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International Agricultural Research

An evaluation of the ACIAR Transformative Agriculture and Enterprise Development Program



2

ACIAR OUTCOME
EVALUATION SERIES

An evaluation of the ACIAR Transformative Agriculture and Enterprise Development Program

Clare Hanley and Luke Passfield
Alinea International



2022

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

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Foreword

This report is the second in a new series of reports that are based on outcome evaluations of research programs supported by the Australian Centre for International Agricultural Research (ACIAR). ACIAR initiates, brokers, funds and manages international research partnerships between scientists from Australia and partner countries in the Indo-Pacific region to improve the productivity and sustainability of agriculture, fisheries and forestry for smallholder farmers.

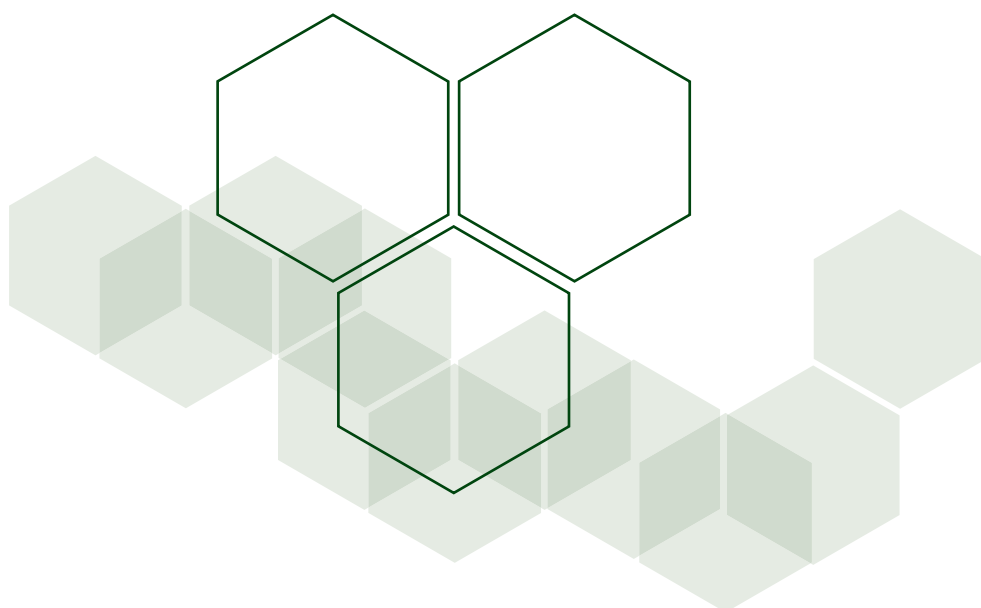
As a learning organisation, ACIAR is committed to understanding the diverse outcomes delivered by the research collaborations we develop, to demonstrate the value of investment of public funds, to inform research design and to boost the capacity of our research to improve the lives of farming communities in partner countries. An important mechanism for achieving our aims is to work closely with the wider Australian aid program to transition promising research into better agricultural practices and more profitable enterprises at scale.

This report presents a suite of evaluations of the Transformative Agriculture and Enterprise Development Program (TADEP), co-funded by the Department of Foreign Affairs and Trade (DFAT) and ACIAR from 2015 to 2021. The program was an opportunity for the 2 agencies to promote agricultural development in Papua New Guinea by leveraging a foundation of strong scientific research. It focused on opportunities to scale up successful innovations from previous ACIAR projects focused on cocoa, galip nut and sweetpotato, as well as a project developing extension methodology through the family farm teams approach. The program was also an opportunity to engage the private sector, expanding reach of the projects over larger areas and to more people. The DFAT and ACIAR investment sought to deliver efficiencies and co-benefits by linking a group of 5 projects into a programmatic structure.

The evaluations ultimately seek to understand the value that this programmatic structure delivered and identify lessons for future research-for-development investments. To inform these insights, a series of project-level outcome evaluations were conducted to see how the funded projects contributed to short-term development outcomes. Outcome evaluations adopt a largely qualitative, theory-based approach and seek to empirically test project logic and underpinning assumptions. These outcome evaluations are also intended to generate data for cross-case analysis that, over time, will help us to improve our research-for-development practice.



Andrew Campbell
Chief Executive Officer, ACIAR



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Part 2: PNG cocoa project

An evaluation of the ACIAR Transformative Agriculture and Enterprise Development Program Papua New Guinea cocoa project

Abbreviations and acronyms

ACIAR	Australian Centre for International Agricultural Research
ASLP	Agriculture Sector Linkages Program
CB	Cocoa Board
CCI	Cocoa Coconut Institute Limited
CMFT	Cocoa Model Farmer Trainer
CRG	Collaborative Research Grant
DAL	Department of Agriculture and Livestock
DFAT	Department of Foreign Affairs and Trade (Australia)
DPI	Divisions of Primary Industries
FFT	Family Farm Teams
PNG	Papua New Guinea
REDS	Research, Extension and Development Services (within PNG Cocoa Board)
TADEP	Transformative Agriculture and Enterprise Development Program
UNRE	University of Natural Resources and Environment

Acknowledgements

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Summary

From 2015 to 2021, the Australian Centre for International Agricultural Research (ACIAR) oversaw the Transformative Agriculture and Enterprise Development Program (TADEP), which was a multidisciplinary research program that aimed to improve the livelihoods of rural men and women in Papua New Guinea (PNG). The program involved 5 research-for-development projects: PNG cocoa, Bougainville cocoa, galip nut, sweetpotato and Family Farm Teams.

This project evaluation focuses on 'Enterprise-driven transformation of family cocoa production in East Sepik, Madang, New Ireland, and Chimbu provinces of Papua New Guinea' (HORT/2014/096), commonly known as the PNG cocoa project. The project ran from March 2016 to March 2021.

The overarching aim of the PNG cocoa project was to foster enterprise-driven transformation and increased production and profitability of smallholder cocoa farmers in East Sepik, Madang, New Ireland, and Chimbu provinces of PNG, working with families through village extension workers, called Cocoa Model Farmer Trainers (CMFTs). The project aimed to develop a small business model of cocoa farming and related enterprises that is self-sustaining and viable as a livelihood for families, and particularly youth, by supporting farmers to establish themselves as profitable CMFTs who generate income through a mix of cocoa-related enterprises and provision of paid advisory services to farmers.

The project focused on facilitating capacity development of farming families by disseminating knowledge and resources through CMFTs to their networks of farmers, including introducing new cocoa varieties and management practices to increase cocoa yields and profitability.

The project sought to achieve 3 objectives:

1. To foster the development of profitable, self-supporting, village-based cocoa extension and other services as micro-enterprises supported by financial institutions, commercial cocoa buying and supply companies, and existing research and extension services.
2. To introduce and evaluate on farms, with farmer participation led by village extension workers, transformative new cocoa cultivars and cocoa selection, propagation, production and post-harvest methods.
3. To introduce and evaluate on farms, with farmer participation led by village extension workers, options for development of new cocoa farming systems integrating food crops, livestock and high-value shade and other tree crops.

The project also aimed to increase the involvement of women in cocoa and non-cocoa farming, which is intended to both benefit cocoa management as well as improve women's economic empowerment. This has been supported through delivery of training on sustainable livelihoods by the PNG University of Natural Resources and Environment (UNRE), the integration of Family Farm Teams (FFT) training modules promoting family-centred approaches to farming management, and by introducing crop diversification and small livestock husbandry practices alongside cocoa, which are more conducive to women's participation.

The PNG cocoa project was led by LaTrobe University, working in partnership with the Curtin University, the UNRE, and the Cocoa and Coconut Institute Limited (CCI, later the Research, Extension and Development Services (REDS) section of the Cocoa Board of PNG). The budget for the project was A\$4,997,863.

This project evaluation is Part 2 of a suite of evaluations of TADEP, which assess the effectiveness of each of the 5 individual projects (Parts 2–6) and the lessons learned from the overall TADEP programmatic approach (Part 1).

A similar evaluation was conducted on the Agriculture Sector Linkages Program (ASLP) and is reported in ACIAR Outcome Evaluation No. 1.

A separate synthesis report, ACIAR Outcome Evaluation No. 3, will summarise lessons from the 2 ACIAR programs, ASLP and TADEP.

Key findings



What was the project's theory of change and how did this evolve during implementation?

The project did not fully develop a theory of change; however, it is clear there was an underlying strategy linking project activities with higher-level outcomes. The core assumption is that increased income from cocoa farming and related enterprises, and improved food security, could be achieved for farming families if farmers adopted improved farming practices and received support through village-based extension services. These village-based extension services would be linked with available government extension support at a provincial level. Given the limitations in availability of extension services provided by government, a further theory was that village-based extension services could become self-sustaining by developing income-generating enterprises based on increased production of cocoa and sale of cocoa-related products and advisory services.

The CMFT model has been demonstrated to be an appropriate extension model in most contexts in which the project was implemented, enabling outreach to remote farmers, and filling a gap in areas with limited access to formal extension services. There are indications this is leading to the adoption of improved cocoa farming practices among CMFTs and the farmers they support, and reinvigorating farmers' interest in the cocoa industry as planned. While many CMFTs have established small businesses related to cocoa farming, **the assumption that provision of cocoa-related products and advisory services would be an income-generating activity for CMFTs has not held true in many locations,** as cocoa farmers have often not been willing (or able) to pay for these services. Where nurseries have been successful, they have primarily supplied other government or donor-supported programs (that include funds to purchase planting materials), rather than supplying farmers directly. A number of stakeholders noted that this fee-for-service approach was unlikely to be viable in the PNG context. The project also anticipated developing stronger connections between CMFTs and private enterprise-linked advisory services for ongoing support. This would have helped the model to be more sustainable, but has not eventuated as planned, partly because company extension services are very limited. Finally, some stakeholders indicated that the project was initially designed for the lowland areas where cocoa was already an established crop, and project approaches could have been further adapted for highlands areas where cocoa farming is new.

Key findings (cont.)

2

What outcomes (intended and unintended) has the project achieved or contributed to?

The project has contributed to significant scientific achievements in establishing successful cocoa crops in areas previously considered un conducive to growing cocoa, namely highlands and grasslands regions. Evidence indicates next and final users adopted new knowledge and skills, including identifying seedlings best suited to specific growing conditions, cloning, propagation, and rehabilitating ageing trees. A key outcome was the success of cocoa trials in highlands regions, which demonstrated that cocoa could be grown up to 1,600 m above sea level, more than twice the altitude previously considered suitable for growing cocoa. This has sparked substantial interest from other highlands provinces, leading to the CMFT model being replicated in Western Highlands, Eastern Highlands and Hela province, with support of provincial governments.

The adoption of the CMFT model has achieved notable outcomes in building the capacity of cocoa farmers at the community level. While rigorous data is not yet available on the extent of adoption of new farming methods, nor the overall impact this has had, **project coordinators estimate about 50% of CMFTs have applied new methods learned**, and that farmers are adapting new practices and technologies to suit their specific contexts. Practices including field grafting, central and field nurseries and budwood garden establishment, and drying and fermentary techniques are reported to have been adopted most strongly, with anecdotal evidence from stakeholders suggesting **this has had a positive effect on enhancing cocoa production and renewing interest in cocoa**. Reports suggest some CMFTs have become effective trainers, have assisted the establishment of satellite farming groups, and have provided support to extension worker sites operated by other projects in several regions. However, issues of retention and engagement of CMFTs in some areas have undermined capacity building of cocoa farmers and adoption of new practices promoted through the project.

The project has shown intercropping cocoa plants with food crops and shade trees, such as galip nut, betel nut, coconut, and other palm and fruit trees, is an effective method for improving cocoa production. Reports indicate intercropping practices have been taken up by next users in several project sites, however there is limited evidence suggesting adoption by final users at this stage. **Trials of other new practices, namely integrating goat husbandry into cocoa farming systems, have produced mixed results**, with 2 initial goat colonies failing, and a third (in East Sepik) showing good potential. More effort is required to overcome persisting deficits in knowledge of goat husbandry, and to further explore the appropriateness and feasibility of goats and other small livestock husbandry in cocoa farming systems.

Reports indicate widespread adoption of cheaper alternatives to typically expensive technologies, for example, farmers using readily available local materials to develop more affordable alternatives to equipment such as budding knives and budding tape. **A key achievement has been the expansion in construction of solar dryers from cheap and locally available materials**, using UV resistant plastic film initially supplied by the project. CMFTs in some regions are reportedly supporting other villages and communities to construct solar dryers and assisting the establishment of successful wet bean buying and fermentary businesses using solar drying technologies. Limited support from the Cocoa Board (CB) to officially register solar dryers is delaying commencement of commercial operations, and further exploration of solar drying methods is required to improve their efficacy in all weather conditions.

While most cocoa farmers in Madang and East Sepik are not constrained by market linkages, the project has struggled to effectively foster market linkages for cocoa farmers in New Ireland. This issue, combined with the need for ongoing support for CMFTs and lack of formal commitment to the continuation of the CMFT model from the CB, mean that **overall sustainability of project achievements is uncertain**.



How did project activities and outputs contribute to the outcomes achieved?

A range of factors influenced the adoption of outputs and achievement of outcomes. **Trials of new cocoa hybrids and management practices directly contributed to achievements in demonstrating potential for growing cocoa in regions previously considered inhospitable**, namely in highlands and grasslands areas. Additionally, the participatory approach adopted through the project enabled the co-development of new practices and technologies with CMFTs, for example, solar dryers and cheaper budding equipment alternatives, which are better suited to local contexts and have been conducive to wide adoption among cocoa farmers.

The process for selecting CMFTs was a critical factor influencing their level of engagement and attrition and undermined the successful transfer of skills and knowledge in several areas. Although project reports indicate selection criteria were followed, several stakeholders felt this process was not sufficiently robust. In addition, beliefs held by farmers about the direct benefits they would receive for taking on the role of CMFT also influenced retention and success of CMFTs. Notably, the allowance system, and how this was communicated, proved to be problematic.

The absorption of CCI into the CB was a major challenge for the project, as many key personnel employed by CCI were not taken up by the CB. While the program transitioned to working with REDS within the CB as best as possible, the lack of resourcing of REDS had an ongoing impact. Within this context, the project played a vital role in bolstering the capacity of REDS to continue to provide extension services, in many cases providing the only source of operating budget for REDS extension staff. While staff within REDS worked hard to advocate internally for funding in this area, it remains to be seen whether this will be forthcoming.



What strategies were adopted to address gender equity and social inclusion and how effective were these?

The project employed 2 key strategies to enhance the engagement of women and youth in cocoa farming. The first was the integration of concepts around equity and involvement of women in CMFT training. This was done initially through the UNRE sustainable livelihoods training, and then through incorporation of the FFT approach through a TADEP Collaborative Research Grant (CRG). This promoted the concept of husband/wife farmer teams as community trainers of cocoa farmers, and introduced ideas on negotiating roles and shared control over resources within family units. Second, the project promoted cocoa management practices focused on 'light' work aimed to encourage greater involvement of women and youth. **Reports indicate an increase in the number of women participating in cocoa farming**, particularly through accompanying their husbands to CMFT training and adopting the FFT model on their cocoa blocks. It is unclear to what extent CMFTs have been sharing key concepts from the FFT training with other farmers. There is anecdotal evidence shared by project coordinators of women-led farming groups and cooperatives in some regions, but the evaluation team has not seen data on the extent of women's participation or the impact of this on women's economic empowerment.

Reports indicate young people have become more involved in cocoa production and this has had a positive impact both on young people and their communities. Increased involvement of youth has predominantly been from young men, and there is no evidence suggesting young women have been able to access the same opportunities to become involved in cocoa farming and related activities. As with other ACIAR projects included in this programmatic evaluation, development of a gender and social inclusion strategy and increased monitoring of outcomes for women and men would be beneficial.

Key findings (cont.)

5

How did management arrangements impact delivery of the project?

Management arrangements were reportedly strong overall. In particular, having a full-time project manager in-country, supported by a team of regional coordinators, was critical to supporting implementation of project activities. This project structure was key to enabling the project to continue operating throughout 2020 despite the impacts of COVID-19. As noted earlier, personnel changes following the absorption of CCI into the CB saw the departure of a number of key staff collaborating with the project, including the PNG country project manager and 3 key research staff. This also resulted in less support offered by CB for ACIAR projects, as well as a loss of expertise and skills available for project implementation. Diversion of project funds to cover operational costs of extension workers within REDS constrained funding available for project activities. Nevertheless, project coordinators were positive about what they had been able to achieve over the life of the project.

6

How well did the project align with and contribute to the overall goals of its umbrella program?

The project contributed to several of the objectives of the TADEP umbrella program, including:

- enhancing rural livelihoods through increasing agricultural productivity
- building individual and institutional capacity in agricultural research, development and extension
- promoting gender equality and women's empowerment in rural communities.

The main value-adds of being a part of the umbrella program for the PNG cocoa project included access to communication products produced by TADEP to help socialise the work of the projects with other stakeholders, and TADEP meetings, which were useful for encouraging collaboration and knowledge sharing across projects. Collaboration with the FFT project, supported by a CRG, was central to the project's approach to promoting greater inclusion of women and youth in project activities.

Stakeholders expressed mixed views about the utility of grouping the different projects under TADEP, with some suggesting greater value would have been derived from being grouped just with other cocoa projects, as this could have facilitated more focused knowledge sharing. Project staff highlighted the reporting load as burdensome and expressed doubts as to whether inputs into program-level reporting provided any value to the project. Having said that, some also found this useful as a precursor to preparing annual project reports.



Conclusion and lessons learned

The PNG cocoa project has generated important scientific knowledge and tested the viability of an extension services model designed to be largely independent of government support. This is an important achievement in a context where government-led extension continues to be under-resourced. Evidence of project outcomes to date indicate there has been an increase in interest and enthusiasm for cocoa farming in all 4 regions. However, the long-term sustainability of outcomes achieved is less certain, given CMFTs will require ongoing technical support and motivation from extension workers in some form, which cannot be assured beyond the end of the project.

Difficulties in facilitating linkages to markets and access to finance to support establishment of small cocoa-linked enterprises have constrained project impacts in terms of the extent to which improved cocoa yields have led to increased farmer incomes. Aspects of the CMFT model regarding provision of fee-for-service advisory support to farmers has also been problematic, although reports indicate a number of CMFTs have set up nurseries and solar dryers which are beginning to operate commercially.

Lessons learned

Key lessons learned through this project for future ACIAR programming include:

1. The CMFT model appears to be effective for supporting uptake of new and improved cocoa farming practices by many farmers. To overcome issues with retention and community tensions experienced in some areas, future projects should aim to better understand community and social structures and follow a more rigorous CMFT selection process.
2. Care should be taken to select appropriate incentives for CMFTs, with preference given to in-kind rather than monetary rewards. Any incentives should be clearly communicated to potential CMFTs and the broader community they will be operating in prior to their selection.
3. The participatory approach central to the project has proven valuable and should be encouraged. New practices and technologies co-developed with CMFTs, such as solar dryers, have proven effective as they are appropriate for local context and able to be adopted widely by farming families.
4. Potential for sustainability should always be a central issue that is assessed and explored as agricultural extension models are trialled and developed. This includes consideration of what level of ongoing support village extension workers require, and where this will come from. Given scepticism around the viability of a fee-for-service model of extension within the PNG context, it is unclear why this was included in the original design.
5. Articulation and implementation of a specific gender equality and social inclusion strategy would help projects improve gender equality outcomes. Monitoring and reporting against this strategy should form part of regular project reports so that there is greater oversight of this area.
6. Undertaking market analysis at the outset of projects, with a focus on potential barriers to market access, would be useful to identify risks to the achievement of project objectives. Conducting this analysis as part of project design processes would enable planning of approaches to address and overcome barriers and facilitate more active private sector engagement and market linkages throughout the project duration.
7. The project management structure for this project, including an in-country manager, and regional coordinators embedded within the CB, appears to be an effective model to support project implementation.

Introduction

Purpose, scope and audience

Since 1982, the Australian Centre for International Agricultural Research (ACIAR) has brokered and funded research partnerships between Australian scientists and their counterparts in developing countries. As Australia's specialist international agricultural research-for-development agency, ACIAR articulates its current mission as 'achieving more productive and sustainable agricultural systems, for the benefit of developing countries and Australia, through international agricultural research partnerships'. ACIAR receives a direct funding appropriation from the official development assistance budget, as well as contributions for specific initiatives from external sources including the Department of Foreign Affairs and Trade (DFAT).

From 2015 to 2021, ACIAR managed the Transformative Agriculture and Enterprise Development Program (TADEP) in Papua New Guinea (PNG). The program focused on opportunities to scale up successful innovations from previous ACIAR projects in PNG, with impetus provided by private sector involvement, over larger areas and for more people. It was expected to achieve economic benefits, especially increased employment and incomes in rural areas, and enhanced rural-urban supply chains. It worked in the sectors of greatest benefit to rural communities and had a particular focus on the empowerment of women and commodities that could be brought to market.

ACIAR commissioned project-level evaluations of the TADEP projects shown in Table 3 to identify lessons that will inform the design and implementation of future ACIAR projects and improve the quality of outcomes. These evaluations form Parts 2-6 of Outcome Evaluation 2.

Drawing on these project evaluations, the program-level evaluation (Outcome Evaluation 2, Part 1) includes an analysis of the program structure and the value-add from these management arrangements.

A similar evaluation has been undertaken for the ACIAR Agriculture Sector Linkages Program (ASLP) in Pakistan (Outcome Evaluation 1), and the ASLP and TADEP evaluations will be synthesised into a final report to outline common lessons from ACIAR programs (Outcome Evaluation 3).

This evaluation focuses on the commodity-specific PNG cocoa project.

Purpose

The project-level evaluation has 2 key purposes:

1. Compile performance information from each project under TADEP and investigate the contribution to specific project outcomes, with a particular focus on differential effects for women and men.
2. Generate project-level case studies for use in a qualitative cross-case analysis.

Table 3 Projects in TADEP

Program / Project	Project full name
PNG cocoa	Enterprise-driven transformation of family cocoa production in East Sepik, Madang, New Ireland and Chimbu provinces of Papua New Guinea
Bougainville cocoa	Developing the cocoa value chain in Bougainville
Sweetpotato	Supporting commercial sweetpotato production and marketing in the Papua New Guinea highlands
Galip Nut	Enhancing private sector-led development of the <i>Canarium</i> industry in Papua New Guinea
Family Farm Teams	Improving opportunities for economic development for women smallholders in rural Papua New Guinea

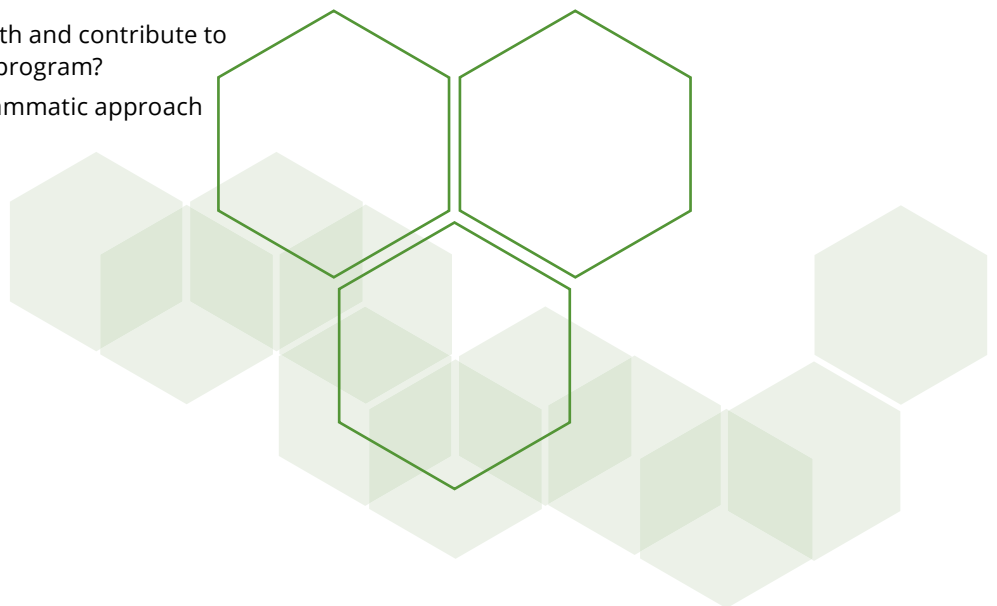
Scope

This project-level evaluation assesses 'Enterprise-driven transformation of family cocoa production in East Sepik, Madang, New Ireland, and Chimbu provinces of Papua New Guinea' (HORT/2014/096), known as the PNG cocoa project. It provides an assessment against the following key evaluation questions:

1. What was the project's theory of change and how did this evolve during implementation?
 - Was the theory of change appropriate to the project context and desired results?
2. What outcomes (intended and unintended) has the project achieved or contributed to?
 - What was the unique knowledge contribution of the project/cluster that was/is expected to influence practice/policy?
 - To what extent is there evidence of adoption of new practices based on research process and findings?
3. How did project activities and outputs contribute to the outcomes achieved?
 - To what extent and how did they differ from what was planned?
4. What strategies were adopted to address gender equity and social inclusion and how effective were these?
 - How did the project impact men and women differently?
5. How did management arrangements impact delivery of the project?
 - What other factors influenced project performance?
6. How well did the project align with and contribute to the overall goals of its umbrella program?
 - To what extent has the programmatic approach added value at project level?

Audiences

The primary audience for this project-level evaluation is ACIAR staff with direct responsibilities for programs and/or their constituent projects. This includes Canberra-based research program managers, and country network managers and coordinators.



Methodology

Data collection and analysis

Data was primarily drawn from existing project reports and reviews, supplemented by 8 semi-structured interviews with 9 key stakeholders. Stakeholders were intentionally selected in consultation with ACIAR and the project leader (see Appendix 2.1). Interviews were conducted online using Zoom, and via telephone. Thematic analysis of data collected through these processes was undertaken using NVivo qualitative data analysis software to distil findings.

ACIAR working definitions and assessment frameworks for project outputs, outcomes and 'next users' were used to analyse, categorise and summarise findings (see Table 4). In addition, the report assesses economic outcomes as a core expectation of the project. Preliminary findings were shared and tested in a project validation workshop involving the stakeholders previously consulted. These workshops provided the opportunity to 'ground-truth' the assessments, identify any key issues not addressed, clarify any areas of uncertainty, and correct any misinterpretations. A draft evaluation report was then prepared for review by ACIAR and finalised in accordance with feedback received.

Limitations

The evaluation relied heavily on data produced through project analysis and reporting. End-of-project data was not available as this evaluation was conducted prior to the end of the project.

Conducting online interviews presented a series of limitations. Interviews were conducted in English, which may have led to communication barriers. During phone and Zoom interviews, the evaluator had limited ability to build rapport with participants and interpret non-verbal communication.

Direct consultations mostly focused on ACIAR staff and implementing partners. The evaluator was unable to visit project sites or speak with direct beneficiaries of the project. This limited the ability to evaluate the impact of the project as experienced by farming families, particularly in relation to enhancing income and food security, which were key focuses of the project.

Interviewees for the project were intentionally selected by ACIAR and the project leader (so they were not a representative sample). Given the selection process, it is also likely that respondent experiences fall at the positive end of the spectrum, meaning data from interviews is likely positively biased.

Table 4 ACIAR project outcome assessment terminology

Outputs	Next users	Outcomes
Scientific knowledge: New knowledge or current knowledge tested in other conditions, locations, etc.	<ul style="list-style-type: none"> Individual scientists/researchers/ agricultural professionals Individuals responsible for the management of research or a government institution Producers that the project engages directly or influences outside its immediate zone of operation (for instance, at scale), including crop and livestock producers as well as fisherfolk Public and private extension service providers Public policy actors Public and private value chain operators Consumers 	Scientific achievement: Researchers use scientific knowledge outputs to make new discoveries or do their work differently
Technologies: New or adapted technologies and products that offer added value to intended end users		Capacity built: Project partners or stakeholders use enhanced capacity to do something differently
Practices: New practices and processes		Innovation enabled: Includes the adoption of improved technologies, systems or processes, access to new markets, or changes in the opinions or practices of policymakers and advocates
Policy: Evidence for policy formulation		
Capacity building: Short courses, academic training, coaching and mentoring		

Ethical considerations

The evaluation was conducted in accordance with the *DFAT Monitoring and Evaluation Standards (2017)*. This included considering:

- **Informed consent:** All participants in consultations were provided with a verbal overview of why they are being consulted, how the information would be used and that their participation was voluntary prior to the consultation. Consultations were only undertaken once verbal consent was obtained.
- **Privacy and confidentiality:** The identity of any program beneficiaries involved in the evaluation is protected. Key informants in professional roles may be referred to by their position title in the report where explicit consent has been obtained; otherwise they are referred to as a representative of the organisation they work with.



Farmers in PNG spreading cocoa beans out to dry.
Photo: Conor Ashleigh, ACIAR

Overview of project

Project number	HORT/2014/096
Project title	Enterprise-driven transformation of family cocoa production in East Sepik, Madang, New Ireland and Chimbu provinces of Papua New Guinea
Collaborating institutions	LaTrobe University Curtin University The Divisions of Primary Industries (DPI) The Cocoa and Coconut Institute Ltd (CCI) PNG University of Natural Resources and Environment (UNRE) NGIP-Agmark Pty Ltd Farmset Cocoa Board of PNG (CB)
Project leaders	Dr Philip Keane, LaTrobe University, Australia Professor George Curry, Curtin University, Australia David Yinil, Cocoa Board, PNG Dr James Yoko, University of Natural Resources and Environment, PNG
Project duration	March 2016 to March 2021
Funding	A\$4,997,863
Countries involved	Australia and Papua New Guinea
Commodities involved	Cocoa
Related projects	ASEM/2014/095 Family Farm Teams HORT/2014/094 Bougainville Cocoa



Context

Cocoa is a profitable smallholder crop and export trade commodity in Papua New Guinea (PNG) and an important driver of rural development, now directly involving about 150,000 smallholder farming families and accounting for 18% of agricultural exports. However, old cocoa plantings have become overgrown, resulting in low yields, under-harvesting and heavy losses due to pests and diseases, leading to widespread abandonment of the crop. In particular, the Cocoa Pod Borer incursion in 2006 increased pod losses to 85%, more than 10 times that obtained on well-managed plantings. PNG has also been losing its reputation for high-quality cocoa due to smoking of beans during drying with woodfired kilns.

The PNG Cocoa and Coconut Institute Limited (CCI, which is now part of the Cocoa Board) has developed new cocoa cultivars with high yields and disease resistance, new methods of growing cocoa that can increase productivity, and small-scale post-harvest processing methods that can improve quality. It has also been shown in the previous project, 'Enhancing PNG smallholder cocoa production through greater adoption of disease control practices' (ASEM/2003/015), that farmer participation in managing demonstration blocks can foster adoption of better management methods. In Indonesia, projects have shown that cocoa plantings can be rehabilitated by:

- pruning and field grafting of improved genotypes
- use of composts and incorporation of livestock to improve soil fertility and cocoa management
- involvement of private sector partners in projects to greatly extend farmer training services and project impacts.

Adoption of these developments on farms in PNG has been limited by lack of support for government extension services. However, some progress is being made in East New Britain and Bougainville where factors contributing to success have included family-centred extension services and greater involvement of whole families in cocoa production, and engagement with industry stakeholders to foster the development of self-sustaining, village-level extension enterprises.

The project

The PNG cocoa project aims to foster enterprise-driven transformation and increased production and profitability of smallholder cocoa in East Sepik, Madang, New Ireland and Chimbu provinces of PNG. It seeks to develop a small business model of cocoa farming and related enterprises that is self-sustaining and viable as a livelihood for families and particularly youth. The project seeks to introduce new cocoa varieties and management practices to increase cocoa yields. It is also supporting farmers to establish themselves as profitable Cocoa Model Farmer Trainers (CMFTs), who generate income through a mix of cocoa-related enterprises and provision of paid advisory services to farmers.

Through promoting more equitable family labour in farming, and diversification of food crops and small livestock production alongside cocoa, the project also aims to increase the involvement of women in cocoa and non-cocoa farming, to the benefit of cocoa management as well as improving women's economic empowerment. Finally, the project seeks to improve linkages between good cocoa growers, post-harvest service providers and relevant markets to enable direct sales into these markets, creating an attractive cocoa business model that provides an incentive for young people to seek employment and livelihoods in cocoa production.

The objectives of the project were:

1. To foster the development of profitable, self-supporting, village-based cocoa extension and other services as micro-enterprises supported by financial institutions, commercial cocoa buying and supply companies, and existing research and extension services.
2. To introduce and evaluate on farms, with farmer participation led by village extension workers, transformative new cocoa cultivars and cocoa selection, propagation, production and post-harvest methods.
3. To introduce and evaluate on farms, with farmer participation led by village extension workers, options for development of new cocoa farming systems integrating food crops, livestock, and high-value shade and other tree crops.

Findings

1. What was the project's theory of change and how did this evolve during implementation?

Project theory of change

The **aim** of this project is to foster enterprise-driven transformation and increased production and profitability of smallholder cocoa farming in East Sepik, Madang, New Ireland, and Chimbu provinces of Papua New Guinea (PNG).

An initial impact pathway or theory of change was developed in a workshop in 2016, but this was not completed and not often referred to during project implementation. While not formalised, it is clear there was an underlying strategy linking various activities with higher-level outcomes or objectives. The theory of change diagram at Appendix 2.2 articulates that strategy, as understood by the evaluation team. Importantly, this theory of change describes the project's logic and assumptions at the outset of the project, rather than in light of what has been learned through implementation:

- If farmers participate in trialling transformative new farming practices (such as cocoa cultivars, intercropping, and cocoa selection, propagation, production and post-harvest methods) and have advice available on an ongoing basis through Cocoa Model Farmer Trainers (CMFTs), they will adopt new practices that increase their productivity and yield. This requires that:
 - Improved farming practices are developed and trialled with participation of farmers, with knowledge and skills shared through training by CMFTs.
 - New farming practices are sustainable, accessible, effective and affordable for farmers.
 - Farmers can generate additional income or economic benefits from increased yields to provide an incentive for continued adoption of new practices.
- If CMFTs can run profitable small enterprises and provide fee-for-service advice to farmers, they will be able to establish themselves as a self-sustaining network for delivery of extension services at the village level. In order to achieve this:
 - CMFTs need to have the skills and knowledge to run profitable advisory or cocoa-related small enterprises.
 - CMFTs need to be connected to commercial and government formal extension services to gain continued technical support and upskilling, including access to new innovations and research.
 - Farmers need to be supported by bank loans or private sector financing required to kickstart new farm development or rehabilitation of unproductive farms.
 - Increased interest and enthusiasm for cocoa production needs to be fostered among rural farmers, encouraging increased involvement in cocoa farming to drive demand for extension services.
- If farming families adopt a whole-family approach to farm labour and women and youth are more involved in cocoa management, diversified crops/ livestock husbandry, and cocoa-related small enterprises, this will benefit both women and youth (through increased incomes and food security) and families as a whole (through increased family productivity). This requires that:
 - Farming families understand and adopt the approaches embedded in the Family Farm Teams (FFT) training modules.
 - New cocoa management and post-harvest production approaches are more conducive to the involvement of women and youth.

Analysis of the theory of change

The CMFT model has been demonstrated to be an appropriate extension model in most contexts in which the project was implemented, enabling outreach to remote farmers, and filling a gap in areas with limited access to formal extension services. There are indications this is leading to the adoption of improved cocoa farming practices among CMFTs and the farmers they support, and reinvigorating farmer interest in the cocoa industry as planned. In New Ireland, the model appeared to be less successful as many CMFTs opted to work in logging rather than cocoa farming, and access to markets has been an issue. In the highlands, the CMFT model still worked effectively, although some stakeholders indicated that project approaches could have been further adapted for highlands areas where cocoa farming is new. It appears that the project was replicated and rolled out far more extensively in the highlands than initially intended, which may explain why this was not originally considered.

The concept of establishing CMFTs as self-sustaining businesses was an innovative solution to overcome the lack of existing government or private sector extension services. While many CMFTs have established small businesses related to cocoa farming, **the assumption that provision of cocoa-related products and advisory services would be an income-generating activity for CMFTs has not held true in many locations**, as farmers have often not been willing (or able) to pay for these services. This is particularly the case for paid advisory services. Nurseries have been more successful, although they have primarily supplied other government or donor-supported programs, rather than selling to farmers directly. On reflection, a number of stakeholders noted that this fee-for-service approach was unlikely to be viable in the PNG context.

Activities to increase access to finance to support CMFT small businesses do not appear to have been undertaken as planned, beyond initial consultations with financial institutions that indicated a hesitation to invest because of previous negative experiences. This does not seem to have had a major impact on the achievement of project objectives, in that CMFT businesses were constrained by a lack of access to markets for their products or services, rather than a lack of access to capital.

Strengthening access to cocoa markets for farmers was not a substantial focus of the program. Project stakeholders noted that this was because of an assumption that there were sufficient existing market linkages for cocoa products in project areas. While this generally held true, **New Ireland market connections were not as strong and this was a barrier for farmers wanting to sell their produce**. A more nuanced market analysis during the initial stages of the project may have been useful to enable a tailored approach to each project location. Initial plans for CMFTs to be linked to and potentially supported by cocoa-buying companies (effectively becoming buying agents) would also have helped to secure market access if this had eventuated. Without this, there continue to be questions around the overall sustainability of the model given limited resources within the Cocoa Board (CB) to provide ongoing extension support to CMFTs.

2. What outcomes (intended and unintended) has the project achieved or contributed to?

Outputs

Scientific knowledge

A full list of scientific publications or reports produced by the project is included at Appendix 2.4. **The project undertook testing of cocoa clones to build knowledge of the productivity and sustainability of different cocoa varieties.** This included trialling seedlings to determine which variants best adapted to conditions specific to each target province. While there were some promising results, particularly in highlands regions, further exploration of appropriate cocoa clones is required as farmers identified issues with certain clones, and some varieties of cocoa plants produced highly variable results.

The project established mature budwood gardens in at least 15 locations in each province, providing farmers with access to the 18 latest-release clones from CCI. Farmers were supported to use their newly developed budding skills (see agricultural practices in this section) to test which trees performed best on their farms and multiplied their production (Keane and Clarke 2020).

Particular attention was given to trialling cocoa production in areas previously considered ill-suited to growing cocoa, such as the highlands and the Sepik grasslands. In the highlands, new cocoa hybrid seedlings were initially trialled by CCI. Seedlings found to perform strongly were selected by farmers for cloning through the project, with open-pollinated seedlings transported to other sites for test plantings (Keane and Clarke 2020). While the long-term success of these seedlings is yet to be determined, successes in locations such as Karamui has generated substantial interest and led to replication of the model across highlands provinces. This is promising for establishing cocoa farming as a viable livelihood and industry in highlands areas, which were previously thought to be at too high an altitude for cocoa production. In Sepik grassland areas, deep ploughing to aerate the soil and establishing adequate shade prior to cocoa planting have been found to be effective in supporting better growth of cocoa plants.

'For the first time in PNG, cocoa is being produced commercially and sold in the highlands. It is defying the textbooks. That is our biggest achievement.'

– Project team member

Sharing knowledge on cocoa farming was also facilitated through the distribution of 2 books: project manager Trevor Clarke's *Pacific Islands Cocoa Book* (2020), and the CCI extension handbook, *Buk Bilong Kakao Fama* (PNG Cocoa Coconut Institute 2017c), published during the project. Both books have been well received by farmers and have contributed to filling a knowledge gap in cocoa farming.

Technologies

The project has developed and supported construction of solar dryers for drying cocoa beans, modelled on the style of dryers used in Solomon Islands. These provide an affordable option for cocoa farmers in comparison to traditional kiln dryers, particularly for those in remote locations as they can be built from locally available materials (along with a UV resistant plastic film supplied through the project). Drying cocoa enables farmers to earn a greater return for their cocoa harvests through the sale of dry cocoa beans rather than wet beans. Other benefits of solar dryers include reducing the time and effort exerted on the collection of firewood (which often falls to women), as well as producing high-quality cocoa beans without smoke contamination.

There are contestable reports as to the efficacy of solar dryers in all weather conditions, with some indicating they are less effective in wet weather. This has prompted **development of techniques for drying cocoa beans in wet weather, including combination dryers and using solar powered fans.** The solar dryers are still awaiting certification from the CB, and this is delaying the commencement of commercial operation for some CMFTs. The project is also looking to source alternative suppliers of the plastic film used in the dryers so they can be constructed after the project ceases.

Other technological outputs include the development of cheaper alternatives to expensive farming equipment – including budding knives and budding tape (often made from strips of plastic bags) – which have enabled more farmers to access equipment required for grafting.



Agricultural practices

The project has introduced new cocoa farming practices across different stages in the growing, harvesting, and processing cycle, including propagating clones, budding, grafting, rehabilitation of cocoa trees, pruning, integrated pest and disease management, and post-harvest practices such as drying and fermenting to improve quality. These practices have been compiled into the *Pacific Islands Cocoa Book* (Clarke 2020), which has been widely distributed among farmers.

Integrating goat husbandry alongside cocoa farming was also trialled, with goats intended to assist with pruning trees, consuming waste from crops, and producing fertiliser for use on cocoa and other crops. These trials produced mixed results. The trial in Madang failed, while in East Sepik it initially faced challenges but was more successful after the goats were moved to a new site. While some training and advice was provided to farmers as part of the trials, **further effort is required to overcome farmers' lack of knowledge on goat husbandry to enhance the viability of goats within cocoa farming systems in PNG.**

Other strategies to improve cocoa production included intercropping and use of different shade trees. Galip nut, betel nut, coconut, and other palm and fruit trees were investigated as shade trees for cocoa, with intercropping found more effective than relying on just one type of shade plant in case it is affected by pests or diseases. In Madang, food crops were used as temporary shade trees. In East Sepik, intercropping with vanilla has proven effective, particularly when combined with goat husbandry, as the goat manure can be used as a fertiliser for vanilla. Field trials in East Sepik and New Ireland also demonstrated planting methods, including composting organic matter and deep ploughing to aerate soil and support better growth of cocoa plants.

Capacity building

The project sought to impart new agricultural skills and practices to farmers primarily through CMFTs. Training for CMFTs covered a broad range of skills and topics, including cocoa production, post-harvest practices and business skills. CMFTs also received training in the FFT approach, which encouraged more equitable division of labour within farming families. End-line data is not yet available, but there are indications many CMFTs developed a greater understanding of productive farming practices, ways of improving the quality of cocoa produced and post-harvest approaches as a result of the project. Some farmer groups are also demonstrating improved understanding on selecting the best cocoa varieties for cloning that suit their specific growing conditions.

The project guided CMFTs to establish model farms to test improved cocoa management methods and demonstrate these with other farmers. Most CMFTs established model farms, with 27 in Madang, 26 in East Sepik, 2 in West Sepik, 21 in New Ireland, and 7 in Chimbu as of June 2020 (Keane and Clarke 2020). These model farms are available to provide ongoing training to farmers on agricultural practices, and for use during field days.

The CMFT model is proving to be a successful approach to capacity building, and appropriate to the context, filling a gap left by limited government extension services. Engagement in demonstration farming and skills development has been strong, with some provinces recording far greater numbers of CMFTs involved than originally anticipated. Initially, CMFTs were predominantly men, however, most attended training with their wives. This enabled the CMFTs to operate as husband/wife teams in line with the FFT approach adopted by the project. All CMFTs received training through the project, with reports suggesting women constituted approximately 30% of attendees at project training and field days (Keane and Clark 2020).

Building cocoa farming capacity within communities has also been pursued through activities that reach beyond the CMFT model. In East Sepik, the project developed linkages with 3 secondary schools and a correctional institution to use cocoa model farms as teaching facilities. Project coordinators have spoken at school assemblies, and training materials have been developed for use by the CB and Department Agriculture and Livestock (DAL) in training with farmers and at village meetings. While not a direct focus of the project, carpenters were also trained in construction of new dryers.

The project has also built the capacity of government extension workers, including CB Research, Extension and Development Services (REDS) and provincial government DAL staff. This appears to have occurred primarily through mentoring and engagement in project activities, rather than more formal training. PowerPoint presentations prepared by project leader, Trevor Clarke, covering multiple aspects of cocoa technology, were distributed to CB, REDS, and DAL staff in most provinces, however, it is unclear how these were utilised and whether they demonstrably contributed to capacity development within these agencies (Keane n.d.). The project covered all the operating costs of those REDS employees involved in the project (including vehicles, fuel, allowances and in some cases housing), enabling the delivery of extension services that would otherwise not have been possible. The project also supported DAL staff to replicate the CMFT approach in additional locations within New Ireland and the highlands.

Adoption

Australian Centre for International Agricultural Research (ACIAR) uses a 4-level classification scheme to indicate the level of uptake of key outputs. This has been used by the evaluation team to summarise output adoption for the projects reviewed under each program, as illustrated in Table 5.

New technologies or practical approaches

Solar dryers and farming equipment

The adoption of solar dryers has been a significant achievement for the project. The affordable nature of solar dryers, and the ability to construct them from locally available materials, has supported their strong uptake by farmers, with numerous villages sourcing their own resources for construction. CMFTs in some areas are supporting other farmers to build dryers, for example a CMFT in Yekimbole established a successful wet bean buying and fermentary business and is assisting 7 villages to construct solar dryers, demonstrating uptake by both next and final users.

The use of cheaper equipment alternatives is continuously being taken up by farmers as a way of overcoming the challenges of high-cost equipment, for example budding knives (fashioned from hack saw blades) and budding tape. This has spurred the adoption of more affordable options, such as adapting kitchen knives, or using strips cut from plastic bags or rice packaging for grafting.

New cocoa farming practices

As end of project studies have not yet been undertaken, there is limited data on the extent of adoption of new farming practices. That said, **stakeholders reported a reasonably strong level of uptake of new cocoa farming practices by CMFTs, as the next users**, with some project coordinators estimating around 50% of CMFTs have applied changes in their farming practices during the project.

Specific practices which have demonstrated good levels of adoption by next users include new field grafting techniques, usage of solar dryers, establishment of nurseries and budwood gardens for cultivation of cocoa seedlings, and field budding of seedlings as an alternate option to reduce nursery costs. The annual project report (Keane and Clarke 2020) indicates that many CMFT nurseries, budwood gardens and model farms have been established – 27 in Madang, 26 in East Sepik, 2 in West Sepik, 21 in New Ireland, 7 in Chimbu.

Reports suggest farmers have been successful at adapting methods and farming practices to suit their specific contexts, farming conditions, and available resources. For example, in the highlands, some farmers are planting seedlings directly in the ground rather than establishing nurseries to grow seedlings.

Table 5 Levels of adoption of key project outputs

Category	Output	Users	Level of adoption
New technologies or practical approaches	Solar dryers	<ul style="list-style-type: none"> Users of project-constructed dryers are initial users Other farmers building or using dryers are final users 	NF*
	New cocoa farming practices	<ul style="list-style-type: none"> CMFTs are initial users Other farmers are final users 	Nf*
	FFT approach	<ul style="list-style-type: none"> CMFTs are initial users Other farmers are final users 	N**
New scientific knowledge	Cocoa production in the highlands	<ul style="list-style-type: none"> CMFTs are initial users Other farmers are final users 	NF*
Knowledge or models for policy and policymakers	CMFT model	<ul style="list-style-type: none"> Those involved in the model are initial users Evidence of uptake of the model by extension agencies reflects final users 	Nf

Notes:

* Only anecdotal reports are available to assess adoption by final users

** There is no evidence available to assess adoption by final users

O No uptake by either initial or final users

N Some use of results by the initial users but no uptake by the final users

Nf Demonstrated and considerable use of results by the initial users but only minimal uptake by the final users

NF Demonstrated and considerable use of results by the initial and final users

Intercropping practices, particularly planting vanilla and coffee among cocoa crops, have been adopted by CMFTs in various locations, but there is insufficient data to ascertain their adoption beyond next users. Farmers in Madang province have taken up planting food crops, namely banana and taro, as temporary shade for cocoa trees while longer-term shade trees are developing.

The project aimed to support CMFTs to develop small businesses related to cocoa farming, including budwood gardens and nurseries, pruning and rehabilitation businesses, cocoa marketing and farm supplies businesses, advisory services, and cocoa fermentary and dryer businesses. **Reports indicate that many CMFTs have begun establishing self-sustaining businesses including budwood gardens, nurseries, wet bean buying and fermenting businesses, with several having been formally registered.** However, there is insufficient evidence on how many small businesses have been established as a result of the project, how successful they are, or the explicit activities undertaken by the project to actively support business development.

As noted earlier, the concept of CMFTs providing fee-for-service advisory services for cocoa farming families has not eventuated in practice. In some instances, CMFTs have been paid by farmers in kind, rather than in cash, although this does not appear to be widespread. Nurseries and post-harvest processing (such as drying) businesses seem to be the most viable small business options for CMFTs. There were reportedly several independent and self-sustaining nursery businesses supplying cocoa clones to farmers, particularly in New Ireland and East Sepik. However, successful nurseries are often linked to supplying government programs rather than supplying farming families. While this is supporting the viability of nurseries, there is not sufficient demand in all locations. In some cases, this lack of demand was noted as a disincentive for further nursery establishment. Goals to see the establishment of youth-run pruning businesses as an employment opportunity also struggled to gain traction amongst youth, as have businesses focused on cocoa marketing and farm supplies distribution.

'Some end their operation due to no payment of seedlings. The seedlings stay in the nursery and don't get sold ... If nobody is paying for the seedlings then there is not motivation to keep growing them.'

– Project team member



Cocoa farmers in PNG removing cocoa beans from ripe pods after harvest. Photo: Conor Ashleigh

There has been good uptake of the CMFT model as an approach to building capacity of farmers, with evidence some CMFTs have become effective trainers. While each CMFT was designed to support up to 25 farmers in their own village, several CMFTs also established numerous new satellite groups beyond their villages through which training and resources are being provided to other farmers. The annual project report (Keane and Clarke 2020) indicates that:

- 5 of 27 CMFTs in Madang are supporting satellite groups
- 4 of 26 CMFTs in East Sepik are supporting new satellite groups, including one which is supplying materials to 50 satellite groups.

In addition, other farmers in project sites not originally selected as CMFTs have witnessed the success of the CMFT model and taken the initiative to start their own satellite groups.

While many CMFTs have taken up the role of building capacity of other farmers, some have been less interested or willing to do this and have primarily focused on improving their own farming practice or setting up a small business. One stakeholder suggested this may be because of the commercial advantage that comes from staying one step ahead of your peers.

'They (CMFTs) are well trained, they are doing some of the work that the extension workers normally do, they are telling their farmers and forming groups. The knowledge is extending.'

– Project stakeholder

'A few of the CMFTs are still providing training to others – extension work. Others are just working on their project sites – but they still discuss with others on how to go about cocoa.'

– Project stakeholder

FFT approach

While the FFT training was reported to be well received by CMFTs, there is not yet evidence available as to the extent to which CMFTs have adopted or shared the FFT approach. This evidence will be collected during an end-line evaluation of the Collaborative Research Grant (CRG), which was scheduled for late 2020 but was delayed due to COVID-19.

New scientific knowledge

The project has seen next and final users adopt scientific knowledge in relation to new cocoa variants for cloning, propagation, and rehabilitation of ageing trees. Farmers have demonstrated greater knowledge of cocoa clones and clone selection methods through successful identification and propagation of seedlings best adapted to various growing conditions. Notably, a key achievement has been farmers selecting cocoa types better adapted to highlands conditions, with success in cloning and distributing seedlings to other highlands provinces for test plantings with support by local administrators. This demonstrates adoption of new knowledge built through the project on growing cocoa in high altitude areas, where **certain cocoa types can now be grown up to 1,600 m above sea level, significantly higher than previous understanding that cocoa growing was limited to around 600 m above sea level.**

The longer-term sustainability of disseminating new research and knowledge to farmers will present a challenge once the project closes. There is no plan to continue resourcing activities such as visits to cocoa growing regions to provide ongoing encouragement and support to farmers. Furthermore, there is limited support for facilitating wider sharing of farmer-led innovations which may benefit other farmers, especially those in remote areas.

Knowledge or models for policy and policymakers

The project has demonstrated a model for CB/DAL extension staff to be able to deliver extension services to cocoa farming families and communities through CMFTs. REDS staff within the CB have expressed strong interest in continuing the model but have not yet secured commitment from CB management to do so.

A notable achievement has been the replication of the model (or aspects of it) in new provincial government programs and other donor programs.

For example, the Provincial Government in New Ireland commenced a project called the Cocoa Development Extension Liaison Project following the CMFT model in 2017. This project supports activities which follow the same model as ACIAR project activities, but on a larger scale, extending to cover all 109 cocoa-growing wards in New Ireland (Keane et al. 2017). The ACIAR project team has been able to assist the provincial government with building capacity of extension workers to deliver this project. In addition, the concept of establishing budwood gardens and nurseries as a source for distributing seedlings in the community has been adopted by the EU-funded Smart Cocoa Project.

Provincial governments are beginning to consider cocoa as a salient policy priority area, with annual budgets starting to include fund allocations to cocoa projects, predominantly in low-lying areas, but also to some extent in highlands regions (Keane and Clark 2020). This represents a significant change since the project commenced and is an indication of the revived interest and confidence in cocoa throughout the region.

Outcomes

Scientific achievement

The project has contributed to significant scientific achievements in establishing successful cocoa crops in areas where cocoa farming was previously considered unviable. One of the key achievements has been the establishment of the cocoa industry in the highlands, which has prompted considerable interest by provincial administrations and DAL officers in Eastern Highlands, Western Highlands, Southern Highlands and Jiwaka provinces in trialling cocoa planting. Test plantings of cocoa seedlings have begun in these provinces, while in some areas, cocoa is being commercially produced and sold in the highlands for the first time. **Cocoa is now able to be grown at altitudes over twice as high as was previously thought.** The successful propagation of cocoa in the Sepik grasslands areas is also a notable outcome, with the project identifying that aerating soil, and ensuring shade trees are well established prior to planting of cocoa, are critical factors in its success.

The project has been successful in establishing nurseries and budwood gardens in locations where cocoa planting materials were previously unavailable. Prior to the project, cocoa planting materials were primarily distributed from government-run stations which were inaccessible to many communities. Establishing nurseries and budwood gardens within community locations, and the adoption of this approach by provincial governments and other donor projects, marks an important shift in practice which should have long-term positive implications for cocoa production.

The project also successfully introduced methods for using solar dryers to dry cocoa beans rather than conventional dryers, identifying optimum techniques to use these dryers in all weather conditions. Some dryers are now beginning to be 'unofficially' registered by the CB (Keane and Clarke 2020). Most stakeholders interviewed were positive about the ability for solar dryers to be used year-round, albeit with lowered effectiveness during wet weather.

Capacity built

At the village level, the project has significantly contributed to building the capacity of CMFTs to manage improved cocoa farming and viable small enterprises. **Model farms are operating successfully and driving the rollout of new practices across farmer groups by providing a space for demonstrations and training on farming techniques and methods.** Outcomes have reached beyond CMFT and their direct farmer groups, with satellite groups being established in all 4 provinces and other farmers emulating what CMFTs are doing. While it is unclear exactly how many CMFTs have shared knowledge with other farmers, there are reports farmers have taken up new ideas and practices, adapting learned techniques to suit their specific contexts and capacities. There are also examples of new practices contributing to improved quality of cocoa products, with cocoa produced by CMFTs in Madang placing second and eighth at the CB PNG Cocoa of Excellence Show held in Lae in 2019, and cocoa from one CMFT selected as a finalist at the Salon du Chocolate in Paris in 2019.

Project reports indicate CB staff have built capacity to link to and educate farmers on improved cocoa farming practices, including through field days, village visits and training sessions. Capacity development supported within REDS focused on upskilling in technology and approaches to providing extension services. This was particularly important for new staff coming in following the merging of CCI into the CB. However, there is limited evidence of capacity building beyond the core project team. Nevertheless, a key achievement was the ability of CB extension officers to continue to lead the project and maintain progress against all activities during the COVID-19 pandemic, including through lockdown periods and with limited Australian staff presence due to travel restrictions.

'The project has actually assisted in terms of mobility – by engaging our staff and getting them involved. Some of them were quite new when they started so we have been building their capacity in terms of the technology and approaches to extension.'

– Government stakeholder

Stakeholders were positive about the sustainability of the CMFT model and believed CMFTs would continue to provide advice to their farmers after project support ceased. However, many CMFTs reported feeling unprepared to operate as independent extension service providers in their communities, without formal support systems linking them to new cocoa research and expert advisory services when needed (ACIAR n.d.). As yet, there is no formal commitment from the CB to continue supporting the CMFT model so it is unclear how or to what extent CMFTs will be supported beyond the project.

Economic outcomes

A central objective of the project was to support CMFTs to establish viable small businesses which would increase availability of cocoa planting materials and extension services in communities in a sustainable manner, beyond the life of the project. Although the project is complete, it is still very early to be assessing economic outcomes as many of the new or rehabilitated cocoa trees have only recently started bearing fruit, and production is anticipated to increase over the coming years.

Many budwood gardens and nurseries have been established by CMFTs and are starting to provide a source of income, although there is no clear evidence yet about their longer-term commercial viability. Other avenues of income generation promoted through the project included post-harvest processing, including construction of cheap, plastic-covered solar dryers. Some CMFT groups in East Sepik successfully developed businesses buying wet beans from nearby farmers to dry in their solar dryers, with one group in Yekimbole now selling dry beans to one of the main cocoa buying and exporting companies in PNG (Keane and Clarke 2018). Many businesses have struggled to take off given time lags in CB officially registering nurseries and solar dryers to enable farmers to begin commercial operations. **Overall, beyond individual success stories, there is limited evidence to date to suggest the project has been able to produce economic outcomes for farmers.**

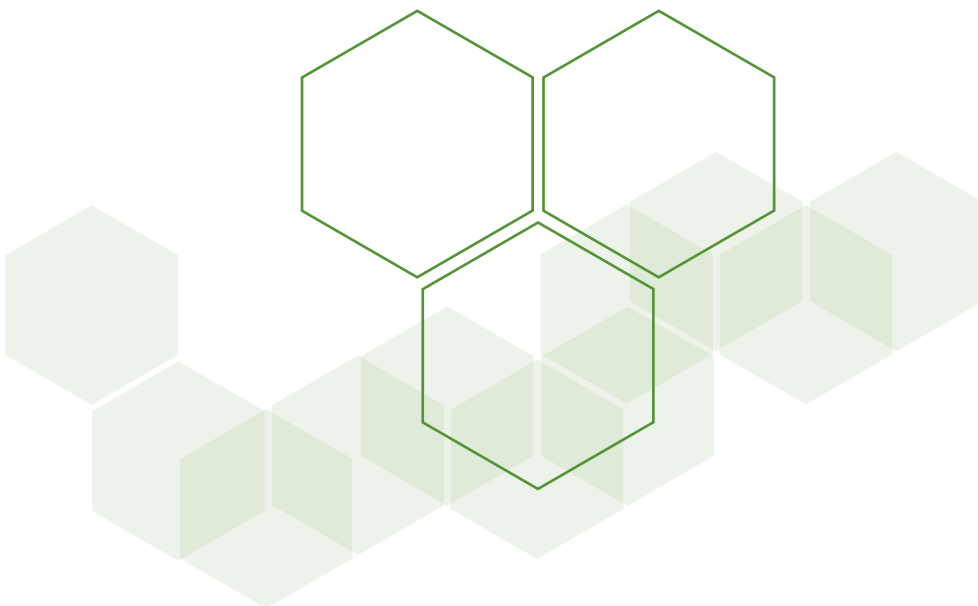
Community outcomes

Multiple stakeholders noted the impact of the project in increasing enthusiasm and interest in cocoa farming, which had waned substantially following the rise of the Cocoa Pod Borer. This enthusiasm for the project resulted in a far greater reach than anticipated, with the project expanding from the initial design of working with 10 CMFTs in 4 provinces to working with about 80 groups across 8 provinces, reaching a few thousand farmers.

'Improving morale is the main one [achievement] – getting farmers back to cocoa.'

– Project team member

CMFTs are reported to be becoming more involved in their communities and facilitating families to work together, which has reportedly improved morale and contributed to relationship building within communities. In some instances, CMFTs have also gone on to be selected as ward counsellors, indicating their positive position and respect within their communities. In some communities, unintended consequences have arisen in the form of jealousy coming from community members towards CMFTs as a result of actual or perceived benefits that CMFTs have received through the project. The payment of allowances (designed as an incentive to encourage CMFTs to share their knowledge with other farmers) has proved particularly problematic and did not necessarily support capacity building outcomes.



3. How did project activities and outputs contribute to the outcomes achieved?

Factors influencing adoption and outcomes

The project was impacted substantially by the closure of CCI, and the transition of cocoa functions from CCI to the CB in 2017. Key project staff (including the in-country manager and 2 provincial coordinators) were lost in this transition, which in some cases meant specific research activities could not be completed as planned. In addition, while the original project design anticipated the sharing of costs related to extension services with CCI, the CB did not provide any funding in this regard. The project team has proven very resilient in these challenging circumstances, adapting budgets and activities to enable the project to continue to work towards its objectives. This has required diverting funds originally designed for project activities into operational costs for the project team – such as vehicles, fuel, operating expenses and travel allowances – which should have been supplied by CB. This poses a serious sustainability risk for capacity built through the project and the continuation of the CMFT system as there is no certainty among stakeholders that support will continue beyond areas where other donors are operating. Limited engagement and support from the CB also hindered some project outcomes. For example, it took 5 years to influence the CB to officially recognise and register solar dryers, which delayed their use in commercial production. Similar delays in registering gardens and nurseries also impacted further development of commercial nursery enterprises (ACIAR n.d.).

The process for selecting CMFTs was a critical factor influencing levels of engagement and attrition.

Although project reports indicate selection criteria were followed and selection of CMFTs was done in consultation with village wards, several stakeholders stated this process was not sufficiently robust. In some cases this resulted in selection of farmers to be CMFTs who had little interest in cocoa; overlooking other farmers who were more dedicated to cocoa farming. Inappropriate selection of CMFTs is thought to be a key reason some sites have not performed as well as others and for weak dissemination of knowledge. Other projects, including Family Farm Teams (ASEM/2014/095) and Bougainville cocoa project (HORT/2014/094), identified similar issues regarding selection of village extension workers/village farmer trainers. Stakeholders suggest that an alternative selection process could be to establish the group first, and then allow farmers to select their own leader, rather than the leader being selected by external stakeholders.

'There were a few groups where the PNG representatives on the project took the lead in appointing the group leaders (CMFTs). Where the farmers themselves did the selection it worked much better.'

'When we pick the model farmers – looking back I feel we should have understood the community better, I should have got the community to nominate their own leaders.'

– Project team members

Beliefs held by farmers concerning the direct benefits they would receive from the project for taking on the role of CMFT also influenced their retention and success.

An allowance system was introduced as an incentive for CMFTs, but this proved to be problematic as it motivated some farmers to sign up as CMFTs for the allowance rather than for their genuine commitment to the role. In some cases, promises were made during initial community awareness meetings which were not always kept, and this inhibited some farmer involvement in the project. In other areas, CMFTs struggled to get community buy-in to demonstrate and encourage uptake of new practices among farmers as villagers felt the CMFTs should do all the work as they were getting paid. It was also reported allowances created jealousy between farmers and CMFTs. Project leaders identified a better approach would be to pay farmers in kind with materials, and drive engagement through the results and increased yield they generate rather than providing cash allowances. Better communication at the outset of the project about the value of becoming a CMFT could also have bolstered greater understanding among farmers of the expected benefits of taking on the CMFT role.

Incentives to undertake cocoa farming varied across locations, and were strongly influenced by the perceived income earning potential of cocoa compared to other crops.

This influenced the extent of adoption of new practices shared by the project. Higher prices for cocoa beans in comparison to other cash crops, such as coffee, positively influenced farmers in some provinces (particularly the highlands) to switch to cocoa growing. Conversely, expansion of logging practices in New Ireland negatively impacted progress in boosting cocoa farming as logging work offers an opportunity to earn 'fast and easy money', making cocoa production less appealing. Further consideration of these external influences and focusing projects on locations where adequate incentives are thought to exist will assist with maximising outcomes.

While there were established markets for farmers to sell cocoa products in most locations, **insufficient access to markets was a persistent issue in New Ireland, and in some other remote communities.** In these areas, limited or poor-quality roads and high transportation costs were a barrier to accessing markets, and also made it challenging for project staff to visit sites regularly. The project attempted to address this issue by establishing a buying point in Kokapo, East New Britain (although local agreement on this has not yet been reached). In New Ireland, one dominant cocoa buyer also insisted on buying cocoa at a very low price which resulted in prices remaining low.

The participatory approach adopted through the project seems to have enabled it to be more successful. For example, new practices and technologies which have emerged through the project, such as solar dryers, were co-developed with CMFTs and were therefore appropriate for the local context and adopted widely. This proved to be a good research-for-development methodology and useful for wider learning for ACIAR. This approach also promoted use of cheap, locally available materials which supported uptake.

Table 6 provides key findings against the categories and factors influencing adoption and outcomes as part of the ACIAR evaluation framework.

Table 6 Factors influencing adoption and impact

	Factor	Key findings
Knowledge	Do potential users know about the outputs?	<ul style="list-style-type: none"> This was not a relevant issue for this project.
	Is there continuity of staff in organisations associated with adoption?	<ul style="list-style-type: none"> The transfer of the cocoa function of CCI to the CB resulted in key project staff not being offered continued employment at CB. This undermined project implementation and capacity building of staff. Multiple staffing changes in regional coordinator roles also affected implementation.
	Are outputs complex in comparison with the capability of users?	<ul style="list-style-type: none"> The availability of inexpensive, localised materials and approaches was central to key achievements through the project, notably the construction of solar dryers.
Incentives	Are there sufficient incentives to adopt the outputs?	<ul style="list-style-type: none"> In most areas the project has revitalised interest in cocoa farming. In some cases, insufficient incentives contributed to CMFTs not adopting outputs or sharing practices with other farmers.
	Does adoption increase risk or uncertainty?	<ul style="list-style-type: none"> This was not an issue for this project.
	Is adoption compulsory or effectively prohibited?	<ul style="list-style-type: none"> The need for cocoa solar dryers, nurseries and budwood gardens to be certified by the CB delayed commercial production.
Barriers	Do potential users face capital or infrastructure constraints?	<ul style="list-style-type: none"> This does not appear to be an issue for farmers. The lack of budget from CB for extension services meant there was no indication that their support would continue beyond the project, risking sustainability of progress achieved under the project.
	Are there cultural or social barriers to adoption?	<ul style="list-style-type: none"> The evidence available is inadequate to assess this, however it is likely that social networks influenced selection of CMFTs which played a role in levels of attrition.

4. What strategies were adopted to address gender equity and social inclusion and how effective were these?

Gender equity

While not an explicit project objective, the project design expresses an intention to increase involvement of women and youth in cocoa production and marketing, with the expectation this would improve the status and financial situation of women in their communities. The project employed 2 key strategies to achieve this. The first was the integration of concepts around equity and involvement of women into the CMFT training. This was done initially through the University of Natural Resources and Environment (UNRE) training in sustainable livelihoods, and then through incorporation of the FFT approach through a Transformative Agriculture and Enterprise Development Program (TADEP) CRG with the FFT project. The FFT training promoted the concept of husband/wife farmer teams as community trainers of cocoa farmers, and introduced ideas around negotiating roles and shared control over resources within family units. Second, the project promoted cocoa management practices focused on 'light' work aimed to encourage greater involvement of women and youth, and strategies to diversify crop production.

Early in the project, the number of women who participated was disappointing, with reports indicating over 90% of attendees at initial training were male (Keane and Clarke 2020). This was primarily because most CMFTs selected within communities were men, indicating that a more gender-aware approach to selection of CMFTs was needed to ensure gender parity. FFT trainers reflected that in some cases women were unwilling to participate as men generally have control over the sale of cocoa and cocoa-related income. **With continued encouragement from the project team, women's interest and participation in project activities increased throughout implementation.** Women started accompanying their husbands to training, indicating more successful adoption of the husband/wife team approach. By 2020, the annual project report indicated that approximately 30% of training attendees were women (Keane and Clarke 2020).

Beyond training participation, there were multiple examples of women actively contributing to and benefiting from project activities. For example, during a visit to one site in East Sepik, women were carrying out all the nursery work (filling polybags, planting seeds and so on), while in Madang province, women are becoming increasingly involved in harvesting and processing cocoa. Female CMFTs are successfully leading farmer groups and cooperatives established through the project in sites in East Sepik, Madang and New Ireland, including all-female groups led by women who are the head of their household. In addition, women have benefited from the introduction of solar dryers as this has lessened women's workload in relation to collecting firewood which is required for kiln-based dryers. **These examples are very positive, but there is currently insufficient evidence to determine how widespread women's involvement is or the extent (if any) this has impacted on gender roles more broadly.** Project stakeholders observed that while women are more active as cocoa farmers they are still largely excluded from decision-making, particularly in relation to use of family financial resources, although discussions are beginning to take place around more equitable financial decision-making through the FFT training.

With the exception of the FFT approach, the strategies used to promote women's participation in cocoa production and farming more generally worked primarily within existing gender norms rather than by trying to positively influence them. For example, adopting 'lighter' maintenance techniques which are seen as more appropriate for women, and encouraging diversification of cropping to include food crops traditionally seen as women's domain. Future ACIAR projects should be encouraged to take a more transformative approach to gender, coupled with close monitoring of gender outcomes.

'Some of the families are really helping each other and working together – they are changing from the previous way they used to live. Previously even though the family worked at the farm, when it came to selling the cocoa the man would sell it and get the money and spend it, but during the training they now discuss with the family and spend income more wisely.'

– Project team member

Social inclusion

The project design indicated an intention to support youth to develop small enterprises linked to cocoa farming services, with targets to establish 5 youth pruning 'gangs' within each province. Through this, the project aimed to reinvigorate the cocoa farming industry in rural areas and reduce rural to urban migration by young people. It is unclear whether the project has had an impact in this area, and there is little evidence indicating young people have gained employment through cocoa-linked enterprises.

However, **stakeholders consistently reported that youth are more engaged in cocoa farming due to the project.** Youth have reportedly been establishing their own cocoa plots, growing and harvesting seedlings for sale, distributing seedlings to farmers, and working as pruners to prune trees. In East Sepik, young people have been active in learning propagation skills and using these skills in other projects as well.

Youth engagement in cocoa farming has had other positive impacts for communities. In a community in New Ireland, stakeholders reported positive transformations in the behaviour of young men by giving them something productive to do rather than causing trouble. Importantly however, youth engagement is reportedly skewed towards young men, with no reports indicating young women have taken up opportunities in cocoa farming. Future work in this area should focus on finding ways to encourage participation of young women as part of broader strategies to enhance gender equality and diversity in the cocoa sector.

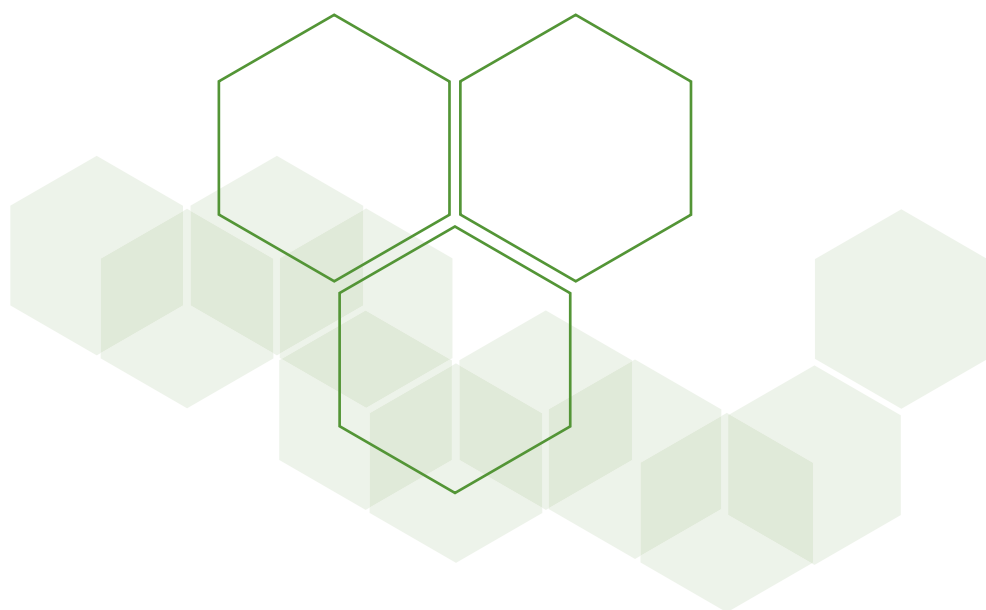
Beyond engaging women and youth in the project, there is no reference to people with disability being involved in the project. Enabling participation of people with disability was not a consideration within the project design, nor did project reports or stakeholder interviews indicate much awareness of broader social inclusion issues. More should be done in the future to engage people with disability and other marginalised groups in cocoa farming.

5. How did management arrangements impact delivery of the project?

Stakeholders interviewed for this evaluation were very positive overall about the project management arrangements. **The structure of the project team, comprising regional coordinators located in each province, with an in-country project manager, was a successful model** and attributed as a key factor in the success of the project and enabling the continuation of activities through 2020 despite COVID-19 restrictions.

As noted earlier, the transfer of the cocoa function from the CCI to the CB had major ramifications for the project, with a number of key personnel lost during the transition. Within this context, **the project team showed exceptional resilience and creativity in identifying new personnel, and adapting project activities and the budget to continue to work towards objectives**. Staff changes within CB resulted in high turnover in regional coordinators at the provincial level – for example in East Sepik, 4 different people carried out the coordinator role over the project’s life. This, alongside insufficient financial support, restricted the regularity of visits to remote locations, creating a bias preferencing sites that were closer and easier to get to. These challenges aside, project coordinators were positive about what they have been able to accomplish over the life of the project.

Management of the CMFT network was progressively handed over to REDS between August 2018 and December 2020, and it is hoped they will continue to provide support to CMFTs and deliver aspects of the project activities into the future. A handbook is in planning on the development and maintenance of an extension network involving CMFTs linked to REDS, provincial DAL and cocoa businesses, which aims to support this transition (Keane and Clarke 2020). However, the lack of clarity about project management or plans beyond the end of the project is creating uncertainty among staff and brings into question the sustainability of the model.



6. How well did the project align with and contribute to the overall goals of its umbrella program?

There were mixed levels of awareness of TADEP and its objectives among project staff and stakeholders, and differing views on the utility of grouping the different projects under the TADEP umbrella. **The project team did feel TADEP was generally valuable for facilitating collaboration, particularly through the CRG which enabled implementation of the FFT approach within the project.** Communications aspects of TADEP, for example production of videos and newsletters, and the annual meetings were also reported as key value-adds.

Some regional coordinators felt there was little value in grouping the projects together across crop varieties, and instead believed they would gain more by collaborating only with other cocoa projects. In addition, some felt there could have been more interaction or feedback at the program level in support of the projects, seeing the relationship as largely unidirectional with projects providing reports to TADEP for inclusion in program-level reporting.

Alignment with TADEP objectives and projects

The project aligned to 3 of TADEP's objectives:

- **To enhance rural livelihoods by increasing agricultural productivity and access to markets for farmers in PNG.** The project made significant contributions to increasing agricultural productivity of cocoa farming. There was less focus on increasing access to markets.
- **To build individual and institutional capacity in agricultural research, development and extension.** The project had significant impact in the areas of capacity building, including supporting capacity development of both CB staff as well as CMFTs, and by extension other cocoa farmers through the CMFT model.
- **To promote gender equity and women's empowerment in rural communities.** The project aimed to achieve this through implementation of the FFT approach. Evidence suggests there has been a notable increase in the involvement of women in cocoa farming, including through husband/wife CMFT teams, and stories of female-led farmer groups and cooperatives, but there is no substantive evidence of changes in relation to women's empowerment and gender equity at the community level.

Collaboration with other projects

The project collaborated to varying extents with 3 other TADEP projects:

- 'Improving opportunities for economic development for women smallholders in rural Papua New Guinea' (Family Farm Teams) (ASEM/2014/095). The FFT project provided training to CMFTs involved in this project through a CRG.
- 'Developing the cocoa value chain in Bougainville' (Bougainville cocoa) (HORT/2014/094). The PNG cocoa project coordinator was part of the mid-term review of the Bougainville cocoa project, and the 2 projects collaborated informally through sharing ideas and resources throughout implementation.
- 'Enhancing private sector-led development of the *Canarium* industry in Papua New Guinea' (galip nut) (FST/2014/099). The galip nut project provided advice to the PNG cocoa project on galip nut cultivation and production, with plans to integrate galip nut into cocoa farms to provide shade to cocoa trees, and a secondary source of income for cocoa farmers.

The FFT project had the strongest influence and collaboration among the other projects under the TADEP umbrella. The project leader described being influenced by that approach during the design of this project in aiming to select husband/wife teams as CMFTs rather than individuals. Following the mid-term review, allocation of CRGs allowed the project to roll out the FFT approach as part of the CMFT training. As with other TADEP projects, **this is another example of the CRGs being used strategically to allow the project team to 'make real' an interest or intention to collaborate.**

'That was the most profitable collaboration that we had through TADEP. I was very strongly influenced by the FFT approach.'

– Project team member

The project hoped to collaborate more with the galip nut project, including trialling galip nut as a shade tree for cocoa. This collaboration was not as active as it could have been, largely due to the slow-growing nature of galip nut trees.

As noted in the Bougainville cocoa review report, it is interesting that there was not stronger collaboration between the PNG cocoa and Bougainville cocoa projects given the appetite for programs to be structured more closely by crop type. This appears to have been a missed opportunity, particularly given both programs were trialling different community-based extension models.

Knowledge transfer and learning

Facilitating knowledge sharing between projects was seen as a key benefit of the TADEP umbrella program. Stakeholders who had attended the annual TADEP meetings saw these as a useful mechanism for encouraging collaboration and knowledge sharing across the projects. Some noted that the meetings could be quite exhausting and there could be value in spreading the discussions out across additional days. It is worth noting though that these meetings were primarily for project leaders so most of the project team did not attend (or only attended once), and primarily received information about the other projects through the TADEP newsletters. These newsletters were very well received and seen as useful and informative.

While some stakeholders were very positive about the value-add of TADEP with regards to knowledge transfer, several people (particularly those who did not participate in the annual meetings) felt that informal collaboration and learning is common between ACIAR projects and would have occurred without the TADEP umbrella. As an example, this project collaborated closely with a soils project implemented by Sydney University that used the CMFT approach, but which is not part of TADEP.³

Reporting

Stakeholders indicated that the reporting requirements for TADEP were high and at times felt burdensome. However, project stakeholders appreciated how this reporting fed into the annual project report, and found value in being able to gain insight into what other projects were doing.



Photo: Conor Ashleigh, ACIAR

3 'Optimising soil management and health in Papua New Guinea integrated cocoa farming systems' (SMCN/2014/048)

Conclusions and lessons learned

The Papua New Guinea (PNG) cocoa project has generated new scientific knowledge, with particular breakthroughs in growing cocoa at higher altitudes and in grassland areas, and adoption of effective and affordable technologies such as solar dryers, which are predicted to positively impact the level of uptake and value of cocoa as a commodity crop in PNG. The project has also successfully expanded the availability and range of cocoa planting materials available in communities and tested the viability of an extension services model designed to be largely independent of government support. This is an important achievement in a context where government-led extension services continue to be under-resourced and misdirected. Evidence of project outcomes to date indicate there has been an increase in interest and enthusiasm for cocoa farming in all 4 regions, and the uptake of a range of new cocoa farming practices as a result of the project.

Difficulties in facilitating linkages to markets, particularly in New Ireland, and delays in registering solar dryers, nurseries and budwood gardens have constrained project impacts in terms of the extent to which improved cocoa yields have led to increased farmer incomes. Aspects of the Cocoa Model Farmer Trainer (CMFT) model regarding provision of fee-for-service advisory support to farmers have also been problematic, although some CMFTs have set up nurseries and solar dryers which are beginning to operate commercially.

The Transformative Agriculture and Enterprise Development Program (TADEP) was useful for collaboration and learning and enabled the Family Farm Teams (FFT) approach to be implemented in this program. This appears to have resulted in CMFTs comprising husband/wife teams and there are examples of how this is benefiting women and youth. However, there is insufficient evidence as yet to determine the extent to which women and youth have benefited, or whether the FFT approach has spread beyond core CMFTs to other farmers.

While the project has clearly achieved some good outcomes to date, the long-term sustainability of outcomes achieved is less certain, given CMFTs will require ongoing technical support and motivation from extension workers in some form, which cannot be assured beyond the end of the project.



Lessons learned

Specific recommendations for future research have been documented elsewhere and will not be summarised here. More general lessons for Australian Centre for International Agricultural Research (ACIAR) in relation to implementation of research-for-development projects and the programmatic approach learned through this project include:

1. The CMFT model appears to be effective for supporting uptake of new and improved cocoa farming practices by many farmers. To overcome issues with retention and community tensions experienced in some areas, future projects should aim to better understand community and social structures and follow a more rigorous process in the selection of CMFTs.
2. Care should be taken to select appropriate incentives for CMFTs, with preference given to in kind rather than monetary rewards. Prior to CMFT selection, any incentives should be clearly communicated to potential CMFTs and the broader community in which they will be operating.
3. The participatory approach central to the project has proven valuable and should be encouraged. New practices and technologies co-developed with CMFTs, such as solar dryers, have proven effective as they are appropriate for the local context and able to be adopted widely by farming families.
4. Potential for sustainability should always be a central issue that is assessed and explored as agricultural extension models are trialled and developed. This includes consideration of what level of ongoing support village extension workers require, and where this will come from. Given scepticism around the viability of a fee-for-service model of extension within the PNG context, it is unclear why this was included in the original design.
5. Articulation and implementation of a specific gender equality and social inclusion strategy would help projects improve gender equality outcomes. Monitoring and reporting against this strategy should form part of regular project reports so that there is greater oversight of this area.
6. Undertaking market analysis at the outset of projects, with a focus on potential barriers to market access, would be useful to identify risks to the achievement of project objectives. Conducting this analysis as part of project design processes would enable planning of approaches to address and overcome barriers and facilitate more active private sector engagement and market linkages throughout the project duration.
7. The project management structure for this project, including an in-country manager, and regional coordinators embedded within the Cocoa Board (CB), appears to be an effective model to support project implementation.

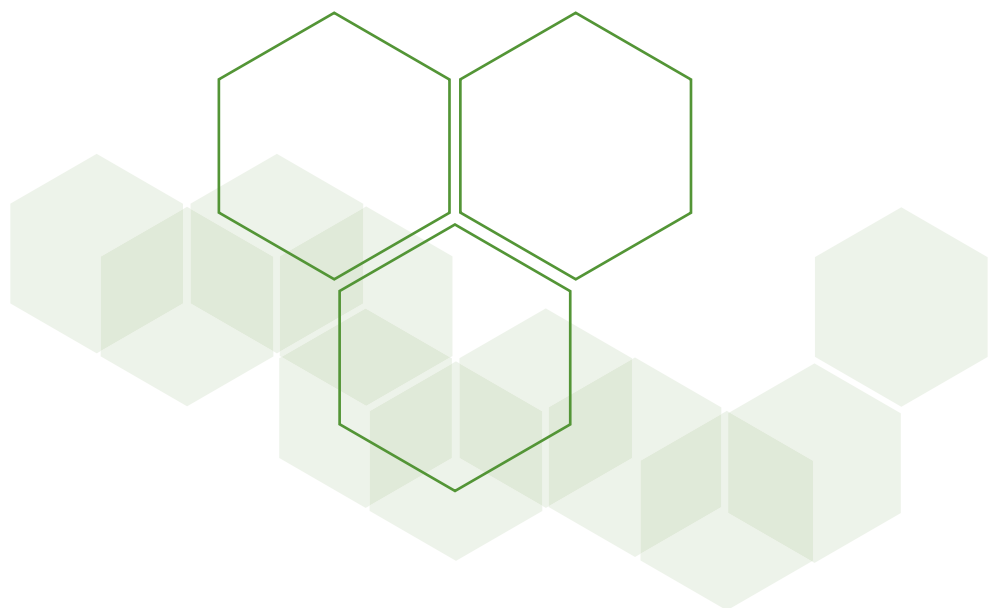
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- PNG Cocoa Coconut Institute (2017c) *Buk Bilong Kakau Fama*, PNG Cocoa and Coconut Institute, East New Britain Province.

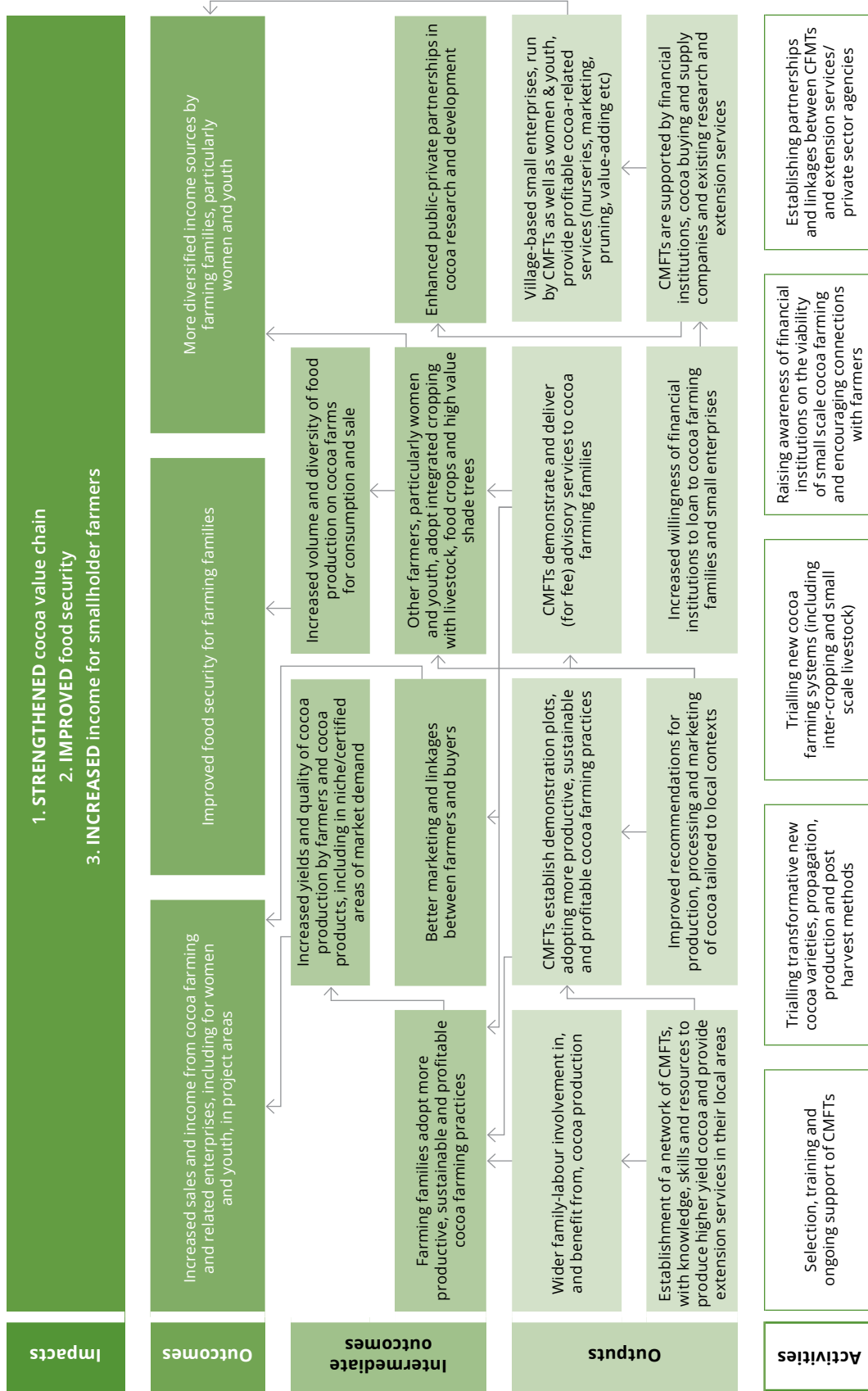
Appendices

Appendix 2.1: Stakeholders consulted

Name	Role	Organisation
Dr Phil Keane	Project Leader	Latrobe University
Trevor Clarke	Project Coordinator	REDS, CB
George Curry	Social Scientist	Curtin University
Gina Koczberski	Social Scientist	Curtin University
David Yinil	Senior Extension Manager	REDS, CB
Timothy Sam	Regional Coordinator, East Sepik	REDS, CB
John Joseph	Regional Coordinator, New Ireland	REDS, CB
John Konan	Regional Coordinator, Chimbu	REDS, CB
Aitul Weoh	Regional Coordinator, Madang	REDS, CB



Appendix 2.2: Theory of change



Appendix 2.3: Project team members

#	Team member	Gender	International/National Researcher
1	Philip Keane	M	International
2	Trevor Clarke	M	International
3	Peter Sale	M	International
4	George Curry	M	International
5	Gina Koczberski	F	International
6	Grant Vinning	M	International
7	John Morgan	M	International
8	Peter Green	M	International
9	James Hunt	M	International
10	Paul Horne	M	International
11	Eremas Tade	M	National
12	Alfred Nongkas	M	National
13	Boto Gaupu	M	National
14	Arnold Parapi	M	National
15	Josephine Saul-Maeora	F	National
16	John Konam	M	National
17	Aitul Weoh	M	National
18	Jimmy Risimeri	M	National
19	Daslogo Kula	M	National
20	John Joseph	M	National
21	Chris Toli	M	National
22	John Thomas	M	National
23	Graham McNally	M	National
24	John Nightengale	M	National
25	Steve Woodhouse	M	National
26	Joachim Lummani	M	National
27	Jeffrie Marfu	M	National
28	Kenny Francis	M	National
29	David Yinil	M	National
30	Peter Bapiwai	M	National
31	Chris Fidelis	M	National
32	Paul Gende	M	National
33	Samson Laup	M	National
34	Hosea Turbarat	M	National
35	Suri Taisa	M	National
36	Charles Maika	M	National

Appendix 2.4: Research outputs

Publication	Peer-reviewed	Author (gender, nation)
Books		
Clarke T and Meninga R (2020) <i>Pacific Islands Cocoa Book</i> , ACIAR, Canberra.	N	Clarke (male, PNG)
PNG Cocoa Institute (2017) <i>Papua New Guinea Cocoa Extension Manual</i> , PNG Cocoa and Coconut Institute, East New Britain Province.	N	Keane (male, Australia) Nongkas (male, PNG)
PNG Cocoa Institute (2017) <i>Papua New Guinea Cocoa Farmer's Handbook</i> , PNG Cocoa and Coconut Institute, East New Britain Province.	N	Keane (male, Australia) Nongkas (male, PNG)
PNG Cocoa Coconut Institute (2017) <i>Buk Bilong Kakau Fama</i> , PNG Cocoa and Coconut Institute, East New Britain Province.	N	Keane (male, Australia)

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