO, 2005a. *State of the World's Forests 2005*, Food and Agriculture Organization of the United Nations, Rome, Italy. Available at: http://www.fao.org/docrep/007/y5574e/y5574e00.htm

FAO, 2005b. *Global Forest Resources Assessment 2005*, Food and Agriculture Organization of the United Nations, Rome, Italy. Available at: http://www.fao.org/forestry/fra/fra2005/en/

FAO, 2009. *Papua New Guinea Forestry Outlook Study*, Food and Agriculture Organization of the United Nations: Regional Office for Asia and the Pacific, Bangkok. Available at: http://www.fao.org/docrep/014/am614e/am614e00.pdf

FAO, 2014. *Contribution of the Forestry Sector to National Economies, 1990-2011*, Food and Agriculture Organization of the United Nations, Rome. Available at: http://www.fao.org/3/a-i4248e.pdf

FAO, 2015. *Global Forest Resources Assessment 2015: Desk Reference*, Food and Agriculture Organization of the United Nations, Rome, Italy. Available at: http://www.fao.org/3/a-i4808e.pdf

Fargher, J. and Kelly, D., 2012. *From seed to scale-up: Lessons learned from Australia's rural development assistance*, Office of Development Effectiveness, Canberra. Available at: http://dfat.gov.au/aid/how-we-measure-performance/ode/Documents/from-seed-to-scale-up.pdf

Farmer, B., Duncan, R., Enright, T. and Jarvie, W., 2013. *Independent review of the Australian Centre for International Agricultural Research (ACIAR)*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/publication/cp025

Farrington, J., Thirtle, C. and Henderson, S., 1997. Methodologies for monitoring and evaluating agricultural and natural resources research, *Agricultural Systems,* **55**(2): 273-300. Available at: http://dx.doi.org/10.1016/S0308-521X(97)00011-5

Feeny, S., 2005. The Impact of Foreign Aid on Economic Growth in Papua New Guinea, *The Journal of Development Studies,* **41**(6): 1092-1117. Available at: 10.1080/00220380500155403

Feeny, S. and Vuong, V., 2017. Explaining Aid Project and Program Success: Findings from Asian Development Bank Interventions, *World Development,* **90**: 329-343. Available at: http://doi.org/10.1016/j.worlddev.2016.10.009

Fisher, H., 2010. *The biology, socioeconomics and management of the barramundi fishery in Papua New Guinea's Western Province*, Australian Centre for International Agricultural Research, Canberra. Available at: https://www.aciar.gov.au/node/10006

Fisher, H., 2011. *Forestry in Papua New Guinea: a review of ACIAR's program*, Australian Centre for International Agricultural Research, Canberra. Available at: https://www.aciar.gov.au/node/10521

Fisher, H. and Gordon, J., 2007. *Improved Australian tree species for Vietnam*, Australian Centre for International Agricultural Research, Canberra. Available at: https://www.aciar.gov.au/node/9086

Fisher, H. and Gordon, J., 2007a. *Improved Australian tree species for Vietnam*, Australian Centre for International Agricultural Research, Canberra. Available at: https://www.aciar.gov.au/node/9086

Fisher, H. and Gordon, J., 2007b. *Minimising impacts of fungal disease of eucalypts in South-East Asia*, Australian Centre for International Agricultural Research, Canberra. Available at: https://www.aciar.gov.au/node/9101

Fisher, H., Winzenried, C. and Sar, L., 2012. *Oil palm pathways: an analysis of ACIAR's oil palm projects in Papua New Guinea*, Australian Centre for International Agricultural Research, Canberra. Available at: https://www.aciar.gov.au/node/10841

Forest Trends, 2006. *Logging, legality and livelihoods in PNG*, Forest Trends, Washington DC. Available at: http://www.forest-trends.org/publication_details.php?publicationID=105

Forss, K., Cracknell, B. and Samset, K., 1994. Can Evaluation Help an Organization to Learn?, *Evaluation Review,* **18**(5): 574-591. Available at: 10.1177/0193841x9401800503

Fox, J. and Keenan, R., 2011. *Assessment, management and marketing of goods and services from cutover native forests in Papua New Guinea*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/publication/fr2011-10

Fox, J. C., Keenan, R. J., Brack, C. L. and Saulei, S., 2011. *Native forest management in Papua New Guinea: advances in assessment, modelling and decision-making* Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/publication/pr135

Francis, A., Beadle, C., Puspitasari, D., Irianto, R., Agustini, L., Rimbawanto, A., Gafur, A., Hardiyanto, E., Junarto, Hidyati, N., Tjahjono, B., Mardai, U., Glen, M. and Mohammed, C., 2014. Disease progression in plantations of Acacia mangium affected by red root rot (Ganoderma philippii), *Forest Pathology,* **44**(6): 447-459. Available at: 10.1111/efp.12141

Franzel, S., Cooper, P. and Denning, G. L., 2001. Scaling up the benefits of agroforestry research: Lessons learned and research challenges, *Development in Practice,* **11**(4): 524-534. Available at: 10.1080/09614520120066792

Franzel, S., Denning, G. L., Lillesø, J. P. B. and Mercado, A. R., Jr., 2004. Scaling up the impact of agroforestry: Lessons from three sites in Africa and Asia, *Agroforestry Systems,* **61-62**(1-3): 329-344. Available at: 10.1023/B:AGFO.0000029008.71743.2d

Franzel, S., Nanok, T., Wangia, S. and DeWolf, J., 2008. Collaborative monitoring and evaluation: Assessing the uptake of improved fallows and biomass transfer in Western Kenya,

Experimental Agriculture, **44**(1): 113-127. Available at: http://search.proquest.com/docview/203135868?accountid=8330

Gafur, A., Nasution, A., Yuliarto, M., Yong, W. C. and Sharma, M., 2015. A new screening method for Ganoderma philippii tolerance in tropical Acacia species, *Southern Forests: a Journal of Forest Science,* **77**(1): 75-81. Available at: 10.2989/20702620.2014.999304 (accessed 2015/03/20).

Ghaffariyan, M. R., Jenkin, B., Mitchell, R. and Brown, M., 2016. Quantitative and qualitative assessment of timber harvesting residues: a case study of a balsa plantation in Papua New Guinea, *Australian Forestry,* **79**(1): 25-31. Available at: 10.1080/00049158.2015.1092627

Gilmour, D. A., King, G. C., Applegate, G. B. and Mohns, B., 1990. Silviculture of plantation forest in central Nepal to maximise community benefits, *Forest Ecology and Management,* **32**(2–4): 173-186. Available at: http://dx.doi.org/10.1016/0378-1127(90)90169-C

Glen, M., Alfenas, A. C., Zauza, E. A. V., Wingfield, M. J. and Mohammed, C., 2007. Puccinia psidii: a threat to the Australian environment and economy —a review, *Australasian Plant Pathology,* **36**(1): 1-16. Available at: 10.1071/AP06088

Glencross, K., Nichols, J. D., Grant, J. C., Sethy, M. and Smith, R. G. B., 2012. Spacing Affects Stem form, early Growth and Branching in Young Whitewood (Endospermum medullosum) Plantations in Vanuatu, *International Forestry Review,* **14**(4): 442-451. Available at: 10.1505/146554812804715865 (accessed 2014/12/30).

Global Environment Facility, 2018. Annual Performance Report 2017, Global Environment Facility, Washington DC, USA. Available at: https://www.thegef.org/council-meeting-documents/annual-performance-report-2017

Government of Papua New Guinea, 2009. *Papua New Guinea Vision 2050*, Port Moresby. Available at: http://www.treasury.gov.pg/html/publications/files/pub_files/2011/2011.png.vision.2050.pdf

Government of Papua New Guinea, 2016. *Medium Term Development Plan 2: 2016-17*, Port Moresby. Available at: http://www.planning.gov.pg/images/dnpm/pdf/MTDP2.pdf

Government of Vietnam, 2007. *Viet Nam Forestry Development Strategy 2006-2020*, Office of Prime Minister, Hanoi. Available at: https://theredddesk.org/sites/default/files/viet_nam_forestry_development_strategy_2.pdf

Grant, J. C., Glencross, K., Nichols, J. D., Palmer, G., Sethy, M. and Vanclay, J. K., 2012. Silvicultural Implications Arising from a Simple Simulation Model for Endospermum medullosum in Vanuatu, *International Forestry Review,* **14**(4): 452-462. Available at: 10.1505/146554812804715874 (accessed 2014/12/30).

Greenland, D. J., 1997. International agricultural research and the CGIAR system—past, present and future, *Journal of International Development,* **9**(4): 459-482. Available at: 10.1002/(sici)1099-1328(199706)9:4<459::aid-jid457>3.0.co;2-g

Griffin, A. R., Chi, N. Q., Harbard, J. L., Son, D. H., Harwood, C. E., Price, A., Vuong, T. D., Koutoulis, A. and Thinh, H. H., 2015. Breeding polyploid varieties of tropical acacias: progress and prospects, *Southern Forests: a Journal of Forest Science,* **77**(1): 41-50. Available at: 10.2989/20702620.2014.999303 (accessed 2015/03/20).

Gritten, D., Greijmans, M., Lewis, S., Sokchea, T., Atkinson, J., Quang, T., Poudyal, B., Chapagain, B., Sapkota, L., Mohns, B. and Paudel, N., 2015. An Uneven Playing Field: Regulatory Barriers to Communities Making a Living from the Timber from Their Forests–Examples from Cambodia, Nepal and Vietnam. *Forests* **6**(10): 3433.

Guinea, J., Sela, E., Gómez-Núñez, A. J., Mangwende, T., Ambali, A., Ngum, N., Jaramillo, H., Gallego, J. M., Patiño, A., Latorre, C., Srivanichakorn, S. and Thepthien, B., 2015. Impact

oriented monitoring: A new methodology for monitoring and evaluation of international public health research projects, *Research Evaluation,* **24**(2): 131-145. Available at: 10.1093/reseval/rvu034

Haddad, L., 2012. Five Assumptions of Dominant Thinking in International Development, *Development,* **55**(1): 34-44. Available at: http://search.proquest.com/docview/922730060?accountid=8330

Haddad, L., Lindstrom, J. and Pinto, Y., 2010. The Sorry State of M&E in Agriculture: Can People-centred Approaches Help?, *IDS Bulletin,* **41**(6): 6-25. Available at: 10.1111/j.1759-5436.2010.00177.x

Haines, R., 2005. *The contribution of Australian and international forestry research*, ATSE Crawford Fund, Parliament House, Canberra. Available at: https://ideas.repec.org/p/ags/cfcp05/124417.html

Hajjar, R., Kozak, R. A., El-Lakany, H. and Innes, J. L., 2013. Community forests for forest communities: Integrating community-defined goals and practices in the design of forestry initiatives, *Land Use Policy,* **34**(0): 158-167. Available at: http://dx.doi.org/10.1016/j.landusepol.2013.03.002

Hall, A., Rasheed Sulaiman, V., Clark, N. and Yoganand, B., 2003. From measuring impact to learning institutional lessons: an innovation systems perspective on improving the management of international agricultural research, *Agricultural Systems,* **78**(2): 213-241. Available at: 10.1016/s0308-521x(03)00127-6

Hardcastle, P., Forbes, A., Karani, I., Tuominen, K., Sandom, J., Murtland, R., Muller-Platenberg, V. and Davenport, D., 2010. *Finnish Support to Forestry and Biological Resources: Evaluation Report 2010: 5/I*, Ministry of Foreign Affairs for Finland, Helsinki. Available at: http://formin.finland.fi/public/download.aspx?ID=72519&GUID={DBA6F480-8265-43D4-A0D2-4E8ED7AC2265}

Hardiyanto, E., 2003. 'Growth and genetic improvement of *Eucalyptus pellita* in South Sumatra, Indonesia',in Turnbull, J. W. (ed) *Eucalypts in Asia: Proceedings of an international conference held in Zhanjiang, China, 7–11 April 2003*, Vol. ACIAR Proceedings No. 111, Australian Centre for International Agricultural Research, Canberra, pp. 82-88.

Harisetijono and Suriamihardja, S., 1991. 'Sandalwood in Nusa Tenggara Timur',in McKinnell, F. H. (ed) *Sandalwood in the Pacific region. Proceedings of a symposium held on 2 June 1991, Honolulu, Hawaii* Vol. ACIAR Proceedings No 49, Australian Centre for International Agricultural Research, Honolulu, Hawaii, pp. 39-43.

Harwood, C. E., Ha, H. T., Tran, H. Q., Butcher, P. A. and Williams, E. R., 2004. The Effect of Inbreeding on Early Growth of Acacia mangium in Vietnam, *Silvae Genetica,* **53**: 65-69.

Harwood, C. E., Hardiyanto, E. B. and Yong, W. C., 2015. Genetic improvement of tropical acacias: achievements and challenges, *Southern Forests: a Journal of Forest Science,* **77**(1): 11-18. Available at: 10.2989/20702620.2014.999302 (accessed 2015/03/20).

Harwood, C. E., Kha, L. D., Dien, P. Q. and Thang, L. V., 1988. 'Performance of Australian dry-zone *Acacia* species on white sandy soil in dry, south-eastern Vietnam.',in Turnbull, J. W., Crompton, H. R. and Pinyopusarerk, K. (eds), *Recent developments in acacia planting. ACIAR Proceedings No. 82*, Australian Centre for International Agricultural Research, Canberra, pp. 29-35.

Harwood, C. E. and Nambiar, E. K. S., 2014. *Sustainable plantation forestry in South-East Asia*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/publication/tr084

Heinecke, D., Dollery, B. and Fleming, E., 2008. The Samaritan's dilemma: The effectiveness of Australian foreign aid to Papua New Guinea, *Australian Journal of International Affairs,* **62**(1): 53-71. Available at: 10.1080/10357710701842686

Henderson, J. S., 2000. Evaluating the impact of forestry research for development, *International Forestry Review,* **2**(3): 191-199.

Henderson, J. S. and Burn, R. W., 2004. Uptake pathways: the potential of Bayesian belief networks to assist the management, monitoring and evaluation of development-orientated research, *Agricultural Systems,* **79**(1): 3-15. Available at: http://dx.doi.org/10.1016/S0308-521X(03)00042-8

Henderson, W. and Braidotti, G., 2013. Innovation and entrepreneurs, *Partners,* **November 2013**: 18-19. Available at: http://aciar.gov.au/files/partners_1309_p18-19_innovation_and_entrepreneurs.pdf

Hilhorst, T. and Guijt, I., 2006. *Participatory Monitoring and Evaluation - A Process to Support Governance: A Guidance Paper* Report to the World Bank, Royal Tropical Institute (KIT), Amsterdam The World Bank, Washington DC, USA. Available at: http://www.gsdrc.org/go/display&type=Document&id=3306 (accessed 31 May 2012).

Høgh-Jensen, H., Oelofse, M. and Egelyng, H., 2010. New Challenges in Underprivileged Regions Call for People-Centered Research for Development, *Society & Natural Resources,* **23**(9): 908-915. Available at: 10.1080/08941921003671502 (accessed 2015/05/25).

Holzknecht, H., 1996. *Policy reform, customary tenure and stakeholder clashes in Papua New Guinea's rainforests*, Overseas Development Institute, London. Available at: https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/1116.pdf

Horton, D. and Mackay, R., 2003. Using evaluation to enhance institutional learning and change: recent experiences with agricultural research and development, *Agricultural Systems,* **78**(2): 127-142. Available at: 10.1016/s0308-521x(03)00123-9

Hudson, J., 2000. Forests and the United Kingdom's Department for International Development, *International Forestry Review,* **2**(3): 156-157.

Hughes, H., 2003. *Aid has failed the Pacific*, The Centre for Independent Studies, St. Leonards, NSW, Australia. Available Available at: http://www.cis.org.au/app/uploads/2015/07/ia33.pdf

Humphreys, D., 1999. The evolving forests regime, *Global Environmental Change,* **9**(3): 251-254. Available at: http://dx.doi.org/10.1016/S0959-3780(99)00005-9

Humphreys, D., 2001. Forest negotiations at the United Nations: explaining cooperation and discord, *Forest Policy and Economics,* **3**(3–4): 125-135. Available at: http://dx.doi.org/10.1016/S1389-9341(01)00039-9

Hunt, C. e., 2001. *Production, privatisation and preservation in Papua new Guinea forestry* International Institute for Environment and Development, London. Available at: http://pubs.iied.org/pdfs/9065IIED.pdf

IDRC, 2010. *IDRC Evaluation Strategy 2010-2015*, International Development Research Centre, Ottawa. Available at: http://www.idrc.ca/EN/Programs/Evaluation/Documents/Evaluation-Unit-Strategy-2010-2015.pdf

Ika, L. A., 2009. Project success as a topic in project management journals, *Project Management Journal,* **40**(4): 6-19. Available at: 10.1002/pmj.20137

Ika, L. A., Diallo, A. and Thuillier, D., 2012. Critical success factors for World Bank projects: An empirical investigation, *International Journal of Project Management,* **30**(1): 105-116. Available at: https://doi.org/10.1016/j.ijproman.2011.03.005

Ika, L. A. and Donnelly, J., 2017. Success conditions for international development capacity building projects, *International Journal of Project Management,* **35**(1): 44-63. Available at: https://doi.org/10.1016/j.ijproman.2016.10.005

Irawan, S. and Tacconi, L., 2009. Reducing Emissions from Deforestation and Forest Degradation (REDD) and Decentralized Forest Management, *International Forestry Review,* **11**(4): 427-438. Available at: 10.1505/ifor.11.4.427 (accessed 2015/05/29).

Irawanti, S., Ginoga, K., Prawestisuka, A. and Race, D., 2014. Commercialising Community Forestry in Indonesia: Lessons About the Barriers and Opportunities in Central Java, *Small-scale Forestry,* **13**(4): 515-526. Available at: 10.1007/s11842-014-9268-4

Jacobs, A., Barnett, C. and Ponsford, R., 2010. Three Approaches to Monitoring: Feedback Systems, Participatory Monitoring and Evaluation and Logical Frameworks, *IDS Bulletin,* **41**(6): 36-44. Available at: 10.1111/j.1759-5436.2010.00180.x

Jarvie, W. and Stewart, J., 2018. Conceptualizing learning in the public sector: the importance of context, *International Journal of Public Sector Management,* **31**(1): 14-30. Available at: doi:10.1108/IJPSM-08-2016-0137

Jauhiainen, J., Hooijer, A. and Page, S. E., 2012. Carbon dioxide emissions from an *Acacia* plantation on peatland in Sumatra, Indonesia, *Biogeosciences,* **9**(2): 617-630. Available at: 10.5194/bg-9-617-2012

Johnson, N. L., Lilja, N. and Ashby, J. A., 2003. Measuring the impact of user participation in agricultural and natural resource management research, *Agricultural Systems,* **78**(2): 287-306. Available at: 10.1016/s0308-521x(03)00130-6

Joly, P.-B., Gaunand, A., Colinet, L., Larédo, P., Lemarié, S. and Matt, M., 2015. ASIRPA: A comprehensive theory-based approach to assessing the societal impacts of a research organization, *Research Evaluation,* **24**(4): 440-453. Available at: 10.1093/reseval/rvv015

Kanowski, P., Blyth, M., Essacu, F., Holzknecht, H., Jenkin, B., Kuniata, L., Mulung, K. and Rollinson, S., 2014a. *Value-adding to Papua New Guinea agroforestry systems*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/publication/fr2014-10

Kanowski, P., Holzknecht, H. and McGregor, A., 2014b. *The potential of incorporating high-value tree species in Papua New Guinea agroforestry systems to enhance landowner livelihoods*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/publication/fr2014-06

Kanowski, P. and Jenkin, B., 2016. *Improving the Papua New Guinea balsa value chain to enhance smallholder livelihoods*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/publication/fr2016-34

Kanowski, P. and Mulung, K., 2017. *Adoption Study: FST/2004/050 Value-adding to PNG agroforestry systems. Unpublished report to ACIAR*, Australian Centre for International Agricultural Research, Canberra.

Kha, L. D. and Nghia, N. H., 1991. 'Growth of some Acacia species in Vietnam',in Turnbull, J. W. (ed) *Advances in Tropical Acacia Research*, Vol. ACIAR Proceedings No. 35, Australian Centre for International Agricultural Research, Canberra, pp. 173-176.

Khang, D. B. and Moe, T. L., 2008. Success criteria and factors for international development projects: A life-cycle-based framework, *Project Management Journal,* **39**(1): 72-84. Available at: 10.1002/pmj.20034

Khanzada, A. N., Morris, J. D., Ansari, R., Slavich, P. G. and Collopy, J. J., 1998. Groundwater uptake and sustainability of Acacia and Prosopis plantations in Southern Pakistan,

Agricultural Water Management, **36**(2): 121-139. Available at: http://dx.doi.org/10.1016/S0378-3774(98)00030-4

Koehler, G., 2015. Seven Decades of 'Development', and Now What?, *Journal of International Development,* **27**(6): 733-751. Available at: 10.1002/jid.3108

Koontz, H., O'Donnell, C. and Weihrich, H., 1984. Management: Eighth Edition, McGraw-Hill Book Company, Tokyo, Japan.

Lane, P. N. J., Morris, J., Ningnan, Z., Guangyi, Z., Guoyi, Z. and Daping, X., 2004. Water balance of tropical eucalypt plantations in south-eastern China, *Agricultural and Forest Meteorology,* **124**(3–4): 253-267. Available at: http://dx.doi.org/10.1016/j.agrformet.2004.01.015

Langrell, S. R. H., Glen, M. and Alfenas, A. C., 2008. Molecular diagnosis of Puccinia psidii (guava rust) – a quarantine threat to Australian eucalypt and Myrtaceae biodiversity, *Plant Pathology,* **57**(4): 687-701. Available at: 10.1111/j.1365-3059.2008.01844.x

Laurance, W. F., Kakul, T., Keenan, R. J., Sayer, J., Passingan, S., Clements, G. R., Villegas, F. and Sodhi, N. S., 2011. Predatory corporations, failing governance, and the fate of forests in Papua New Guinea, *Conservation Letters,* **4**(2): 95-100. Available at: 10.1111/j.1755-263X.2010.00156.x

Lindner, R., 2011. *The economic impact in Indonesia and Australia of investment in plantation forestry research, 1987–2009*, Australian Centre for International Agricultural Research, Canberra. Available at: https://www.aciar.gov.au/node/12266

Lindner, R., McLeod, P. and Mullen, J., 2013. *Returns to ACIAR's investment in bilateral agricultural research*, Australian Centre for International Agricultural Research, Canberra. Available at: https://www.aciar.gov.au/node/11946

Liverani, A. and Lundgren, H. E., 2007. Evaluation Systems in Development Aid Agencies: An Analysis of DAC Peer Reviews 1996—2004, *Evaluation,* **13**(2): 241-256. Available at: 10.1177/1356389007075226

Lucas, H. and Longhurst, R., 2010. Evaluation: Why, for Whom and How?, *IDS Bulletin,* **41**(6): 28-35. Available at: 10.1111/j.1759-5436.2010.00179.x

Lynam, J. K. and Herdt, R. W., 1989. Sense and sustainability: Sustainability as an objective in international agricultural research, *Agricultural Economics,* **3**(4): 381-398. Available at: http://dx.doi.org/10.1016/0169-5150(89)90010-8

Macqueen, D., 2013. Enabling Conditions for Successful Community Forest Enterprises, *Small-scale Forestry,* **12**(1): 145-163. Available at: 10.1007/s11842-011-9193-8

Maredia, M. K., 2009. *Improving the Proof: Evolution of and Emerging Trends in Impact Assessment Methods and Approaches in Agricultural Development*, International Food Policy Research Institute, Washington. Available at: www.ifpri.org/publication/improving-proof

Maredia, M. K. and Raitzer, D. A., 2010. Estimating overall returns to international agricultural research in Africa through benefit-cost analysis: a "best-evidence" approach, *Agricultural Economics,* **41**(1): 81-100. Available at: 10.1111/j.1574-0862.2009.00427.x

Maredia, M. K. and Raitzer, D. A., 2012. Review and analysis of documented patterns of agricultural research impacts in Southeast Asia, *Agricultural Systems,* **106**(1): 46-58. Available at: http://dx.doi.org/10.1016/j.agsy.2011.10.011

Maryudi, A., Devkota, R. R., Schusser, C., Yufanyi, C., Salla, M., Aurenhammer, H., Rotchanaphatharawit, R. and Krott, M., 2012. Back to basics: Considerations in evaluating the outcomes of community forestry, *Forest Policy and Economics,* **14**(1): 1-5. Available at: https://doi.org/10.1016/j.forpol.2011.07.017

Maxwell, J. A., 2004. Using Qualitative Methods for Causal Explanation, *Field Methods,* **16**(3): 243-264. Available at: 10.1177/1525822x04266831

Mayne, J., 2001. Addressing attribution through contribution analysis: using performance measures sensibly, *The Canadian Journal of Program Evaluation,* **16**(1): 1-24.

Mayne, J., 2012. Contribution analysis: Coming of age?, *Evaluation,* **18**(3): 270-280. Available at: 10.1177/1356389012451663

Mayne, J. and Johnson, N., 2015. Using theories of change in the CGIAR Research Program on Agriculture for Nutrition and Health. *Evaluation* **21**(4): 407-428.

Mayne, J. and Stern, E., 2013. *Impact evaluation of natural resource management research programs: a broader view*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/files/ias84.pdf

McElwee, P., 2009. Reforesting "Bare Hills" in Vietnam: Social and Environmental Consequences of the 5 Million Hectare Reforestation Program, *AMBIO: A Journal of the Human Environment,* **38**(6): 325-333. Available at: 10.1579/08-R-520.1 (accessed 2013/07/19).

McKenney, D. W., 1998. *Australian tree species selection in China*, Australian Centre for International Agricultural Research, Canberra Available at: http://aciar.gov.au/files/node/2105/ias08_pdf_11431.pdf

McLeod, L., Doolin, B. and MacDonell, S. G., 2012. A Perspective-Based Understanding of Project Success, *Project Management Journal,* **43**(5): 68-86. Available at: 10.1002/pmj.21290

Melati, Purnomo, H. and Shantiko, B., 2013. *Making research work for small-scale furniture makers: Action research in the Jepara furniture industry, Indonesia*, Center for International Forestry Research (CIFOR), Bogor, Indonesia. Available at: https://www.cifor.org/library/4310/making-research-work-for-small-scale-furniture-makers-action-research-in-the-jepara-furniture-industry-indonesia/

Mendham, D., 2010. *Adoption Study for ACIAR project FST/1995/106*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/publication/as007

Mendham, D. and Hardiyanto, E., 2011. *Realising genetic gains in Indonesia and Australian plantations through water and nutrient management*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/publication/fr2011-07

Mercer, D. E., 2004. Adoption of agroforestry innovations in the tropics: A review, *Agroforestry Systems,* **61-62**(1-3): 311-328. Available at: http://dx.doi.org/10.1023/B:AGFO.0000029007.85754.70

Midgley, S., Bennett, J., Samontry, X., Stevens, P., Mounlamai, K., Midgley, D. and Brown, A., 2012. *Enhancing livelihoods in Lao PDR through environmental services and planted-timber products* Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/files/node/14946/tr081_enhancing_livelihoods_in_lao_pdr_through_en_37142.pdf

Midgley, S., Blyth, M., Howcroft, N., Midgley, D. and Brown, A., 2010. *Balsa: biology, production and economics in Papua New Guinea*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/files/node/12685/balsa_biology_production_and_economics_in_papua__40057.pdf

Midgley, S., Somaiya, R. T., Stevens, P. R., Brown, A., Nguyen, D. K. and Laity, R., 2015. *Planted teak: global production and markets, with reference to Solomon Islands*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/publication/tr085

Miles, D. W. J., 1998. Evaluating International Development Projects: Lessons from the Construction Sector, *Evaluation,* **4**(4): 469-482. Available at: 10.1177/13563899822208734

Millstone, E., Van Zwanenberg, P. and Marshall, F., 2010. Monitoring and Evaluating Agricultural Science and Technology Projects: Theories, Practices and Problems, *IDS Bulletin,* **41**(6): 75-87. Available at: 10.1111/j.1759-5436.2010.00185.x

Morris, J., Ningnan, Z., Zengjiang, Y., Collopy, J. and Daping, X., 2004. Water use by fast-growing Eucalyptus urophylla plantations in southern China, *Tree Physiology,* **24**(9): 1035-1044. Available at: 10.1093/treephys/24.9.1035

Morse, S., 2016. Measuring the Success of Sustainable Development Indices in Terms of Reporting by the Global Press, *Social Indicators Research,* **125**(2): 359-375. Available at: 10.1007/s11205-014-0847-8

Myers, B., Fisher, R., Pickering, S. and Garnett, S., 2014. Post-project evaluation of the sustainability of development project outcomes: a case study in eastern Indonesia, *Development in Practice,* **24**(3): 379-389. Available at: 10.1080/09614524.2014.899320 (accessed 2014/12/22).

Nairn, M. E., Castillo, G. T. and Dun, R. B., 1998. *Staying Ahead: report of a review of the Australian Centre for International Agricultural Research* Australian Centre for International Agricultural Research., Canberra. Available at: http://aciar.gov.au/files/node/398/report.PDF

Nambiar, E. K. S. and Brown, A. G., 1997. *Management of soil, nutrients and water in tropical plantation forests*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/biblio/mn043

Nambiar, E. K. S., Harwood, C. E. and Kien, N. D., 2014. Acacia plantations in Vietnam: research and knowledge application to secure a sustainable future, *Southern Forests: a Journal of Forest Science,* **77**(1): 1-10. Available at: 10.2989/20702620.2014.999301 (accessed 2015/03/20).

Nawir, A. A., 2013. Commercial Community Tree-Growing Inside State Forests: An Economic Perspective from Eastern Indonesia, *International Forestry Review,* **15**(2): 200-217. Available at: 10.1505/146554813806948558 (accessed 2014/12/30).

Newby, J., Cramb, R. and Sakanphet, S., 2014. Forest Transitions and Rural Livelihoods: Multiple Pathways of Smallholder Teak Expansion in Northern Laos, *Land,* **3**(2): 482-503. Available at: http://www.mdpi.com/2073-445X/3/2/482

Newby, J., Cramb, R. A., Sakanphet, S. and McNamara, S., 2012. Smallholder Teak and Agrarian Change in Northern Laos, *Small-scale Forestry,* **11**(1): 27-46. Available at: 10.1007/s11842-011-9167-x

Nguyen V. S. and Gilmour, D., 1999. *Forest rehabilitation policy and practice in Vietnam*, IUCN, Hanoi. Available at: http://www.mekonginfo.org/document/0001632-environment-forest-rehabilitation-policy-and-practice-in-vietnam

Novotny, V., 2010. Rain Forest Conservation in a Tribal World: Why Forest Dwellers Prefer Loggers to Conservationists, *Biotropica,* **42**(5): 546-549. Available at: 10.1111/j.1744-7429.2010.00658.x

Nuberg, I. K., Mitir, J. A. and Robinson, B., 2017. Short-rotation coppice agroforestry for charcoal small business in Papua New Guinea, *Australian Forestry,* **80**(3): 143-152. Available at: 10.1080/00049158.2017.1339238

OECD, 1991. *Principles for Evaluation of Development Assistance*, OECD, Paris. Available at: http://www.oecd.org/dac/evaluationofdevelopmentprogrammes/dcdndep/45438179.pdf (accessed 16/09/2012).

OECD, 2002. *Glossary of Key Terms in Evaluation and Results Based Management*, OECD, Paris. Available at: http://www.oecd.org/development/peer-reviews/2754804.pdf

OECD, 2005. *Paris Declaration on Aid Effectiveness*, Organisation for Economic Cooperation and Development, Paris. Available at: http://www.oecd.org/dac/aideffectiveness/43911948.pdf (accessed 16/09/2012).

OECD, 2010. *Evaluating Development Co-operation. Summary of Key Norms and Standards. Second Edition*, OECD, Available at: http://www.oecd.org/dac/evaluationofdevelopmentprogrammes/dcdndep/41612905.pdf

OECD/UNDP, 2016. *Making Development Co-operation More Effective: 2016 Progress Report*, OECD/UNDP, Paris. Available at: http://dx.doi.org/10.1787/9789264266261-en

Ofir, Z., 2010. Commentary on 'The sorry state of M&E in agriculture: can people-centred approaches help?', *IDS Bulletin,* **41**(6): 26-27.

Ojha, H. R., 2014. Beyond the 'Local Community': the Evolution of Multi-Scale Politics in Nepal's Community Forestry Regimes, *International Forestry Review,* **16**(3): 339-353. Available at: 10.1505/146554814812572520 (accessed 2014/12/30).

Oktalina, S. N., 2015. *Forestry livelihood framework: Unpublished report for ACIAR project FST/2008/030 'Overcoming constraints to community-based commercial forestry in Indonesia'*, University of Gadjah Mada Yogyakarta, Indonesia.

Old, K. M. and Mohammed, C., 2003. In *Eucalypts in Asia: Proceedings of an international conference held in Zhanjiang, China, 7–11 April 2003*, Vol. ACIAR Proceedings No. 111 (ed, Turnbull, J. W.) Australian Centre for International Agricultural Research, Canberra, pp. 253.

Old, K. M., See, L. S., Sharma, J. K. and Yuan, Z. Q., 2000. *A manual of diseases of tropical acacias in Australia, South-East Asia and India*, CIFOR, Bogor, Indonesia. Available at: https://www.cifor.org/library/639/a-manual-of-diseases-of-tropical-acacias-in-australia-south-east-asia-and-india/

Old, K. M., Wingfield, M. J. and Yuan, Z. Q., 2003. *A manual of diseases of eucalyptus in South-East Asia*, CIFOR, Bogor, Indonesia. Available at: https://www.cifor.org/library/1428/a-manual-of-diseases-of-eucalyptus-in-south-east-asia/

Ozarska, B., Peki, M., Gusamo, B., Edwin, P., Sapi, J., Tsiritsi, C., Niangu, M. and Cross, G., 2013. *Increasing downstream value adding in PNG's forest and wood products industry*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/publication/FR2013-18

Page, T., Lata, A., Jeffrey, G., Yelu, W., Rollinson, S., Howcroft, N., Kulang, S., Waldi, D., Zamang, L., Rabbi, J., Vinarut, I., Famiok, S., Spencer, D., Rome, G., Oa, L. and Graham, V., 2016. Development of a PNG timber industry based on community-based planted forests: design and implementation of a national germplasm delivery system. *ACIAR Final Reports No. FR2016-18*. Canberra, Australian Centre for International Agricultural Research**:** 87 pp.

Pamphilon, B., Mikhailovich, K., Simeon, L. and Chambers, B., 2013. 'Two-way learning: key gender lessons from participatory community workshops with smallholders in the Baiyer Valley and Kerevat areas of Papua New Guinea',in *Socioeconomic agricultural research in Papua New Guinea. ACIAR Proceedings No. 141*, Australian Centre for International Agricultural Research, Canberra, pp. 103-114.

Parliament of Australia, 1992. *Review of the Australian Centre for International Agricultural Research: a report of the Joint Committee on Foreign Affairs, Defence and Trade*, Australian Government Publishing Service, Canberra. Available at: http_www.aphref.aph.gov.au_house_committee_reports_1992_1992_pp100

Pattanayak, S. K., Mercer, D. E., Sills, E. and Yang, J.-c., 2003. Taking stock of agroforestry adoption studies, *Agroforestry Systems,* **57**(3): 173-186. Available at: http://dx.doi.org/10.1023/A:1024809108210

Patton, M. Q., 1994. Developmental Evaluation, *Evaluation Practice,* **15**(3): 311-319. Available at: 10.1177/109821409401500312

Patton, M. Q., 1996. A World Larger than Formative and Summative, *Evaluation Practice,* **17**(2): 131-144. Available at: 10.1177/109821409601700205

Patton, M. Q., 2011. *Developmental Evaluation: applying complexity concepts to enhance innovation and use*, The Guildford Press, New York, USA.

Patton, M. Q., 2012a. *Essentials of utilisation-focussed evaluation (4th ed.)*, Sage Publications Thousand Oaks, USA.

Patton, M. Q., 2012b. A utilization-focused approach to contribution analysis, *Evaluation,* **18**(3): 364-377. Available at: 10.1177/1356389012449523

Patton, M. Q., 2014. *Qualatative Research and Evaluation Methods 4th ed*, Sage Publications, Los Angeles.

Pawson, R., 2013. *The Science of Evaluation: A Realist Manifesto*, SAGE Publications Ltd, London.

Pawson, R. and Tilley, N., 1997. *Realistic Evaluation*, Sage, London, United Kingdom.

Pawson, R. and Tilley, N., 1998. Caring Communities, Paradigm Polemics, Design Debates, *Evaluation,* **4**(1): 73-90. Available at: 10.1177/13563899822208400

Pearce, D., 2010. *Lessons learned from past ACIAR impact assessments, adoption studies and experience*, Australian Centre for International Agricultural Research, Canberra. Available at: https://www.aciar.gov.au/node/10196.

Pearce, D. and Alford, A., 2015. *Adoption of ACIAR project outputs 2015*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/publication/as012

Pearce, D., Jilani, A. and Templeton, D., 2013a. *Adoption of ACIAR project outputs 2013* Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/files/adoption_2013-web.pdf

Pearce, D., Jilani, A. and Templeton, D., 2013b. *Adoption of ACIAR project outputs 2013*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/publication/AS010

Perdana, A. and Roshetko, J. M., 2015. Survival Strategy: Traders of Smallholder Teak in Indonesia, *International Forestry Review,* **17**(4): 461-468. Available at: 10.1505/146554815817476477 (accessed 2016/07/17).

Persson, R., 2000. Assistance to forestry": what have we learnt?, *International Forestry Review,* **21**(3): 218-224.

Phi, H. H., Harwood, C., Beadle, C., Nambiar, S., Pinyopusarek, K., Vu, D. H., Dang, T. T., Pham, X. D. and Trieu, T. H., 2009. *Sustainable and profitable development of acacia plantations for sawlog production in Vietnam: Unpublished report from AusAID's Collaboration for Agriculture and Rural Development (CARD) program - Project Number: 032/05 VIE*,

Phimmavong, S., Ozarska, B., Midgley, S. and Keenan, R., 2009. Forest and Plantation Development in Laos: History, Development and Impact for Rural Communities, *International Forestry Review,* **11**(4): 501-513. Available at: 10.1505/ifor.11.4.501 (accessed 2015/05/29).

Phuc, X. T. and Canby, K., 2011. *Vietnam: Overview of Forest Governance and Trade*, European Forest Institute, Kuala Lumpur. Available at: http://www.euflegt.efi.int/documents/10180/23308/Baseline%20Study%203,%20Vietnam

Picciotto, R., 2013. The logic of development effectiveness: Is it time for the broader evaluation community to take notice?, *Evaluation,* **19**(2): 155-170. Available at: 10.1177/1356389013483715

Pinto, J. K. and Mantel, S. J., 1990. The causes of project failure, *IEEE Transactions on Engineering Management,* **37**(4): 269-276. Available at: 10.1109/17.62322

Pistorius, T., 2012. From RED to REDD+: the evolution of a forest-based mitigation approach for developing countries, *Current Opinion in Environmental Sustainability,* **4**(6): 638-645. Available at: http://dx.doi.org/10.1016/j.cosust.2012.07.002

Pollock, L. J., Thuiller, W. and Jetz, W., 2017. Large conservation gains possible for global biodiversity facets, *Nature,* **546**(7656): 141-144. Available at: 10.1038/nature22368

Pramono, A. A., Fauzi, M. A., Widyani, N., Heriansyah, I. and Roshetko, J. M., 2011. *Managing smallholder teak plantations: Field guide for farmers*, Center for International Forestry Research (CIFOR), Bogor, Indonesia. Available at: http://www.cifor.org/library/3493/managing-smallholder-teak-plantations-field-guide-for-farmers/

Purnomo, H., Achdiawan, R., Melati, Irawati, R. H., Sulthon, Shantiko, B. and Wardell, A., 2014. Value-chain dynamics: strengthening the institution of small-scale furniture producers to improve their value addition, *Forests, Trees and Livelihoods,* **23**(1-2): 87-101. Available at: 10.1080/14728028.2013.875279 (accessed 2015/02/21).

Putzel, L., Dermawan, A., Moeliono, M. and Trung, L. Q., 2012. Improving Opportunities for Smallholder Timber Planters in Vietnam to Benefit from Domestic Wood Processing, *International Forestry Review,* **14**(2): 227-237. Available at: 10.1505/146554812800923435 (accessed 2014/12/30).

Raitzer, D. A., 2003. *Benefit-cost meta-analysis of investment in Intenational Agricultural Research Centres of the CGIAR*, Food and Agricultural Organisation of the United Nations, Rome. Available at: https://ispc.cgiar.org/benefit-cost-meta-analysis-investment-international-agricultural-research-centres-cgiar

Raitzer, D. A., 2010. Assessing the Impact of Policy-Oriented Research: The Case of CIFOR's Influence on the Indonesian Pulp and Paper Sector, *World Development,* **38**(10): 1506-1518. Available at: 10.1016/j.worlddev.2010.03.008

Raitzer, D. A. and Lindner, R., 2005. *Review of the returns to ACIAR's bilateral R & D investments*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/publication/ias035

Raitzer, D. A. and Norton, G. W., 2009. *Prioritizing agricultural research for development: experiences and lessons*, CAB International, Wallingford, United Kingdom.

Rebien, C. C., 1997. Development Assistance Evaluation and the Foundations of Program Evaluation, *Evaluation Review,* **21**(4): 438-460. Available at: 10.1177/0193841x9702100402

Roche, C., 2000. Impact assessment: Seeing the wood and the trees, *Development in Practice,* **10**(3-4): 543-555. Available at: 10.1080/09614520050116703 (accessed 2012/05/27).

Rocheleau, D. E. 1991. Participatory research in agroforestry: learning from experience and expanding our repertoire. *Agroforestry Systems* **15**(2): 111-137.

Rogers, P. J., 2008. Using Programme Theory to Evaluate Complicated and Complex Aspects of Interventions, *Evaluation,* **14**(1): 29-48. Available at: 10.1177/1356389007084674

Rogers, P. J. and Weiss, C. H., 2007. Theory-based evaluation: Reflections ten years on: Theory-based evaluation: Past, present, and future, *New Directions for Evaluation,* **2007**(114): 63-81. Available at: 10.1002/ev.225

Rohadi, D., Roshetko, J., Perdana, A., Blyth, M., Nuryartono, N., Kusumowardani, N., Pramono, A., Widyani, N. and Fauzan, A., 2012. *Improving economic outcomes for smallholders growing teak in agroforestry systems in Indonesia*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/publication/fr2012-11

Roshetko, J. M., Rohadi, D., Perdana, A., Sabastian, G., Nuryartono, N., Pramono, A. A., Widyani, N., Manalu, P., Fauzi, M. A., Sumardamto, P. and Kusumowardhani, N., 2013. Teak agroforestry systems for livelihood enhancement, industrial timber production, and environmental rehabilitation, *Forests, Trees and Livelihoods,* **22**(4): 241-256. Available at: 10.1080/14728028.2013.855150 (accessed 2013/12/26).

Ross, L. A., 1988. Collaborative research for more effective foreign assistance, *World Development,* **16**(2): 231-236. Available at: http://dx.doi.org/10.1016/0305-750X(88)90138-6

Russell-Smith, J., Hill, G., Djoeroemana, S. and Myers, B., 2000. *Fire and sustainable agricultural and forestry development in Eastern Indonesia and Northern Australia. Proceedings of an international workshop held at Northern Territory University, Darwin, Australia,13–15 April 1999 Canberra*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/publication/pr091

Ryan, J. G. e., 1987. *Building on success: agricultural research, technology, and policy for development*, Australian Centre for International Agricultural Research, Canberra. Available at: http://aciar.gov.au/publication/tr007

Sachs, J., 1999. Sachs on development: Helping the world's poorest *The Economist* **352**: 17-20. Available at: Retrieved from https://search-proquest-com.virtual.anu.edu.au/docview/224067222?accountid=8330

Saulei, S. and Aruga, J. A., 1994. The status and prospects of non-timber forest products in Papua New Guinea, *Commonwealth Forestry Review,* **73**(2): 97-105.

Schein, E. H., 2004. Oganisational Culture and Leadership, John Wiley & Sons, San Francisco, California.

Schröder, S., Welter, F., Leisten, I., Richert, A. and Jeschke, S., 2014. Research performance and evaluation—Empirical results from collaborative research centers and clusters of excellence in Germany, *Research Evaluation,* **23**(3): 221-232. Available at: 10.1093/reseval/rvu010

Shearman, P. L., Ash, J., Mackey, B., Bryan, J. E. and Lokes, B., 2009. Forest Conversion and Degradation in Papua New Guinea 1972–2002, *Biotropica,* **41**(3): 379-390. Available at: 10.1111/j.1744-7429.2009.00495.x

Shepherd, K. R., 1985. Forestry research within the Australian Centre for International Agricultural Research, *Australian Forestry,* **48**(2): 77-78. Available at: 10.1080/00049158.1985.10674426 (accessed 2014/06/10).

Sikor, T., 2006. Analyzing community-based forestry: Local, political and agrarian perspectives, *Forest Policy and Economics,* **8**(4): 339-349. Available at: https://doi.org/10.1016/j.forpol.2005.08.005

Sillitoe, P., 2014. Local perceptions of forest, conservation and logging in Papua New Guinea, *Revue d'ethnoécologie,* **6**. Available at: 10.4000/ethnoecologie.1905

Simpson, R. and Gill, R., 2007. Design for development: a review of emerging methodologies, *Development in Practice,* **17**(2): 220-230. Available at: 10.1080/09614520701195964 (accessed 2014/12/28).

Springer-Heinze, A., Hartwich, F., Henderson, J. S., Horton, D. and Minde, I., 2003. Impact pathway analysis: an approach to strengthening the impact orientation of agricultural research, *Agricultural Systems,* **78**(2): 267-285. Available at: 10.1016/s0308-521x(03)00129-x

Stame, N., 2010. What Doesn't Work? Three Failures, Many Answers, *Evaluation,* **16**(4): 371-387. Available at: 10.1177/1356389010381914

Stern, E., Stame, N., Mayne, J., Forss, K., Davies, R. and Befani, B., 2012. *Broadening the Range of Designs and Methods for Impact Evaluations*, Department of International Development London, United Kingdom. Available at: https://www.gov.uk/government/publications/broadening-the-range-of-designs-and-methods-for-impact-evaluations-working-paper-38

Stufflebeam, D. L. and Shinkfield, A. J., 2007. *Evaluation Theory, Models, and Applications.*, Jossey-Bass, San Francisco, CA.

Sullivan, H. and Stewart, M., 2006. Who Owns the Theory of Change?, *Evaluation,* **12**(2): 179-199. Available at: 10.1177/1356389006066971

Suyanto, S., Pandu Permana, R., Khususiyah, N. and Joshi, L., 2005. Land tenure, agroforestry adoption, and reduction of fire hazard in a forest zone: A case study from Lampung, Sumatra, Indonesia, *Agroforestry Systems,* **65**(1): 1-11. Available at: http://dx.doi.org/10.1007/s10457-004-1413-1

Tarigan, M., Roux, J., Van Wyk, M., Tjahjono, B. and Wingfield, M. J., 2011. A new wilt and die-back disease of Acacia mangium associated with Ceratocystis manginecans and C. acaciivora sp. nov. in Indonesia, *South African Journal of Botany,* **77**(2): 292-304. Available at: http://dx.doi.org/10.1016/j.sajb.2010.08.006

Thangata, P. H. and Alavalapati, J. R. R., 2003. Agroforestry adoption in southern Malawi: the case of mixed intercropping of Gliricidia sepium and maize, *Agricultural Systems,* **78**(1): 57-71. Available at: http://dx.doi.org/10.1016/S0308-521X(03)00032-5

Tribe, D. E., 1994. *Feeding and Greening the World: the role of international agricultural research*, CAB International, Wallingford, UK.

Tsujino, R., Yumoto, T., Kitamura, S., Djamaluddin, I. and Darnaedi, D., 2016. History of forest loss and degradation in Indonesia, *Land Use Policy,* **57**: 335-347. Available at: http://doi.org/10.1016/j.landusepol.2016.05.034

Turia, R., Kaip, D. and Duega, F., 2011. 'Papua New Guinea',in Morehead, A. (ed) *Forests of the Pacific islands: Foundation for a sustainable future*, Secretariat of the Pacific Community, pp. 29-36.

Turnbull, J. W., 1991. *Advances in tropical acacia research*, Australian Centre for International Agricultural Research, Bangkok, Thailand. Available at: http://aciar.gov.au/files/node/2222/pr35_pdf_92924.pdf

Turnbull, J. W., 2003. *Eucalypts in Asia. Proceedings of an international conference held in Zhanjiang, People's Republic of China, 7-11 April 2003*, Australian Centre for Interenational Agriculture, Canberra.

Turnbull, J. W., 2007. *Development of sustainable forestry plantations in China: a review*, Australian Centre for International Agriculture, Canberra. Available at: http://aciar.gov.au/publication/ias045

Turnbull, J. W., Crompton, H. R. and Pinyopusarerk, K., 1988a. *Recent developments in acacia planting. Proceedings of an international workshop held in Hanoi, Vietnam, 27-30 October 1997*, Australian Centre for International Agricultural Research, Available at: http://aciar.gov.au/publication/pr082

Turnbull, J. W., Midgley, S. J. and Cossalter, C., 1988b. 'Tropical acacias planted in Asia: an overview',in Turnbull, J. W., Crompton, H. R. and Pinyopusarerk, K. (eds), *Recent developments in acacia planting. ACIAR Proceedings No. 82*, Australian Centre for International Agricultural Research, Canberra, pp. 14-28.

Turpin, T., Woolley, R. and Garrett-Jones, S., 2011. Cross-sector research collaboration in Australia: the Cooperative Research Centres Program at the crossroads, *Science and Public Policy,* **38**(2): 87-97. Available at: 10.3152/030234211X12924093660354

Ulnicane, I., 2015. Why do international research collaborations last? Virtuous circle of feedback loops, continuity and renewal, Science and Public Policy, 42(4): 433-447. Available at: 10.1093/scipol/scu060

UNDP, 2016. *Human Development Report*, New York. Available at: http://hdr.undp.org/sites/default/files/HDR2016_EN_Overview_Web.pdf

United-Nations, 1992. *Non-legally binding authoritative statement of principles for a global consensus on the management, conservation and sustainable development of all types of forests*, New York. Available at: http://www.un.org/documents/ga/conf151/aconf15126-3annex3.htm

United-Nations, 2007. *Non-legally binding instrument on all types of forests*, United Nations General Assembly, New York. Available at: https://documents-dds-ny.un.org/doc/UNDOC/GEN/N07/469/65/PDF/N0746965.pdf?OpenElement

United-Nations, 2015. *Transforming our world: the 2030 Agenda for Sustainable Development*, United Nations General Assembly, New York. Available at: http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E

van Bueren, M., 2004a. *Acacia hybrids in Vietnam*, Australian Centre for International Agricultural Research, Canberra. Available at: https://www.aciar.gov.au/node/8511

van Bueren, M., 2004b. *Eucalypt tree improvement in China*, Australian Centre for International Agricultural Research, Canberra. Available at: https://www.aciar.gov.au/node/8611

van Kerkhoff, L. and Berry, H., 2016. Serving the public good: Empirical links between governance and research investment in the context of global environmental change, *Ecological Economics,* **125**: 101-107. Available at: https://doi.org/10.1016/j.ecolecon.2015.06.005

van Kerkhoff, L. and Lebel, L., 2006. 'Linking knowledge and action for sustainable development',in *Annual Review of Environment and Resources*, Vol. 31, Annual Reviews, Palo Alto, pp. 445-477.

Viranamangga, R., Palmer, G. and Glencross, K., 2012. Plantation-Grown Whitewood Timber in Vanuatu: Challenges and Opportunities for Export and Domestic Use, *International Forestry Review,* **14**(4): 486-491. Available at: 10.1505/146554812804715847 (accessed 2014/12/30).

Wallace, H. M., Poienou, M., Randall, B. and Moxon, J., 2010. Postharvest cracking and testa removal methods for Canarium indicum nuts in the Pacific, *Acta Horticulturae,* **Vol. 880**: 155-159. Available at: http://research.usc.edu.au/vital/access/manager/Repository/usc:6466?exact=sm_creator%3A%22Wallace%2C+H+M%22

Weißhuhn, P., Helming, K. and Ferretti, J., 2017. Research impact assessment in agriculture—A review of approaches and impact areas, *Research Evaluation*: rvx034-rvx034. Available at: 10.1093/reseval/rvx034

Wells, M. P., Alderman, C. and Stephanie., A., 2011. *An Evaluation of the Impacts of Selected Activities Supported by the Program on Forests: PROFOR Evaluation Series: Impact Note 1*, Program on Forests (PROFOR), Washington DC. Available at:

http://documents.worldbank.org/curated/en/368071468157791641/An-evaluation-of-the-impacts-of-selected-activities-supported-by-the-program-on-forests

Westoby, J. C., 1979. Forest industries for socio-economic development, *Commonwealth Forestry Review,* **58**(2): 107-116.

Westoby, J. C., 1987. *The Purpose of Forests*, Basil Blackwell Ltd, Oxford, UK.

Westoby, J. C., 1989. *Introduction to World Forestry*, Basil Blackwell Ltd, Oxford, UK.

White, H., 2010. A Contribution to Current Debates in Impact Evaluation, *Evaluation,* **16**(2): 153-164. Available at: 10.1177/1356389010361562

Wibowo, L. R., Race, D. H. and Curtis, A. L., 2013. Policy Under Pressure: Policy Analysis of Community-Based Forest Management in Indonesia, *International Forestry Review,* **15**(3): 398-405. Available at: 10.1505/146554813807700065 (accessed 2014/12/30).

Wimbush, E., Montague, S. and Mulherin, T., 2012. Applications of contribution analysis to outcome planning and impact evaluation, *Evaluation,* **18**(3): 310-329. Available at: 10.1177/1356389012452052

Wingfield, M. J., Slippers, B., Hurley, B. P., Coutinho, T. A., Wingfield, B. D. and Roux, J., 2008. Eucalypt pests and diseases: growing threats to plantation productivity, *Southern Forests: a Journal of Forest Science,* **70**(2): 139-144. Available at: 10.2989/SOUTH.FOR.2008.70.2.9.537 (accessed 2015/04/25).

Woolley, R., Sánchez-Barrioluengo, M., Turpin, T. and Marceau, J., 2015. Research collaboration in the social sciences: What factors are associated with disciplinary and interdisciplinary collaboration?, Science and Public Policy, 42(4): 567-582. Available at: 10.1093/scipol/scu074

Yalegama, S., Chileshe, N. and Ma, T., 2016. Critical success factors for community-driven development projects: A Sri Lankan community perspective, *International Journal of Project Management,* **34**(4): 643-659. Available at: https://doi.org/10.1016/j.ijproman.2016.02.006

Yin, R. K., 2009. *Case Study Research: Design and Methods 4th ed*, Sage Publications, Los Angeles.

Yin, R. K. and Davis, D., 2007. Adding new dimensions to case study evaluations: The case of evaluating comprehensive reforms, *New Directions for Evaluation,* **2007**(113): 75-93. Available at: 10.1002/ev.216

Zethner, O., 1973. Assistance to agricultural scientists in the third world: a neglected field, *World Development,* **1**(12): 53-55. Available at: http://dx.doi.org/10.1016/0305-750X(73)90112-5

Zoomers, A., 2005. Three decades of rural development projects in Asia, Latin America, and Africa: Learning from successes and failures, *International Development Planning Review,* **27**(3): 271-296. Available at: http://search.proquest.com/docview/233326956?accountid=8330

Appendix 1: Interview protocols

A) Interview questions.

1. General questions

What ACIAR projects have you been involved with?

What other donor funded projects have you been involved with?

What do you think about the approach that ACIAR uses for its research projects?

What are the benefits that have come from working with ACIAR projects?

What are the benefits of this approach compared to other donor project approaches?

What do you think constitutes success for an ACIAR project?

What do you think are the 5 most important factors that contribute to project success?

What do you think are the 5 most important factors that result in less successful projects?

2. Questions repeated for each project that a participant was involved with

What was your role in this ACIAR project?

What were the main outputs from this project?

What outcomes have occurred as a result of the outputs from the project?

What do you think the main impacts have been from the project?

How successful do you think the project was on a scale of 1 to 10, where 10 is most successful?

Why do you think the project was successful or not successful?

What do you remember as the most important aspects of the project's design that contributed to how well the project went?

What do you think were the most important aspects of the project's implementation that contributed to how well the project went?

Are there any factors related to the project's operating environment that were outside the control of the project that either assisted or limited the success of the project?

What do you think are the most important aspects that affected the adoption of project outputs during the project?

What factors do you think have influenced the degree to which the research results have been adopted since the project was completed?

Now that the project is completed, are there any things that you think should have been done differently which might have led to the project achieving better results?

B) Interview Participant Information Sheet[1]

Researcher: My name is Mr Tony Bartlett and I am undertaking postgraduate study for a PhD through the Fenner School of Environment and Society at the Australian National University. My research is being conducted as a PhD scholar rather than as part of my employment as ACIAR's Forestry Research Program Manager. ACIAR has provided funding to support my travel to PNG, but it is not funding the research and the data will be analysed independently by me as a PhD scholar.

Project Title: "Implementing collaborative forest research projects in developing countries: an evaluation of factors that contribute to success in ACIAR projects."

General Outline of the Project:
This research aims to understand what factors lead to successful collaborative forestry research projects in developing countries, in terms of achieving planned objectives and outputs and generating positive and enduring outcomes and impacts. I am conducting this research to help improve the effectiveness of collaborative forestry research projects and to provide information about the sorts of factors that contribute to project success in different situations. I am conducting this research as a series of case studies. The first case study involves analysing 10 of the completed ACIAR forestry projects in PNG. The methodology involves analysing the project records that exist at ACIAR and then conducting interviews to verify the findings from my analysis of records. I intend to interview 30-40 people who were involved in the projects or who have knowledge about the way that the research results have been used.

Participant Involvement: The following information can be used to help you decide whether or not to participate in my research project:
Voluntary Participation & Withdrawal: Participation in the research is **voluntary.** You may, without any penalty, decline to take part or withdraw from the research at any time without providing an explanation, or refuse to answer a question. If you do agree to participate but later decide that you want to withdraw, the data collected from you will be destroyed.

What will you have to do? I will interview you for about one hour or perhaps a bit longer if you have been involved in multiple projects. During the interview, you will be asked a series of standard questions regarding different aspects that may contribute to more or less successful projects. Your responses will be recorded on a digital recorder to enable them to be properly transcribed for analysis. Digital recordings will only be used with your consent. Otherwise I will make written notes of your responses. You will be offered the option of checking my transcript of your interview. If you have any concerns after the interview, please contact me or my supervisor at ANU.

Use of Data and Feedback: The information collected from the interviews will be analysed to corroborate and supplement the findings from my academic analysis of ACIAR's project records. The data on factors that contribute to greater or lesser success will be aggregated in the case study reports. I do not intend to identify you as having provided any particular responses or to use the information for any other purpose related to my normal ACIAR work. The PhD thesis will utilise the four case study publications. You will be given a summary of the findings of the relevant case study and each case study will be published in an academic journal. Briefings will be given to ACIAR on the generic findings from the study.

[1] To be adjusted for the relevant case study country

Incentives: Participation is voluntary without any payments for your participation in an interview.

Implications of Participation: The specific information obtained from you will only be used to improve the understanding of what makes some collaborative forestry research projects more successful than others. It is not intended to use information from the interview about any adverse aspects of project implementation to take action against individuals. If you want ACIAR to follow up a particular issue, then you will need to formally raise it separately with the ACIAR Country Manager or the ACIAR Director of Country Programs.

Confidentiality:

The information you provide will be treated confidentially as far as the law allows. It will only be accessible by me and the academics who are supervising my study and not be shared with ACIAR. Your privacy will be protected as far as possible, by assigning code numbers to each interview data set rather than using names. If it is necessary in research reports to discuss information from particular participants they will be assigned identifiers (i.e. Participant A or a position title). Confidential information will only be used in ways that have been previously agreed with you. All interview code numbers and our contact details will be stored securely and separately from the interview data.

Data Storage:

Data management procedures will be in accordance with the ANU Policy for Responsible Practice of Research and the privacy requirements of the Commonwealth Privacy Act, 1988. The data will be stored on an ACIAR computer, with backup storage on the ACIAR server and an ANU Fenner School computer, all of which are password protected. The research data will be retained for at least five years after the completion of the research and publication of related articles and then if no longer needed it will be destroyed.

Queries and Concerns:

Contacts for More Information: For any queries on the study please contact the researcher or supervisor. If you have a concern about this research please contact my ANU supervisor. The researcher's contacts are: Tony.Bartlett@anu.edu.au or phone +61 419496579. The supervisor's contacts in Australia are: Dr Lorrae van Kerkhoff – lorrae.vankerkhoff@anu.edu.au or phone + 61 2 6125 2748.

Contacts for ACIAR Issues: To separately follow up an issue with ACIAR, the contact person in PNG is the ACIAR Country Manager, Ms Emily Flowers. Her contacts are (emily.flowers@aciar.gov.au) or phone +84 903 406 102. The ACIAR Director of Country Programs is Dr Peter Horne. His contact is: peter.horne@aciar.gov.au

Ethics Committee Clearance:

The ethical aspects of this research have been approved by the ANU Human Research Ethics Committee. If you have any concerns or complaints about how this research has been conducted, please contact:

Ethics Manager
The ANU Human Research Ethics Committee
The Australian National University
Telephone: +61 2 6125 3427
Email: Human.Ethics.Officer@anu.edu.au

C) Email sent to potential interviewees

Participation in PhD research into ACIAR forestry projects

My name is Mr Tony Bartlett and I am undertaking part time study for a PhD through the Fenner School of Environment and Society at the Australian National University.

The title of my PhD research is "Implementing collaborative forest research projects in developing countries: an evaluation of factors that contribute to success in ACIAR projects." The details of this research are summarised in the attached participant information sheet. This research is independent from my work role as ACIAR's Forestry Research Program Manager. I have selected you as a possible participant in the interview process, because I can see from the project records that you have good knowledge about one or more of the ten projects that I am studying. The research will certainly be enriched through these interviews, because in some cases the project records do not tell me much about some of the possible success factors. However, your participation in this research process is entirely voluntary, so if you do not wish to participate in an interview with me that will not be any problem for me.

The questions in the interview will cover topics such as: the approach ACIAR uses in its projects; the factors that make projects more or less successful; the achievements of a particular ACIAR project; and factors related to its design, implementation and wider operating environment that you think may have contributed to its success. I will also ask some questions related to the preliminary findings from my analysis of project records to test whether or not my interpretations are right.

I will be travelling to Vietnam for two weeks from 11-24 March 2014. If you are willing to be a participant in my research interviews, then I would like to make an appointment with you to conduct the interview. I expect that each interview would take about one hour. Most of these interviews can be done during the ACACIA 2014 Conference in Hue, but some may be done in Hanoi.

To help me prepare the logistics for these interviews in Vietnam, could you please respond via email to me (tony.bartlett@anu.edu.au) or through my ACIAR email by Wednesday 5th March 2014.

Thanking you in advance

Tony Bartlett