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Impact of vegetable value chain research in the Philippines



107

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Impact of vegetable value chain research in the Philippines

Alinea International

Julie Delforce
Queentries Regar
Kate Angus
Zanna Lee-Palmer
Erin Solomon

Alinea International fieldwork partners

Aileen Lapitan, Nico Anastasio, Emman Flores (University of the Philippines, Los Baños)
Mitchiko Lopez (University of the Philippines, Mindanao)
Hadasha Bongat (Visayas State University)

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Cover: A farmer inspects his crop, which is grown in a protected cropping structure, Leyte, Southern Philippines. Photo: Veejay Villafranca

Foreword

The Australian Centre for International Agricultural Research (ACIAR) is mandated under the *Australian Centre for International Agricultural Research Act 1982* (ACIAR Act) to work with partners across the Indo-Pacific region to generate the knowledge and technologies that underpin improvements in agricultural productivity, sustainability of natural resources, and resilience of food systems. We do this by funding, brokering and managing research partnerships for the benefit of partner countries and Australia.

Consultations in 2006 between ACIAR and the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD), which is a sectoral council of the Philippine Department of Science and Technology (DOST), identified lower-cost and sustainable production systems for high-value vegetables in the southern Philippines as a priority area of research.

In partnership with DOST-PCAARRD, ACIAR and other research organisations implemented a major multidisciplinary program to enhance the profitability of selected vegetable value chains in the region.

The program evolved from several years of engagement with institutions and individuals in the Philippines and Australia on topics relating to vegetable production and marketing. It was framed as ‘value chain’ research and incorporated focus areas on critical crop production issues of soil and nutrient management, protected cropping structures, bacterial wilt and economics and policy. The overriding priority for ACIAR was to develop human and social capital, as well as strong links between Australian and in-country researchers.

The full impact of research-for-development work in agriculture, forestry and fisheries is realised over decades and cannot be properly evaluated when the research first takes place. For more than 30 years, ACIAR has systematically undertaken independent impact assessment studies of its portfolio of research activities. These evaluations have consistently found high returns on investments, reflecting the quality of Australian agricultural science and our partnership model, which ensures a high level of engagement with in-country partners, and a high level of adoption of research results.

This impact assessment found that the research program contributed substantially to scientific knowledge, particularly in the areas of protected cropping, bacterial wilt control and collaborative marketing groups. The dissemination component of the program engaged with farmers directly, but adoption of project outputs varied depending on individual, social and contextual factors influencing farmers and their livelihoods more broadly.

The ACIAR impact assessment program also provides learning for future investment planning and project design. This assessment concluded that for complex and multi-faceted issues, such as vegetable production in the southern Philippines, a multidisciplinary systems approach is necessary, but it must be well designed and underpinned by robust established relationships and a rigorous and participatory consultative process that includes lead in-country implementers.



Professor Wendy Umberger
Chief Executive Officer, ACIAR



The vegetable sector of the southern Philippines was identified as a priority area for research in 2006.
Photo: Jeffrey Maitem

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Many people involved in the southern Philippines vegetable sector since the early 2000s generously shared their experiences and insights with the evaluation team. They include:

- current and former ACIAR research program managers and coordinators
- program and project leads from Australian commissioned agencies
- current and former research staff from counterpart organisations in the Philippines, particularly the Visayas State University and the University of the Philippines Mindanao
- municipal agricultural offices and local government units in several districts of Mindanao and Visayas
- private market actors, including traders and business operators
- farmers and farming groups in Mindanao and Visayas, including those directly involved, those who have indirectly benefited and those with no project involvement.

The consultation list in Appendix 2 captures the breadth of engagement in each of these categories.

Finally, the Alinea team would like to acknowledge the invaluable assistance provided by our collaborators at the University of the Philippines Los Baños, namely Dr Aileen Lapitan, Dr Nico Anastasio and Mr Emmanuel Flores, as well as Ms Mitchiko Lopez at the University of the Philippines Mindanao, Ms Hadasha Bongat at Visayas State University and Ms Charlene Badilla from Central Mindanao University. These experienced researchers contributed to planning, efficiently organised consultations, accompanied and guided Alinea consultants during fieldwork, and shared their contextual knowledge and understanding to keep the analysis grounded in local realities. They also carried out follow-up field visits to explore more quantitative elements of the 2 case studies.

The evaluation team has endeavoured to reflect accurately the wealth of information obtained from project documentation, online consultations and fieldwork, but we take full responsibility for any remaining errors and omissions.

Shortened terms

ACIAR	Australian Centre for International Agricultural Research
AHR	Applied Horticultural Research
ANU	Australian National University
ATI	Agricultural Training Institute, Department of Agriculture (the Philippines)
AUD	Australian dollar
CALCOA	Cabintan Livelihood Community Association
CAO	city agriculture office
CIAT	International Centre for Tropical Agriculture
CRS	Catholic Relief Services
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CUT	Curtin University of Technology
DA	Department of Agriculture (the Philippines)
DFAT	Department of Foreign Affairs and Trade
DOST	Department of Science and Technology (the Philippines)
DPI	Department of Primary Industries
DRACO	Davao Regional Agricultural Cooperative
DTI	Department of Trade and Industry (the Philippines)
EATWELL	Excellent Learning Lessons
EDC	Energy Development Corporation
GAP	Good Agricultural Practices
GESI	gender equity and social inclusion
ICM	integrated crop management
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IPM	integrated pest management
IRRI	International Rice Research Institute
KEQ	key evaluation question
LGU	local government unit
NCCC	New City Commercial Corporation
NGO	non-government organisation
NMACLRRC	Northern Mindanao Agricultural Crops and Livestock Research Complex (formerly NOMIARC)
NOMIARC	Northern Mindanao Integrated Agricultural Research Center
NorMinVeggies	Northern Mindanao Vegetable Producers' Association
NSW DPI	New South Wales Department of Primary Industries
PCAARRD	Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (formerly PCARRD)
PCARRD	Philippine Council for Agriculture and Resources Research and Development
PHP	Philippine peso
QDAF	Queensland Department of Agriculture and Fisheries
QDAFF	Queensland Department of Agriculture, Forestry and Fisheries
R&D	research and development
RPM	research program manager
SEARCA	Southeast Asian Regional Center for Graduate Study and Research in Agriculture
TBIE	theory-based impact evaluation
UPLB	University of the Philippines Los Baños
UPMin	University of the Philippines Mindanao
UQ	University of Queensland
VICSMIn	Vegetable Industry Council of Southern Mindanao
VSU	Visayas State University

Summary

Background and scope

The Australian Centre for International Agricultural Research (ACIAR) is Australia's specialist international agricultural research-for-development agency. ACIAR's agricultural research-for-development projects and programs routinely undergo ex-post evaluations to assess performance and impact. ACIAR is currently exploring opportunities to develop more programmatic, transdisciplinary and place-based initiatives. The program selected as the primary focus for this evaluation was an early example of such an initiative.

ACIAR began supporting agricultural research in the Philippines in the 1980s and was engaged in the southern Philippines by the mid-1990s. The vegetable sector was identified as a priority during country counterpart consultations in 2006. In response, ACIAR and partner research organisations, including ACIAR's counterpart agency, the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD), prepared and implemented a major multidisciplinary program to support 'Enhanced profitability of selected vegetable value chains in the southern Philippines' (HORT/2007/066), which ran from 2008 to 2012. This program had 6 components:

- C1 – soil and nutrient management
- C2 – protected cropping
- C3 – bacterial wilt
- C4 – value chains
- C5 – economics and policy
- C6 – program management and integration.

Several further projects built on selected aspects of the original vegetable program. These programs and projects all aimed to assist farmers in the southern Philippines achieve higher incomes and improve their livelihoods, particularly through the cultivation of high-value vegetables.

The evaluation is intended to:

- contribute to the evidence base on the immediate and enduring impacts of ACIAR project interventions
- inform thinking on the advantages and disadvantages of multidisciplinary programmatic approaches.

Six key evaluation questions (KEQ) were formulated, covering the following topics:

1. Vision, process, structures
2. Scientific and other research impacts
3. Dissemination and adoption
4. Programmatic approach

5. Impact case studies
6. Lessons for ACIAR and PCAARRD.

The primary focus of this evaluation is HORT/2007/066. However, in view of the complexity of that program and the various successor projects, a twofold approach has been taken, focusing on:

- HORT/2007/066 for questions of the programmatic approach and process, research outputs, and activities to promote adoption (KEQ 1–4)
- impact case studies for 2 stand-out areas of activity (protected cropping and marketing clusters) initiated during HORT/2007/066 and continued under subsequent projects (KEQ 5).

Methodology

This is an ex-post summative evaluation, comprising elements of both process and impact assessments and drawing on mixed methods (qualitative and quantitative). The evaluation explores the extent to which program objectives and expectations were met in practice, noting the underlying assumptions, unintended outcomes and contextual factors affecting implementation. Gender equity and social inclusion (GESI) dimensions are considered throughout.

ACIAR contracted Alinea International (Alinea) to undertake the evaluation, and Alinea partnered with the University of the Philippines Los Baños (UPLB) as the local research institution. UPLB in turn identified experienced researchers based in Mindanao and Leyte (Eastern Visayas) to support fieldwork.

After a joint ACIAR–Alinea evaluation scoping visit in March 2023, the evaluation process comprised:

- Phase I: Document review and initial assessment of research outputs (desk-based)
- Phase II: Consultations and fieldwork
- Phase III: Synthesis and reporting (desk-based).

Phase II included:

- online interviews with Australia-based researchers involved in HORT/2007/066 and/or later projects
- qualitative fieldwork by Alinea and UPLB in several locations in Mindanao and Visayas
- quantitative fieldwork by UPLB and local teams in Davao City (Mindanao) and Visayas.

Informants included project researchers, government personnel and other market stakeholders, such as private traders, as well as farmers who were and were not directly engaged in ACIAR programs.



Horticultural research aimed to improve research capacity to support farmers to increase the productivity and profitability of vegetable value chains.
Photo: Veejay Villafranca

Observations and findings

KEQ 1: Vision, process, structures

ACIAR's vision for vegetable sector support in the southern Philippines was to build research capacity in the region to tackle challenges and opportunities in the vegetable sector through a programmatic multidisciplinary approach. However, this vision was not universally recognised or shared by stakeholders. Some informants perceived broader peacebuilding and development objectives, while others had little sense of objectives beyond their own research activities.

At the time, developing human and social capital was the overriding priority for ACIAR. This included establishing strong links between Australian and in-country researchers.

The need for coherence in tackling the multifaceted challenges and opportunities faced by the southern Philippines vegetable industry was based on experience and relationships developed through several earlier ACIAR collaborations in the Philippines. The primary aim articulated in the program proposal for HORT/2007/066 was 'to develop integrated and systems approaches to interventions addressing value chain constraints'. Program and component objectives were all framed in terms of increasing production and profitability of vegetable value chains.

Despite the holistic intentions, the program design was built around 6 separate project proposals, overlaid by a program-level goal and purpose. Program integration proved extremely challenging throughout.

A good sense of impact pathways was evident in the design. The research, capacity development and outreach activities were aimed at producing academic outputs, locally appropriate technologies and approaches, and awareness of research findings among farmers. In combination, these outputs were intended to lead to improved research capacity and (via an adoption pathway) to more beneficial vegetable production and marketing.

Program structures and management arrangements were complex, involving responsibilities within each of the 6 components and overarching program management and coordination through C6 (program management and integration). C6 included an Australia-based vegetable program manager and an in-country coordinator. Ultimate management responsibility rested with ACIAR as the funding agency, with several research program managers (RPM) involved. A program reference committee brought together ACIAR RPMs, PCAARRD and the C6 leads. Annual program meetings provided a formal mechanism for review, planning and adaptation.

As HORT/2007/066 drew to a close, its lessons informed the design of a new phase of the ACIAR southern Philippines horticulture program (2013–2018). This included 4 projects:

- 'Developing vegetable and fruit value chains and integrating them with community development in the southern Philippines' (AGB/2012/109)
- 'Integrated crop management to enhance vegetable profitability and food security in the southern Philippines and Australia' (HORT/2012/020)
- 'Soil and nutrient management strategies for improving tropical vegetable production in southern Philippines and Australia' (SMCN/2012/029)
- 'Improved postharvest management of fruit and vegetables in the southern Philippines and Australia' (HORT/2012/098).

These were followed by a Good Agricultural Practices (GAP) project (2019–2024):

- Developing vegetable value chains to meet evolving market expectations in the Philippines (HORT/2016/188).

KEQ 2: Scientific and other research impacts

HORT/2007/066 contributed substantially to scientific knowledge on vegetable production and marketing in the southern Philippines.

Notable research findings directly attributable to the program were in the areas of **protected cropping (C2), bacterial wilt control (C3) and collaborative marketing groups (C4)** – all areas of direct relevance to local farming communities. Some research activities relating to fertiliser application (C1) and policy modelling (C5) generated knowledge and publications, including quantifiable scientific results, but were regarded as less directly pertinent to farmer needs.

The collaborative research built strong relationships and contributed to professional and personal growth for researchers in both countries. The Australian project teams supported capacity development in the collaborating universities in areas such as **design and conduct of research trials, analysis, interpretation and preparation of publications.** Local researchers were encouraged and funded to participate and present findings at **workshops and conferences**, and many were given **professional development and postgraduate study opportunities.** An impressive volume and variety of **written output** is attributable to the program. Most publications were collaborative efforts, often led by the Filipino teams. Published articles contributed to authors' productivity and impact metrics.

Partner universities benefited both directly and indirectly through staff development, facility upgrades, research funding and higher rankings and status. Several researchers and their universities won awards. Program research led to new courses and curriculum development. **Government partners** also benefited from program engagement.

Gender issues received limited attention at the commencement of HORT/2007/066, but this gradually increased in response to ACIAR requirements. Fortuitously, the majority of component leads and senior researchers in the Philippines were female, reflecting the prevailing gender balance in the partner university departments.

ACIAR has remained engaged with these institutions, and many individuals, through subsequent projects. This has helped to **sustain** the research and capacity development impacts and professional relationships initiated under HORT/2007/066.

KEQ 3: Dissemination and adoption

Each of the HORT/2007/066 scientific and value-chain components (C1–C4) included an intended outcome relating to dissemination of research findings to farmers and/or promoting adoption of new practices. The C5 economic component was expected to contribute to these by building understanding of the economic and policy factors that constrained the adoption of the program's research results, and by providing policy recommendations.

Direct engagement with farmers was a key feature of the dissemination strategies. Demonstration trials and **field days** showcased the technologies on farmers' properties. **Farmer field schools** and **training workshops** helped empower farmers with the knowledge and skills to use new technologies or approaches and share these with others. Project teams developed **written extension materials** and **videos.** Municipal agriculture offices, local government units (LGUs) and individual extension officers played a central role in many of these activities.

Activities to spread awareness and encourage adoption had reached many farmers by the time the program closed in 2012. Reporting included hundreds of farmers trained, trial site visits in the thousands and estimates of wide-ranging adoption. However, recording of such outputs was inconsistent and most final reports focused on dissemination activities rather than providing firm evidence of adoption.¹ Follow-on projects since 2012 have further strengthened impacts from some initial program components.

A few instances were recalled of **research results not being adequately assessed before being disseminated to growers.** A desire to demonstrate progress reportedly led some researchers to promote practices and technologies for which variability and risk had not been adequately assessed. The vigilance of program managers appears to have reduced the incidence of such practices, but it was not possible to determine whether any farmers suffered adverse consequences as a result.

There is strong evidence of positive impacts for individual farmer-collaborators, who had been carefully selected on the basis of having the necessary **attitudes, interest and capability to experiment and innovate.** They increased their technical knowledge and skills, their capabilities in farm management and decision-making, and their confidence and self-esteem. Some received awards and overseas travel opportunities, while others have expanded their farms and built strong farm-based businesses.

1 The exception was C2, which estimated 169 adopters by 2012 and documented 'a proliferation of structures inspired by the current ACIAR project'.

There was mixed reporting on broader impacts. At a minimum, farmers were provided more *options*, such as a variety of disease-control options and protected cropping structure designs. C3 made a significant contribution to the understanding of bacterial wilt, not only for researchers but also among extension workers and farmers, but controlling the disease remains a significant challenge. C4 marketing clusters were found to have resulted in significant income increases during project implementation, as well as benefiting buyers and the broader economy. However, **clusters initiated by C4 have mostly not survived.**

Research findings that were of direct relevance to farmers and had demonstrated major benefits were most likely to be adopted. Other factors that had a positive effect on adoption included engaging with the farmers as full participants and enabling them to see, experience and understand the reasons behind research results. However, farmers' **limited access to capital** often constrained adoption, as did **shortages of crucial inputs** such as 'clean' (bacterial wilt-free) potato planting material in Mindanao.

Close engagement with local and national government agencies, producer groups, private sector operators and other support providers was critical to spreading program impacts. Institutional actors, such as agricultural extension workers, were beneficial to and benefited from dissemination processes. National training providers, such as the Agricultural Training Institute (ATI), remain important partners.

Individual, social and contextual factors also affected technology adoption and impacts. These included group dynamics and the availability of alternative income sources beyond vegetable production. Natural disasters (particularly typhoons in Leyte) have disrupted the agriculture sector.

GESI was not given prominence in program planning and there is **little evidence that gender-specific needs were considered in the dissemination and adoption-focused activities.** In terms of **social inclusion**, C4 deliberately targeted smaller-scale, resource-poor farmers (including many women) who were struggling to engage effectively with markets. In contrast, C1, C2 and C3 generally limited their direct farmer engagement to selected (mostly male) farmer-collaborators who were relatively well educated and well connected. However, some collaborators then helped modify approaches (for example, protective structure designs) to suit a wider range of farmer circumstances and constraints.

KEQ 4: Programmatic approach

The programmatic approach was well intentioned, sensible in principle and added some value. **Program-wide annual meetings, technical workshops and online information sharing** fostered camaraderie and helped broaden cross-component understanding and perspectives. Synergies arose from **commonalities of institutions, experimental sites and** (in a few cases) **staff** across multiple components.

The program contributed to strong and enduring professional and personal relationships among agriculture-sector researchers and practitioners in the Philippines. For ACIAR, HORT/2007/066 made **RPMS work together** and share funding in ways that had not previously been attempted.

However, **there were many challenges and missed opportunities.** Technical teams had devoted considerable efforts to designing their own standalone projects. Integrating these into the program framework was not easy, but it had to be done quickly to meet funding deadlines. A common view was that **the programmatic approach needed more attention at the design stage** to build a shared understanding of vegetable sector challenges and how individual research efforts could contribute to the broader strategy.

Most researchers' interests and loyalties centred on their own component. The diversity across components in terms of research themes, crops, organisations and locations made for a challenging coordination task. Collaboration was rarely prioritised, due to time pressures and unfamiliar subject matter. Divides were especially evident between the biophysical science (C1, C2, C3) and social science (C4, C5) components, and between researchers pursuing 'pure' science versus impacts for farmers. Many C1–C4 researchers felt the C5 economic assessments were poorly timed and unhelpfully judged the value of their work. Strong personalities probably exacerbated these differences.

There was no program-wide monitoring and evaluation framework. Each component reported separately and C6 extracted highlights for program-level reporting. Results indicators and data quality were not consistent across the program. **Administrative, financial and decision-making complexities** further reduced the potential efficiencies of a programmatic approach.

Directions and approaches for follow-up projects from 2012 were shaped both by high-level strategic objectives and the lessons emerging from program implementation. Emerging research priorities were scoped, and intensive in-country consultations and collaborative program design workshops then helped build consensus on themes and approaches.

The new design signalled there was **more work to be done in the southern Philippines vegetable sector, but in somewhat different directions**, including greater attention to pests and diseases and post-harvest issues, and new approaches to value-chain development and marketing. The new program comprised **4 separate projects**, rather than 'components'. However, a **programmatic overlay** was retained, including a coordination and management function with some continuity of personnel from HORT/2007/066.

A similar process of review and refinement was repeated towards the end of the subsequent 2012 vegetable program, leading to a new project to support farmers capable of achieving GAP standards (HORT/2016/188).

KEQ 5: Impact case studies

ACIAR's long-term engagement and partnerships have reinforced and extended the impacts of the initial vegetable program, while LGUs and others have taken up some of the practices and technologies trialled. Given the breadth of the initial program and the many subsequent interventions, farm-level impacts are addressed through impact case studies for 2 stand-out areas of activity:

- **protected cropping**
- **marketing clusters.**

Protected cropping was the focus of C2 in HORT/2007/066 and continued to underpin the subsequent ICM project (HORT/2012/020) and the GAP project (HORT/2016/188). Marketing clusters were promoted through C4 in HORT/2007/066 and played a role in the subsequent value-chain project (AGB/2012/109), albeit with a different emphasis and approach.

Protected cropping

The introduction of protected cropping structures with support from HORT/2007/066 (C2) significantly enhanced production and productivity, enabling farmers to grow vegetables under a wider variety of climatic conditions. Modifications improved suitability for various purposes and financial capacities. Leading farmers helped improve designs and supported wider adoption. Higher yields usually led to higher gross margins, especially in the wet season when open-field production is generally infeasible.

Integrated crop management proved essential to maximise the benefits of protective structures.

Some diseases were easier to control under protected cropping but some pests were more difficult to control. Profit results were highly dependent on farmers' management skills. Factors such as soil and nutrient management, water supply, pest and disease control, and marketing were all found to be crucial.

Through C2, 34 protected cropping structures were built across several sites in Leyte and Southern Leyte. Six self-funded structures were also built by 3 adopters. Over 1,000 farmers were trained, of whom 48% were female. Structure designs were modified in various ways to improve affordability, ease of use and sustainability.

Major damaging events had a significant influence on sustainability and longevity of structures. In 2013, the Leyte region bore the brunt of Typhoon Haiyan (known as Super Typhoon Yolanda in the Philippines), which destroyed the protective structures established to that point. However, this provided important lessons for protected cropping and spurred renewed interest in adapting designs and materials to improve structure strength and withstand or be adapted for high winds.

The typhoon also triggered **new sources of funds and expertise.** The humanitarian aid organisation IsraAID introduced new and more robust structures, providing greater flexibility (easily removable covers) and stronger steel frames. The IsraAID structures at the Cabintan Livelihood Community Association (CALCOA) are still being used, along with others funded by the Energy Development Corporation (EDC). In addition, **Baybay LGU has funded and constructed more than 50 protective structures since the ACIAR interventions.**

Outcomes on protected cropping from HORT/2007/066 are probably stronger, more enduring and more transformative than might have been anticipated in 2007. The nuances of vegetable production under protective structures have continued to be explored in later projects. There has been strong continuity of research institutions and personnel over time and the skills and capacity developed have continued to be applied across ACIAR projects and within the academic partner institutions. Close engagement from LGUs, private funders and other donors have enabled further uptake. The original farmer-collaborators have also remained closely engaged and some have gone on to become technical experts in their own right, advising LGUs, training providers and other farmers.

The quantitative survey conducted for this evaluation confirmed continuing benefits from use of protected cropping, among both the original C2 collaborators and indirect beneficiaries who received LGU-funded structures. Farmers using protective structures reported significantly higher yields and prices than open-field growers. These differences probably reflect both the higher quality of their produce and stronger market linkages facilitated either by ACIAR projects or other third-party support providers.

Factors found to have affected sustainability of impacts include extreme weather events, disease outbreaks, local government priorities, high construction and maintenance costs, and low incentives to self-finance structures when external support may be on offer.

C2's direct farmer-beneficiaries were a small number of progressive male farmer-collaborators. Detailed information on the gender and/or social distribution of broader impacts is not available, although nearly half of the survey respondents who received LGU support were women. In addition, successive projects endeavoured to modify the structure designs to be more widely affordable and user friendly.

Marketing clusters

Collaborative groups of smallholder farmers ('clusters') were established and supported in Mindanao under HORT/2007/066 (C4). These clusters were **introduced to new institutional markets**, given **training in production and marketing** (including negotiation skills), and linked with **input suppliers**. The technical information and capacity building provided improved farmers' **understanding of market dynamics and quality requirements**. Farmers had **lower costs** through better access to production inputs and materials and working capital. Product quality improved and some clusters secured contracts with institutional buyers offering far **higher prices** than in traditional markets. Participating farmers were estimated to have **increased their income by an average of 47%** during the project.

Farmers also reported **improved social capital** resulting from collaborative production and marketing within the group and stronger external relationship building. They also developed improved understanding of organisational dynamics, which was pivotal to leadership and the strength of their organisation.

The C4 team recognised that **sustaining these gains independently might be challenging**, and recommended building exit strategies into the clustering process for the program's next phase. However, when HORT/2007/006 concluded, the new value-chain project (AGB/2012/109) led by the University of Queensland (UQ) took a broader approach to enhancing community livelihoods and the focus **shifted away from C4's clusters**.

Despite the evident benefits of clustering for participating farmers, **cluster activities proved difficult to sustain once the intensive, tailored external assistance was withdrawn**. Gains made in empowering farmers to engage independently with various buyers were not sustained post-implementation. Trust between buyers and cluster members could be eroded by simple misunderstandings or by failures to uphold agreements, such as timely delivery of specified volumes. Maintaining solidarity within the group was another major challenge, requiring effective leadership and people management skills. Jealousies and concerns about money management and transparency could become critical.

The qualitative and quantitative evidence gathered for this evaluation indicates that **the boost to vegetable productivity, market access and incomes achieved during the project period has had little lasting impact**. Most, if not all, of C4's clusters **discontinued their activities once external support ceased**. Some stopped planting vegetables in favour of more-lucrative crops or off-farm activities. A lack of capital, increasing input costs (including farm labour), pest and disease challenges, and urban encroachment have evidently contributed to a decline in vegetable production in some former project areas.

Among current vegetable farmers surveyed, those with no C4 connection reported better cropping and income results than former C4 beneficiaries. Reliance on external support mechanisms may have contributed to this result. However, many other institutional, social and economic factors would also have been at play in intervening years and the quantitative sample was small and not necessarily representative.

On a positive note, **key elements of clustering** – such as production and marketing planning, product aggregation and advisory support – **remain a feature of current LGU programs promoting formal farmer associations and cooperatives**. LGUs also use 'cluster' terminology, although definitions and approaches vary considerably from the small-group model espoused in C4.

Positive gender outcomes are evident, particularly through the strong community development focus of AGB/2012/109. Over time, gender roles, opportunities and constraints within the value chain were increasingly emphasised. The farmers interviewed reported shared decision-making at cluster level and an appreciation of the respective roles and contributions of women and men in vegetable farming.

KEQ 6: Lessons for ACIAR and PCAARRD

Lessons emerging from this evaluation relate to:

- the programmatic approach itself
- factors affecting on-farm impact
- the importance of people and partnerships
- the duration and sustainability of effort.

Many of these findings are common to other programmatic reviews.²

Multidisciplinary, programmatic approaches

A long-term multidisciplinary systems approach is necessary, but not sufficient, for maximising impacts. Issues affecting vegetable production in the southern Philippines are complex and multifaceted, and are often not amenable to a simple technical 'fix'. The determination to bring in diverse perspectives and avoid 'silo' mentality in HORT/2007/066 by taking a coherent multidisciplinary approach was appropriate and laudable. However, these good intentions were not matched by the design and implementation of the program.

A programmatic design is more likely to succeed if it is intentional from the start rather than being superimposed later. HORT/2007/066 was based largely on existing project proposals, leading to confusion and resentment among some participants that affected efforts to build programmatic collaboration during implementation. The economics and policy component (C5) was especially affected by being added on later, and it lacked full support from other component teams.

An ambitious design is more likely to succeed if it is underpinned by robust established relationships and contextual understanding. This takes time, which needs to be factored in to the design process if it is not already in place. HORT/2007/066 was arguably over-ambitious as the first major foray of ACIAR into the vegetable sector in the southern Philippines. As partnerships matured and researchers developed greater familiarity with the local political economy and other contextual issues, adaptations were made that strengthened the program's effectiveness.

A programmatic design should be based on a rigorous and participatory consultative process that includes lead in-country implementers. Engagement in the design of the program builds ownership and understanding of the full extent of the challenges being addressed, how each participant's activities will fit in to the bigger picture and where the complementarities are.

A programmatic design needs a clear structure and hierarchy of objectives. Monitoring, reporting and evaluation of program outcomes should then reflect this hierarchy and go beyond the collation of component highlights. Reporting against a program-level monitoring-and-evaluation framework reinforces both the contributions of each component and the critical synergies between them.

Dedicated resourcing for program management and coordination is essential for realising the potential benefits of a programmatic approach. Having an overall program coordinator based in the southern Philippines was critical for the ACIAR vegetable program. Resources and incentives for program collaboration also need to be factored in at component level. Program managers need to ensure that component leads are playing their part to support and advocate for the program within their research teams.

ACIAR systems need to support programmatic approaches. At the time of HORT/2007/066, ACIAR's management and reporting systems were geared towards projects rather than programs. The follow-on vegetable activities reverted to a project modality under a programmatic umbrella.

Managing for impact

Adaptive management mechanisms provide the flexibility to adapt to changing circumstances, be innovative, and adopt new approaches in response to challenges and emerging or unexpected opportunities, which may prove transformative.

Research-for-development principles and practices need to be well understood by program partners. Perspectives on the balance between pure and applied science – or between developing in-country research capacity and having an impact on-farm through dissemination and adoption – varied across researchers and components.

Research findings of direct relevance to farmers and with demonstrated major benefits are more likely to be adopted. Cost-effectiveness and affordability are essential for resource-constrained and risk-averse smallholders.

An explicit GESI strategy and the incorporation of a GESI lens is essential to ensure a more inclusive, equitable and impactful approach. This includes documenting engagement by women, men and vulnerable groups, and understanding their contributions and needs. GESI strategies should evolve and adapt over time.

2 For example, Davis P and Hanley C (2023) *A programmatic evaluation of the TADEP and ASLP programs*, ACIAR Outcome Evaluation No. 3, Australian Centre for International Agricultural Research, Canberra.

Climate change and extreme weather events can be severely disruptive, but also instructive and catalytic. Valuable new partners responded to the devastation of Leyte by a typhoon in 2013, and approaches to protected cropping have been modified over time to reduce Leyte's susceptibility to high winds, summer heat and inadequate water.

Other local contextual factors need to be understood and factored in where possible. For example, farmers' inability to source critical inputs such as disease-free planting material can reduce their ability to adopt improved practices.

People and partnerships

Capacity development will always be an important part of ACIAR research programs. It should be ongoing, able to evolve and respond to areas of identified need and comparative advantage in both Australia and the partner country.

Leadership and project management skills both need attention in their own right. Strong technical knowledge and skills do not necessarily make a researcher effective as a project (or program) manager.

A genuine partnership needs to be actively cultivated and managed. The relationship between ACIAR and PCAARRD was not well enough established at the beginning and there was insufficient clarity on some aspects of roles and responsibilities. However, these early difficulties proved to be the catalyst for a much more deliberate brokering of the ACIAR–PCAARRD partnership, which was transformed within a few years and is now described as 'exemplary', featuring strong mutual respect and collaboration.

Cross-country research relationships also take time and effort. Through HORT/2007/066, ACIAR provided opportunities and resources and built institutional linkages, particularly with Visayas State University (VSU), the University of the Philippines Mindanao (UPMin) and the University of the Philippines Los Baños (UPLB). Follow-on projects built on established institutional networks and research relationships.

Sustainability and longevity

Close engagement with third parties is critical to spreading program impacts and strengthening post-program sustainability. For HORT/2007/066, key local partners included LGUs, the Department of Agriculture (DA), producer groups, private sector operators and providers of other similar or complementary programs.

Knowledge management is critical if research findings are to have maximum impact. As programs and projects wrap up, ACIAR should ensure key materials will remain accessible beyond the life of a program.

Policy settings will always be an important enabler or hindrance of impact. ACIAR programs respond to partner government priorities but can also provide valuable evidence and advocacy for policymaking.

Long-term engagement in a sector and region brings many benefits. The ability of ACIAR to build on successive interventions over many years has been a key strength of its work in the southern Philippines vegetable sector.

Reputation and status

Perceptions of both ACIAR and PCAARRD improved as a result of experiences during HORT/2007/066 and have strengthened further during the long engagement of ACIAR in the southern Philippines vegetable sector. Research institutions and government agencies in the Philippines regard ACIAR as a reliable, respected and very valuable partner. PCAARRD's capabilities have developed strongly over the period, contributing to its solid status in both government and agricultural research circles.



Students from the Visayas State University work on experimental crops at a farm in Ormoc City, Leyte.
Photo: Veejay Villafranca

Introduction

Background

Since 1982, ACIAR has brokered and funded research partnerships between Australian scientists and their counterparts in developing countries. As Australia's specialist agricultural research-for-development agency, its mission is 'to achieve 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 Australia's Official Development Assistance budget, as well as contributions for specific initiatives from external sources, including the Department of Foreign Affairs and Trade (DFAT).

ACIAR's agricultural research-for-development projects and programs routinely undergo ex-post evaluations to assess performance and impact. The standard approach for these evaluations is based on economic measures such as benefit-cost analysis (Davis et al. 2008). The ACIAR 10-year strategy (ACIAR 2018) and the 2022 update (ACIAR 2022) noted the importance of expanding the range of assessment tools to include mixed-method approaches that better reflect and capture the complexity of change and enable more comprehensive reporting on the diversity of outcomes and impacts that project activities might generate. Recent mixed-method evaluations include Landcare projects in the Philippines (Williams et al. 2021) and post-tsunami soil restoration and livelihoods projects in Aceh, Indonesia (Delforce et al. 2023).

Purpose

This evaluation serves multiple purposes.

First, it assesses the impacts of selected ACIAR vegetable projects in the southern Philippines from 2007 in relation to scientific/academic research contributions and outcomes for farming households. This assessment provides an additional empirical test of applying an integrated mixed-methods approach for evaluating ACIAR agricultural research-for-development projects.

Second, in response to the mid-term review of the ACIAR 10-year strategy (Craik et al. 2022), ACIAR is now exploring opportunities to develop more programmatic, transdisciplinary and place-based initiatives. HORT/2007/066 was an early example of such an initiative. It is therefore timely to assess both its impacts and the processes and structures that enabled or hindered its achievements.

Audience

The immediate audience for this evaluation is ACIAR staff (including both the executive team and research program managers), PCAARRD, and other organisations in the Philippines and Australia that are involved in the vegetable initiatives reviewed and/or applying mixed-methods impact evaluation in their own work.

Beyond this, the work should be of interest to a range of stakeholders in the broader agricultural research-for-development and evaluation community.

Scope

ACIAR began supporting agricultural research in the Philippines in the 1980s and was engaged in the southern Philippines (in Visayas and Mindanao) by the mid-1990s. In 2006, consultations between ACIAR and PCAARRD identified lower-cost and sustainable production systems for high-value vegetables as priority areas. A major multidisciplinary program, 'Enhanced profitability of selected vegetable value chains in the southern Philippines' (HORT/2007/066), was prepared and implemented from 2008 to 2012. HORT/2007/066 was designed to address multiple issues affecting vegetables through 6 components (Table 1).

Several projects followed HORT/2007/066, picking up on selected aspects of the initial program. The 4 projects that succeeded the 2007 program were conceived as a 'new phase of the ACIAR southern Philippine horticulture program' (McDougall 2019:7). The ICM project took a multidisciplinary approach that further addressed key issues identified during HORT/2007/066, particularly in the context of protected cropping structures.

Table 1 Program components

No.	Full title	Shortened title	Main areas of activity and achievement
C1	Integrated soil and crop nutrient management in vegetable crops in the southern Philippines and Australia	Soil and nutrient management	Benchmarking soil fertility status and management practices through soil surveys and testing, farmer surveys and nutrient omission trials
C2	Development of a cost-effective protected vegetable cropping system in the southern Philippines and Australia	Protected cropping	Demonstrating the financial benefits of protected (vs open-field) cropping for farmers and defining key issues affecting profitability and yield, including crop type, management skills and pest and disease incidence
C3	Integrated strategies for the management of bacterial wilt and other wilting diseases in solanaceous crops in the southern Philippines and Australia	Bacterial wilt	Characterising the causative strain and races of the bacteria causing bacterial wilt and developing a sensitive and reliable method for its detection from field samples
C4	Analysis of selected vegetable value chains in the southern Philippines	Value chains	Supporting the establishment and operations of marketing clusters to increase farmer incomes, and identifying key issues in ensuring cluster sustainability
C5	Economic impacts of new technologies and policy constraints in the production of vegetables in the Philippines and Australia	Economics and policy	Identifying key factors affecting vegetable profitability and productivity, the importance of transport infrastructure and regulations on growers, and impacts of underinvestment in horticulture research and development; and analysing technical interventions by other components
C6	Program management	Program management and integration	Program-wide management and coordination, monitoring and review, and communications

Source: Hall 2013

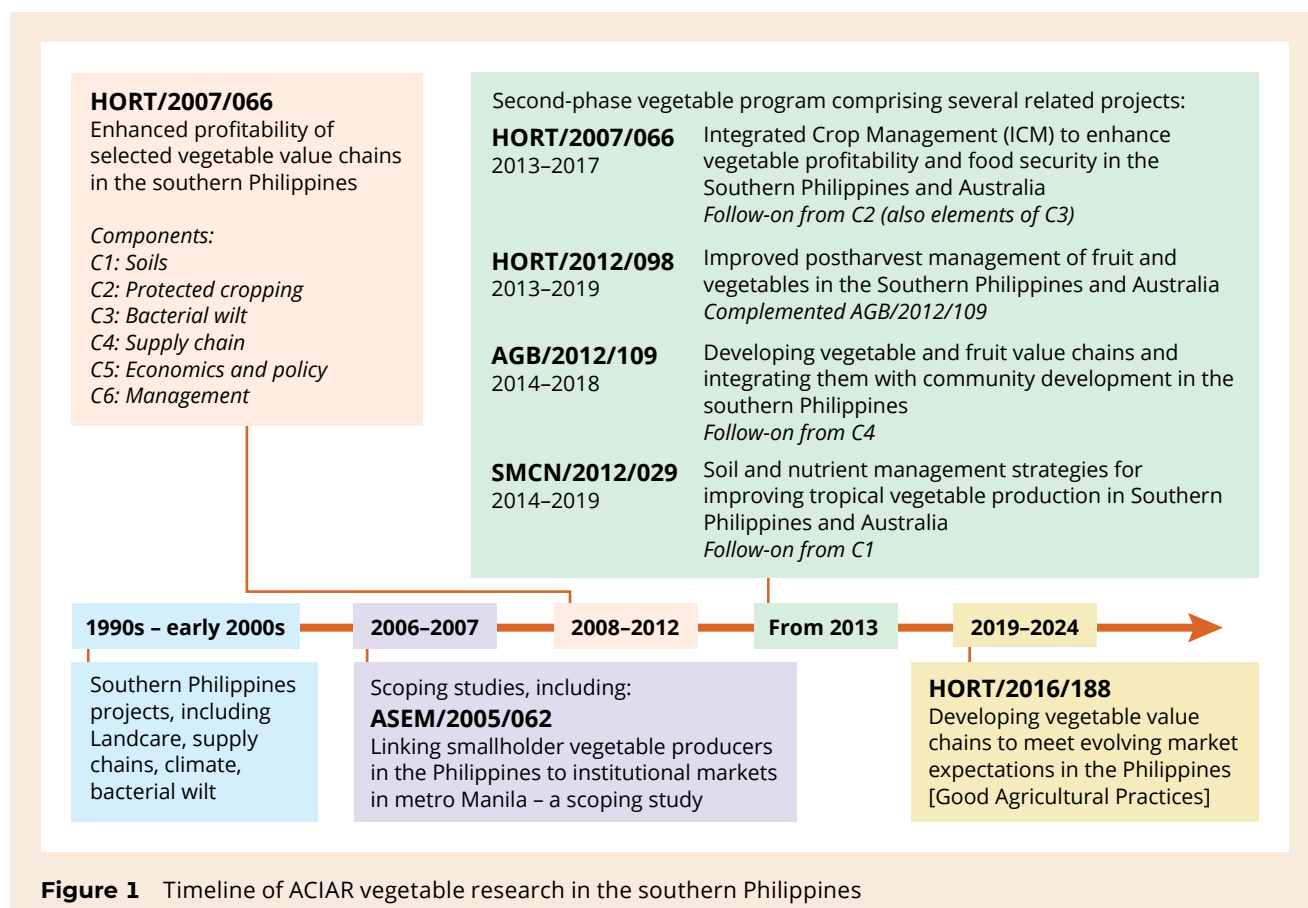


Figure 1 Timeline of ACIAR vegetable research in the southern Philippines

Three separate but complementary vegetable projects addressed soil and nutrient management strategies, post-harvest management of fruit and vegetables, and value chains. More recently, a GAP project has been implemented, again building on aspects of the earlier work (Figure 1).

In addition to these vegetable projects, other ACIAR projects in the southern Philippines during the same period included parallel projects on fruits (HORT/2007/067,³ HORT/2012/11, HORT/2012/097, HORT/2012/019), one relating to Landcare (ASEM-2009-044, building on ASEM-1998-052 and ASEM-2002-051), and one on extension methods in Mindanao conflict areas (ASEM-2012/063).

Primary focus

The multidisciplinary, multicomponent HORT/2007/066 program is the primary focus of this evaluation. ACIAR selected this program for evaluation because of its programmatic nature, the variety of research outcomes and impacts that might have resulted, and the likelihood that a range of data sources and local expertise would be available to support robust mixed-methods evaluation. These expectations were confirmed during a joint ACIAR–Alinea scoping visit to the Philippines in March 2023.

However, it was clear during evaluation scoping that the complexity of HORT/2007/066 and successor projects – across time, place and subject matter – would make it very difficult to conduct a meaningful impact evaluation across either the entire initial program by itself, or in combination with later projects. Instead, a twofold approach was agreed. This approach focuses on:

- HORT/2007/066 for questions of the programmatic approach and process, research outputs and activities to promote adoption
- impact case studies for 2 ‘stand-out’ areas of activity initiated during HORT/2007/066 and continued in subsequent projects:
 - protected cropping structures in Leyte (C2 of HORT/2007/066 and then HORT/2012/020 and to some extent, HORT/2016/188)
 - marketing clusters in Mindanao and Leyte (C4 of HORT/2007/066 then AGB/2012/109 then HORT/2016/188).

Sites

The main research sites initiated under HORT/2007/066 were located in the areas shown in Figure 2. Several of these sites were maintained in later projects, so the geographic targeting for this evaluation is within the areas shown. The protected cropping sites were mostly in Leyte, around the town of Ormoc (north of VSU) and Maasin, Bontoc and Bato (south of VSU), as well as the VSU research farm on its Baybay campus. For the marketing clusters, the main Mindanao sites were in Bukidnon (south of Cagayan de Oro) and the Davao area; as well as Cabintan in Leyte.



Figure 2 Main program research sites in the southern Philippines

³ This project shared its economics component and policy and management component with HORT/2007/066.

Key evaluation questions

In light of initial document review and scoping discussions with key informants in Australia and the Philippines, the following questions were developed to guide the evaluation (Table 2). Each of these is addressed in turn in this report.

Table 2 Key evaluation topics and questions

No.	KEQ topic	Detailed questions
1	Vision, process, structures	<p>1.1 What was ACIAR's vision for its support to the vegetable sector in the southern Philippines from 2005 and how did that vision translate into design and commissioning of HORT/2007/066?</p> <p>1.2 What were the objectives, anticipated impact pathways and assumptions, and management arrangements for HORT/2007/066 and did these evolve over time?</p> <p>1.3 What ACIAR projects followed on from HORT/2007/066 and have since been implemented in the southern Philippines vegetable sector?</p>
2	Scientific and other research impacts	<p>2.1 To what extent, and how, did HORT/2007/066 deliver on the intended scientific and other research impacts, including capacity building in partner organisations? Were those impacts enduring? Where possible and appropriate, what quantifiable impacts are identifiable? Were there unintended research outcomes?</p> <p>2.2 How did the research engagements affect gender equity and inclusiveness in the partner organisations?</p>
3	Dissemination and adoption	<p>3.1 What activities were undertaken through HORT/2007/066 to promote adoption of technologies tested in research trials?</p> <p>3.2 What evidence is available on the extent, process, reasons and consequences of dissemination and adoption, including any gender equality and social inclusion factors?</p>
4	Programmatic approach	<p>4.1 To what extent did the multidisciplinary programmatic design and management structures of HORT/2007/066 support efficient and effective achievement of intended objectives?</p> <p>4.2 Did the multidisciplinary programmatic approach produce identifiable outcomes relating to learning, collaboration and relationship building?</p> <p>4.3 In what ways did the project engage with issues of gender equity and social inclusion and what influence, if any, did this have on partners and collaborators?</p> <p>4.4 What factors determined arrangements for follow-up projects from 2012?</p>
5	Impact case studies (including follow-on projects): i: Protected cropping (Leyte) ii: Marketing clusters (Mindanao and Leyte)	<p>5.1 What impact highlights can be identified in follow-on projects that had their origins in HORT/2007/066?</p> <p>5.2 For each of 2 selected case studies:</p> <p>5.2.1 To what extent, and how, did HORT/2007/066 and its successor(s) achieve their intended impacts on the selected farming and/or marketing practices? What factors affected results?</p> <p>5.2.2 Where possible and appropriate, what quantifiable impacts are identifiable?</p> <p>5.2.3 Were those impacts enduring?</p> <p>5.2.4 Have there been unintended outcomes?</p> <p>5.2.5 How equitable was the distribution of impacts within targeted communities?</p>
6	Lessons for ACIAR and PCAARRD	<p>6.1 What can ACIAR and PCAARRD learn from the design and implementation of HORT/2007/066, decisions on appropriate follow-ups and the highlighted case studies, to improve future investments? What were the factors enabling and hindering impact?</p> <p>6.2 How did HORT/2007/066 affect stakeholder perceptions of ACIAR and PCAARRD?</p>

Context

The Philippine vegetable industry is divided into 2 major categories based on the location of cultivation and other climatic requirements, namely upland and lowland. The top 10 vegetables, in terms of area planted, are all lowland vegetables. They include okra, eggplant, *pechay* (a type of Chinese cabbage) and tomato (PSA 2020). Vegetables such as bell pepper, broccoli, cucumber and lettuce are generally grown in mid- and high-elevation areas, as these areas meet temperature requirements for optimal growth. The major provinces for the production of upland vegetables are found in the Cordillera region in the northern Philippines and in the province of Bukidnon in Mindanao. The production areas of lowland vegetables are more widely dispersed, with the largest-producing provinces located in the northern part of the country. National production statistics for major lowland and upland vegetables are provided in Appendix 1.

In the case of the locations targeted for the ACIAR vegetable projects, and the potential wider areas of subsequent influence and impact, several relevant local contextual issues may have affected the program's impacts.

Adverse weather conditions, particularly frequent heavy rainfall and intense sunlight in Leyte, can damage exposed vegetable crops. When there is an abundance of rain, the costs of pesticides soar, as many vegetables become highly susceptible to pests and diseases. This provided a strong incentive to research various types of physical crop protection structures and associated agronomic requirements. Further, Typhoon Haiyan in late 2013 severely damaged crops in Leyte, including those grown under protected cropping structures that were erected during or after the ACIAR projects. Following the typhoon, there was a significant surge in donor funding. Some of this directly supported ACIAR project activities (e.g. IsraAid's protected cropping project). However, a substantial portion of this assistance was perceived as temporary and lacking sustainability.

More broadly, climate change may also have influenced vegetable production in the southern Philippines since project activity began. The significant impact of weather changes due to climate changes is increasingly evident. Farmers had difficulty forecasting the onset of the dry and rainy seasons and this uncertainty complicated their vegetable production practices.

Communities that were in transition from conflict and insurgency in some parts of Mindanao created challenges in terms of site selection and access, particularly by international teams adhering to travel advisories.

Decentralised government structures, with local agricultural extension agents managed by LGUs as prescribed in the devolution of powers and functions under the 1991 Local Government Code of the Philippines legislation, may have affected linkages between research outcomes and broader dissemination of successful techniques. Changing political contexts, at both national and provincial level, may have affected policy priorities and programs relevant to vegetable production and marketing. There was also potential for influence from existing social divisions/tensions on the distribution of benefits from the program and subsequent projects (e.g. access to resources, participation in field activities).

In addition, broader economic development in the southern Philippines (albeit interrupted by the recent COVID-19 pandemic) makes it difficult to attribute identified changes over time to ACIAR project activities.

This evaluation was conducted in partnership with a local research team convened through the University of the Philippines Los Baños, that was well placed to identify and advise on other significant contextual issues relevant to the study.



The program of vegetable value chain research has included the benchmarking of soil fertility status and nutrient omission trials.
Photo: Veejay Villafranca

Methodology

Evaluation type

This evaluation was designed to assess the direct scientific and other research outputs and outcomes that were achieved during the program lifetime (including capacity building of researchers), the processes through which that research was managed, coordinated and results disseminated, and the longer-term livelihood impacts resulting from selected research activities (protected cropping and cluster marketing).

Using the BetterEvaluation terminology (BetterEvaluation 2022), the approach is an ex-post summative evaluation, comprising elements of both process and impact assessments (Table 3). The purpose in this case does not involve stop/go decisions. Instead, it is intended to:

- contribute to the ACIAR evidence base on the immediate and enduring impacts of its project interventions
- inform thinking on the advantages and disadvantages of multidisciplinary multicomponent programmatic approaches.

KEQ 1 and KEQ 4 primarily focus on process, while KEQ 2, KEQ 3 and KEQ 5 guide examination of various levels of impact.

Mixed-methods approaches

The standard impact assessment guidelines used by ACIAR (Davis et al. 2008) are based on benefit-cost analysis supported by partial equilibrium and/or computable general equilibrium modelling, along with non-market valuation through stated preference and/or revealed preference methods. However, ACIAR has a demonstrated interest in expanding its evaluation toolkit to include a

range of mixed-method approaches and more comprehensive assessment frameworks, including theory-based impact evaluation (TBIE). TBIE is a common evaluation approach that can accommodate both quantitative and qualitative assessment. It is based on a theory of change or program logic that illustrates expected causal steps that link activities and outputs with intermediate, final and high-level outcomes.

Recent mixed-method examples based on TBIE include evaluations of:

- a Landcare program in the Philippines which drew on analyses of quantitative survey data and qualitative information from focus group discussions and key informant interviews to assess the validity of the impact pathways in a hypothesised theory of change (Williams et al. 2021)
- post-tsunami soil restoration and livelihoods projects in Aceh, Indonesia, which tested an integrated impact assessment methodology based on TBIE, supplemented by key concepts from the sustainable livelihoods framework and total economic value approaches (Delforce et al. 2023). Indicative benefit-cost assessments were also undertaken, based on quantitative project data and provincial statistical sources.

Building on these experiences and further discussions with ACIAR, TBIE was adopted as the primary guiding methodology for this evaluation. No explicit theory of change was articulated for HORT/2007/066, but impact pathways were implicit in the program logframe. These were reflected in the framing of the KEQs and interview guides underpinning the evaluation. An indicative summary theory of change is presented under KEQ 1.

Table 3 Types of evaluation

Assessment type	Formative evaluation	Summative evaluation
Process	Focused on processes: intended to inform decisions about improving (primarily implementation)	Focused on processes: intended to inform decisions about stop/go
Impact	Focused on impact: intended to inform decisions about improving (primarily design characteristics)	Focused on impact: intended to inform decisions about stop/go

The evaluation then explores:

- the extent to which objectives and expectations were met in practice
- the validity or otherwise of the underlying assumptions
- unintended outcomes, bearing in mind contextual factors affecting implementation.

Gender and social inclusion

Consideration of GESI factors is essential to any impact evaluation, particularly where project objectives include impacts at community and household level. This is consistent with ACIAR's commitment to mainstream gender perspectives across all research investments as reflected in the ACIAR Gender Equity Policy and Strategy and the ACIAR Gender Guidelines for Project Proposals.

GESI dimensions were incorporated throughout this assessment, including to examine the degree to which:

- program and project activities responded to the (possibly) different priorities of men, women and vulnerable groups
- men, women and vulnerable groups were able to participate in program and project activities (at both research and farm/community level)
- men, women and vulnerable groups derived benefit from the program and project activities they participated in.

Data collection

The evaluation draws on both qualitative and quantitative information.

Qualitative

Qualitative information was gathered from program and project documentation, interviews and field observations, including:

- views and recollections of former ACIAR and program/project staff, collaborating researchers in Australia and the Philippines and other key stakeholders (e.g. PCAARRD, LGUs)
- feedback from direct beneficiaries, such as collaborating farmers
- other field evidence and observations on broader uptake, impacts and sustainability of program-supported technologies and approaches.

Quantitative

Quantitative surveys focused on the 2 impact case studies (protected cropping in Leyte, Visayas, and marketing clusters in Davao City, Mindanao). The aim was to supplement the qualitative information on program results and impacts with current data on farming practices and livelihoods of 3 groups:

- direct beneficiaries of ACIAR support
- indirect beneficiaries of ACIAR support (those who subsequently adopted the practices promoted through the projects)
- those who had no involvement in ACIAR projects and have not adopted those practices.

Quantitative secondary data included:

- production statistics from the Philippine Statistical Authority for selected vegetables and in the provinces where HORT/2007/066 was implemented
- data generated and recorded by the program, such as outreach and adoption, gross margins, production and marketing volumes, and benefit-cost estimates
- research and capacity-building outputs, such as publications, citations and student qualifications achieved (noting that the evaluation does not seek to assess the scientific quality of the research).

Details on evidence collection processes are provided in Appendix 2.

Limitations of the evaluation

This was a complex evaluation, encompassing a multicomponent program and selected elements of 2 successor projects, spanning about 10 years. It was undertaken by an evaluation team based in various locations in Australia, the Philippines and Indonesia, and within set time frames and budget. As a result, there have inevitably been limitations.

Documentary sources

The evaluation team has relied in part on the available documentation on each program and project. The elapsed time since completion resulted in a degree of variability in the extent and quality of reporting available. These documents might not necessarily provide full and objective coverage on the issues and challenges encountered as well as on positive aspects of the projects.

Consultations with stakeholders

While every endeavour was made to consult a range of key stakeholders and triangulate data sources, there may nonetheless have been gaps and/or biases in the information collected. Several years have passed since programs and projects were implemented and some of the key people involved were no longer available. The intensive period of face-to-face qualitative in-country consultations involved over 100 informants across Mindanao and Visayas (Leyte and Southern Leyte), but some gaps remained. In Mindanao, it was difficult to locate the former marketing clusters established under C4 of HORT/2007/066, other than in Marilog (Davao). In Leyte, some of the key ACIAR research leads were not available, as the fieldwork period fell within university vacation time. Many interviews and group discussions took place in the local language (Visayan) or Tagalog rather than English. The local field team did well with simultaneous interpretation and notetaking, but the richness of responses may not have been fully captured in translation.

Contribution vs attribution

Since the completion of HORT/2007/066, various challenges and subsequent activities have influenced crop production and farmer livelihoods in the project sites. New development partners have become active, national policy settings have changed and some local governments (but not all) have prioritised agricultural development. Leyte has been hit by several strong typhoons, particularly Typhoon Haiyan in 2013 and Typhoon Rai (known as Super Typhoon Odette in the Philippines) in 2022.

In many parts of Mindanao, progress in addressing separatist insurgencies has enabled more rapid development including domestic tourism, although political and other tensions occasionally flare into violence.⁴ These factors must be taken into consideration in any comparisons between farmers exposed (directly or indirectly) to new technologies or approaches through the ACIAR projects, and those who had no such exposure.

The extent to which particular findings can be attributed specifically to the ACIAR programs and projects is limited. The assessment is therefore mostly confined to the contribution the projects have made, with no implication that the projects alone can be credited with these results.

⁴ For example, several lives were lost in Marilog around the time of quantitative fieldwork in late 2023, which coincided with local government elections.



Project partners determined that a coherent, multidisciplinary, programmatic approach to research would be the most efficient and effective way to address the challenges and opportunities faced by the southern Philippines vegetable industry.
Photo: Chris Maglangit

KEQ 1: Vision, process, structures

Evolving vision

KEQ 1.1: What was ACIAR's vision for its support to the vegetable sector in the southern Philippines from 2005 and how did that vision translate into design and commissioning of HORT/2007/066?

ACIAR's vision was to build research capacity in the southern Philippines to tackle vegetable sector challenges and opportunities through a programmatic multidisciplinary approach. Developing human and social capital – including establishing strong linkages between Australian and in-country researchers – was the overriding priority. However, this vision was not universally recognised or shared by stakeholders. Despite the holistic intentions, the program design was built around 6 separate project proposals. Lead and collaborating organisations differed for each component, as did the geographic focus. Implementing partners were generally selected from those engaged during previous projects and/or scoping activities.

Precursors to HORT/2007/066

This vision for vegetable sector support in the southern Philippines – resulting in the design of HORT/2007/066 – can be traced back through several distinct threads of ACIAR-funded collaboration in preceding years. These included projects on sloping land management, vegetable supply chains, soil-borne diseases and climate resilience. Several key institutional and personal engagements initiated through these early partnerships were maintained into HORT/2007/066 and beyond.

Focus on the south

Development cooperation between Australia and the Philippines dates back to shortly after World War II, and ACIAR has been part of that effort since the 1980s. By the late 1990s, the geographic focus of Australian aid started shifting to the southern Philippines, particularly Mindanao (Downer 2000:40–41). This reflected both governments' concerns about long-running conflict and instability there, which were stifling development and exacerbating poverty and vulnerability.

Philippines Landcare

ACIAR became involved with Philippines Landcare activities in Mindanao – which included some upland vegetable trials – from the mid-1990s (ACIAR 2006). One such project was 'Enhancing farmer adoption of simple conservation practices: Landcare in the Philippines and Australia' (ASEM/1998/052).

Further Landcare projects have followed, including 'Sustaining landcare systems in the Philippines and Australia' (ASEM/2002/051) (Vock and DEEDI 2013) and 'Enhancing development outcomes for smallholder farmers through closer collaboration between ACIAR's landcare and other projects' (ASEM/2009/044) (Vock and DEEDI 2012). While these are outside the direct scope of this evaluation, there are important links with subsequent vegetable projects in Mindanao.

Engagement with UP Mindanao

In 1995, a new campus of the University of the Philippines was established in Davao, Mindanao, and 2 years later an eminent UPLB academic and scientific researcher, Professor Eufemio (Don) Rasco, joined UPMin's College of Sciences and Mathematics. Professor Rasco had research interests in plant breeding and reportedly initiated ACIAR's first southern Philippines vegetable project.

Marketing and value chains

Professor Rasco then turned his attention to broader vegetable industry issues, including marketing, and initiated a proposal to ACIAR on this topic. At this time, little information was available on the sector. 'Whatever we could read on vegetables in the Philippines was written in the 1970s,' said one local researcher. However, the challenges of inadequate vegetable supply and consumption were increasingly being recognised, as were opportunities for Mindanao to take advantage of its stable climate and low typhoon risk to supplement national production.

The funding proposal was accepted and became the ACIAR project 'Improving the efficiency of agribusiness supply chains' (ASEM/2000/101), with Curtin University of Technology (CUT) as the Australian collaborating organisation. This project involved working with farming groups near Davao to understand farmers' production and marketing systems and identify potential improvements. Professor Rasco handed over project leadership to a social scientist and marketing specialist in UPMIn's School of Management, Dr Sylvia Concepcion, while Dr Roy Murray-Prior led on the CUT side. Others in the UPMIn team included economist Dr Larry Digal and researcher Marilou Montiflor, while CUT's team included agribusiness marketing specialist Dr Peter Batt. The Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA) was also involved.⁵

This initial UPMIn/CUT research led to a scoping study in 2005 led by Dr Batt and Dr Concepcion. 'Linking smallholder vegetable producers in the Philippines to institutional markets in metro Manila' (ASEM/2005/062) identified significant potential for growth of the vegetable sector in Mindanao through new technologies and improved farm and marketing practices (Batt et al. 2007). On the basis of their scoping, CUT and UPMIn submitted a proposal to ACIAR in 2006 for a follow-on value-chain project.

Soil-borne diseases: bacterial wilt

Meanwhile, Australian and Filipino researchers' involvement in an FAO integrated pest management (IPM) program in Asia in the late 1990s led to an ACIAR project to explore the significant problem of bacterial wilt in the Philippines. 'Biofumigation for soil-borne diseases in tropical vegetable production' (SMCN/2000/114) involved the Queensland Department of Primary Industries and Fisheries, CSIRO and the National Crop Protection Centre at UPLB.

The Philippines lead researcher, extension specialist Ms Valeriana Justo, drew on her IPM project experience and networks to run field trials and farmer field schools and prepare a field manual on biofumigation. In Queensland, the interest in bacterial wilt continued under subsequent research staff, leading to preparatory visits to Mindanao beginning in 2006 and subsequent submission to ACIAR of an AUD300,000 project proposal on control of bacterial wilt.⁶

Climate resilience, Leyte

VSU was engaged in an ACIAR project on climate forecasting and response from the early 2000s. 'Bridging the gap between seasonal climate forecasts and decision makers in agriculture' (ASEM/2003/009) gathered local weather and climate risk data and information on farmers' weather risk attitudes and coping strategies, and also had components focusing on soils and plant protection.

Identifying and scoping priorities

Priorities for ACIAR in the Philippines are determined jointly with its counterpart, PCAARRD (formerly known as PCARRD). In March 2006, a Philippines–Australia agricultural research and development (R&D) priority-setting workshop identified a range of priorities in horticulture (fruit and vegetables), land and water management and agricultural systems (see Appendix 3). The majority of vegetable smallholders in the Philippines at that time were earning less than PHP3,000 per month (about AUD85 at average 2003 exchange rate) (Aquino 2003), and the workshop highlighted the need for further attention to lower cost and sustainable production systems for high-value vegetables.

These priorities were incorporated into PCARRD's Integrated Science and Technology agenda for 2006–2010 and were reflected in the 2007–08 ACIAR Annual Operating Plan for the Philippines. The horticultural priorities were then refined at a horticultural R&D priority-setting workshop held in Cebu in September 2007, which was attended by over 40 people from research, government, horticulture industry and farmer marketing groups as well as senior ACIAR managers. The output of the workshop was an outline plan for 2 major projects (one vegetables, one fruit) of 4-years duration, each having a number of subcomponents.⁷

5 Information based on interviews at UPMIn and Murray-Prior et al. (2003). https://www.researchgate.net/publication/253922249_A_pluralistic_methodology_for_analysing_supply_chains

6 Key informant interview.

7 Correspondence from ACIAR CEO (John Skerritt) to David Hall, NSW DPI, dated 8 October 2007 (supplied by D Hall).

ACIAR then called a follow-up meeting of Australian researchers known to have prior relevant experience to further discuss and develop the design concepts. A series of in-country scoping visits relating to the vegetable and fruit sectors then followed, through to early 2008. The following discussion pertains only to vegetables, in line with the focus of this evaluation.

Increasing production

ACIAR Horticulture RPM, Les Baxter, carried out extensive follow-up consultations and was joined by the CEO of Applied Horticultural Research, Dr Gordon Rogers, to scope specific vegetable research opportunities, including potential collaborating partners in-country (Rogers 2007b). One key area identified was the potential for simple, low-cost, protected cropping structures to enable farmers in Eastern Visayas (including Leyte) to grow vegetables in the wettest season, when open-field production was infeasible due to high winds and excessive rainfall.

Soil and crop nutrient management

ACIAR Soil Management and Crop Nutrition RPM, Dr Gamini Keerthisinghe, led a scoping study to Northern Mindanao and Eastern Visayas (Leyte) with Dr Chris Dorahy of the New South Wales Department of Primary Industries (NSW DPI) and Dr Ken Menz (former ACIAR RPM) of the Australian National University (ANU) in November 2007. Issues identified included declining soil fertility, unaffordable input costs, an interest in shifting to more organically based production systems (for which local inputs were available), a lack of information and training for growers on soil and nutrient management, and widespread incidence of soil-borne diseases. In considering potential modalities for support, ACIAR could draw on experience addressing soil management issues elsewhere (e.g. in post-tsunami Aceh, Indonesia, led by NSW DPI) as well as utilising networks and expertise in the Philippines identified through earlier projects, for instance at VSU (Dorahy 2008).

Soil-borne diseases

At the 2007 Cebu workshop, bacterial wilt was identified as the most important disease of solanaceous crops (such as potatoes, tomatoes, eggplant, capsicum and chillies) in Mindanao and other regions. Bacterial canker of tomatoes was also identified as a serious issue. As outlined in the previous section, the Queensland Department of Primary Industries (DPI) was already working on these issues and its plant pathologists (Dr Anthony Young and Peter Trevorrow) had begun scoping a new (standalone) project from 2006. They identified opportunities to research and improve management practices, focusing primarily on bacterial wilt in potatoes, with a secondary aim of addressing canker in tomatoes (Young and Trevorrow 2007).

Marketing

Similarly, as noted above, CUT and UPMin submitted a proposal in 2006 on the basis of their earlier work on supply chains, including a scoping study in 2005. While that report focused primarily on opportunities for innovations in marketing, it also noted a range of factors affecting product quality, including 'poor quality seed; poor cultural practices; excessive insect and disease damage; inappropriate post-harvest handling; the high cost of inputs and limited access to finance' (Hall 2008b:13).

Vision

As various strands of scoping and priority-setting progressed between 2005 and 2007, ACIAR's Horticulture RPM and senior management became convinced that a coherent, multidisciplinary, programmatic approach would be the most efficient and effective way to tackle the multifaceted challenges and opportunities faced by the southern Philippines vegetable industry.

Those close to the preparatory processes noted that ACIAR's priorities at the time centred on strengthening local research capacity and establishing strong linkages between Australian and in-country researchers – also expressed as 'building human and social capital'. In the Philippines context, supporting previously neglected research institutions in the south of the country was especially compelling. To some extent, the specific crops and issues of focus were simply a vehicle to achieve the broader objectives.

In addition to collaboration between research institutions, both the documentation and informant recollections point to an explicit intent to involve key private sector players in program activities, through various types of 'partnerships and collaborations' (Hall 2008b:13). This was a relatively new approach at the time, and it also reflected an increased interest in the Australian development program in strengthening private sector engagement.

Most of the Australian research leads interviewed for this evaluation agreed that ACIAR did have a vision for its new vegetables program, but views differed somewhat on what that vision was. Some recognised the effort to coordinate across disciplines and foster long-term capacity-building relationships between the 2 countries. Others highlighted the context of low vegetable consumption and unhealthy diets as the primary motivation. Some referenced objectives relating to their specific program components. One commented that 'ACIAR had lots of different personalities' but that 'it seemed pretty harmonious... [and] what they were saying made sense.' But another said ACIAR's intent was not clear, beyond the fact that there had to be Australian benefit as well as being consistent with aid policy.

Researchers in the Philippines also had a range of views. One believed that ACIAR's vision was 'something to do with peace,' underpinned by a desire to reduce the perceived threat to Australia associated with the Islamist insurgency in Mindanao.

Another who participated in the preparatory consultations in-country firmly believed that research should not be an end in itself, but rather a means to achieve development (on-farm) outcomes. This person strongly advocated for a holistic systems perspective, expressed as 'from plant to people, including extension and marketing'. However, this outlook was not uniform across all those involved, either at design stage or during implementation. There was also a sense that despite the extensive consultations, there had been limited local input into ACIAR's vision: 'At the big project launch meeting, participants were asked about their vision. But by then there was already a design, we were just implementers.'

In conclusion, it seems fair to say that ACIAR's vision was to build research capacity in the southern Philippines to tackle vegetable sector challenges and opportunities through a programmatic multidisciplinary approach – but that this vision was not necessarily clear to or shared by all stakeholders from the outset.

Design

As outlined above, the concept and ultimate design for HORT/2007/066 evolved from several years of prior engagement with institutions and individuals in the Philippines and Australia on topics relating to vegetable production and marketing, as well as targeted scoping and design consultations. As one component lead commented, 'It [program design] didn't happen overnight. There was a lot of discussion, work in-country and planning meetings in Canberra.'

The conclusion from the preparatory work was that the new program would have an overarching 'value chain' framing but also incorporate research on the critical crop production issues of soils, protected cropping and bacterial wilt. During its internal review process, ACIAR also decided to add an 'economics and policy' component covering both the vegetable program (HORT/2007/066) and the parallel fruit program (HORT/2007/067).⁸ Recognising the complexity of bringing disparate elements together, a single 'program management and integration' component was also overlaid across both the horticulture programs. It was tasked with 'ensuring integration of program components and identification of opportunities for efficiency and effectiveness gains through sharing of resources, trial sites and extension activities' (Hall 2008b:6–7). The resulting components and their ACIAR

Table 4 ACIAR budget by program component

Component	Budget (AUD)
C1: Soil and nutrient management	870,497
C2: Protected cropping	843,620
C3: Bacterial wilt	969,243
C4: Value chains	799,876
C5: Economics and policy	486,487
C6: Program management and integration	323,692
Total	4,293,415

budgets are shown in Table 4. More detailed budgets are in Appendix 4 (Table A4.2).

The design document for the vegetable program articulated as a key aim: 'to develop integrated and systems approaches to interventions addressing value chain constraints'. Nonetheless it is worth noting that the design actually comprised 6 separate project proposals in addition to the overarching 'program master' document (Hall 2008b). At least 2 of the components – C3 (bacterial wilt) and C4 (value chains) – had been designed well in advance of the overall program. In addition, each component had a somewhat different geographic footprint within Mindanao and/or Leyte.

The final versions of each component proposal made reference to intended interactions with other components. C1 (soil and nutrient management) was going to 'interact closely with other components of HORT/2007/066 to ensure the objectives of the multidisciplinary program are achieved' (Dorahy 2008). C2 (protected cropping) referenced the 'many cross linkages between individual components', highlighting clear interdependencies with C4 (value chains) along with the less-convincing statement that 'there are also program components focusing on soils and plant protection which will link with this component' (Rogers 2007a:8–9). C3 (bacterial wilt) identified some specific research connections with C1 and C2 while also undertaking to 'link with the other components as appropriate'.

C4 (value chains) unsurprisingly described itself as 'an integral part of the program HORT/2007/066'. The final proposal states an expectation that 'the marketing clusters established under this component of the program will be utilized by the 4 other components' (C1, C2, C3 and C5). It goes on to say that C4 'will directly service' C1, C2 and C5 through its various market assessment activities. However, interviews with some of those involved in C4 suggest that the extent of collaboration articulated in the final document was a somewhat unexpected ACIAR edit. 'We were worried

⁸ It is worth noting that the addition of explicit policy work within the program was apparently initiated by ACIAR rather than at the request of Philippine Government stakeholders.

when we heard other component proposals, that they were going to use “our” farmers. That would be ok if properly scheduled. But if every day new people were coming, that would dazzle and confuse the farmers.’

While C5 (economics and policy) and C6 (program management and integration) both had a clear program-wide focus, overall the cross-component linkages articulated at design stage feel a little forced. As one interviewee commented, ‘It was really 5 projects lumped together... The only things in common were the Philippines and vegetables.’ Subsequent experience with implementation suggests that the structure of the design was not an ideal match for the vision of a coherent, integrated program. ‘If I was redesigning it, I would start from scratch,’ said one component lead. These issues are discussed further under KEQ 4.

Commissioning

Selection of collaborating institutions was based largely on prior relationships. As outlined above, earlier ACIAR projects had involved the state agriculture or primary industries departments in New South Wales and Queensland, CUT in Western Australia, the University

of the Philippines in Los Baños and Mindanao, VSU in Leyte and SEARCA at UPLB. Within those institutions, many of the component and program leads in both Australia and the Philippines had already worked together on earlier projects or were known to ACIAR through projects elsewhere.

ACIAR’s own scoping activities also helped identify in-country partners, with assistance from those on the ground, such as senior academics. Choices were not always easy, as a balance was sought between providing support where it was most needed, and seeking a level of existing capabilities and resources to enable effective implementation. Decisions also had to be made about the optimum number of participants, meaning that some interested individuals or organisations missed out.

At the time of design the proposed mix of lead and collaborating organisations was different for each component, although some were involved in more than one component (Table 5). The proposed geographic focus also varied, reflecting to some extent the locations of the key institutions. In addition, ACIAR oversight and management was initially spread across 4 separate research programs (later 3).

Table 5 Key players by program component

Component	Proposed geographic focus*	ACIAR research program	Lead partner (Australia)	Lead partner (Philippines)	Other collaborating institutions
C1: Soil and nutrient management	Leyte and Northern Mindanao	Soil Management and Crop Nutrition	NSW DPI	VSU	<ul style="list-style-type: none"> • NOMIARC (DA Bukidnon) • ICRAF (Claveria) • NorMinVeggies (Cagayan de Oro) • UPLB (Luzon)
C2: Protected cropping	Initially Leyte; then Visayas and Mindanao	Horticulture	Applied Horticultural Research	VSU	<ul style="list-style-type: none"> • NSW DPI • East-West Seed (Luzon)
C3: Bacterial wilt	Northern Mindanao	Horticulture	Queensland DPI	UPLB	<ul style="list-style-type: none"> • NSW DPI • NOMIARC
C4: Value chains	Mindanao	Agricultural Systems and Economic Management (ASEM)	CUT	UPMin	<ul style="list-style-type: none"> • Catholic Relief Services
C5: Economics and policy	Mindanao, Leyte and national (policy issues)	Policy Linkages and Impact Assessment (later brought under ASEM)	NSW DPI	SEARCA	<ul style="list-style-type: none"> • Philippine Institute for Development Studies • VSU • UPMin • DA (Crop Statistics Division)
C6: Program management and integration	Mindanao and Leyte	Horticulture	NSW DPI	ACIAR-contracted manager (Davao)	

* Each component also had Australia-based research activities, but these are not the focus of this evaluation.

Notes: ACIAR – Australian Centre for International Agricultural Research; CUT – Curtin University of Technology; DA – Department of Agriculture; DPI – Department of Primary Industries; ICRAF – Center for International Forestry Research and World Agroforestry; NOMIARC – Northern Mindanao Integrated Agricultural Research Center; NSW DPI – New South Wales Department of Primary Industries; SEARCA – Southeast Asian Regional Center for Graduate Study and Research in Agriculture; UPLB – University of the Philippines Los Baños; UPMin – University of the Philippines Mindanao; VSU – Visayas State University

Achieving objectives

KEQ 1.2: What were the objectives, anticipated impact pathways and assumptions, and management arrangements for HORT/2007/066 and did these evolve over time?

Objectives centred on **increasing production and profitability of vegetable value chains** through research and dissemination activities leading to farmer adoption of new technologies and approaches. Management arrangements were complex, involving responsibilities in Australia and the Philippines within each component, plus overarching management and coordination (C6). Personnel changes compounded the challenges. Annual program meetings provided opportunities for review, planning and adaptation.

Objectives

The program design documentation included a logical framework (logframe) with program goal and purpose, and component-level outcomes and outputs (see Table 6 for a summary to outcome level). Indicators, means of verification and assumptions were articulated at each level.

The program and component objectives⁹ were all framed in terms of increasing production and profitability of vegetable value chains. At (intermediate) outcome level, components C1–C4 included language covering both research ('identify', 'test') and dissemination ('promote/assist adoption'). C1 also included an explicit aim of building research staff capacity, while C3 sought to establish capability within the private sector (agribusinesses and entrepreneurial farmers) to produce disease-free seed potato. C5 was seen as contributing to the efficacy of the other components through its economic analyses of local value chains, component impacts and policy issues. C6 was intended to support the individual components, foster linkages between them and establish effective lines of communication within the program and externally.

Anticipated impact pathways

Theory-of-change approaches were not well established at the time of HORT/2007/066 design. Some informants involved with program-wide implementation said that having a theory of change from the outset would have helped.

The logframe was a bit too sophisticated, it didn't seem especially real for the circumstances of the projects. There wasn't enough development of an implementation plan or thought about using research results. Mostly it was based on activities and collecting

information and being busy. Research activities were goals in their own right.

Towards the end of HORT/2007/066, theory-of-change approaches were becoming more popular and an attempt was made to retrofit one, but 'we'd gone too far' and it was never finalised.

On the other hand, program documentation and other key informant interviews suggest that a good sense of impact pathways did inform the design. As one former ACIAR RPM put it, this included identifying 'not just research partners but also impact partners such as extension services or NGOs'. A senior Philippine Government official noted that, even well before HORT/2007/066 began, ACIAR management were expressing concerns about 'why the science wasn't getting to farmers'.

Figure 3 illustrates a high-level summary theory of change for HORT/2007/066 with an implicit (left-to-right) impact pathway, based on the program logframe. In sum, research, capacity development and outreach activities were aimed at producing academic outputs (papers, qualifications), locally appropriate technologies and approaches, and farmer awareness of research findings. In combination, these outputs would generate a range of intermediate outcomes (not shown), leading to final outcomes pertaining to both research capacity and (via an adoption pathway) to more beneficial vegetable production and marketing.¹⁰

⁹ Component objectives equate to end-of-program-outcomes in theory-of-change terminology.

¹⁰ This simple schematic does not fully capture sequencing and the logical pathways that also exist among the final outcomes shown (i.e. top to bottom). A more comprehensive theory of change would have additional outcome layers.

Table 6 Logframe summary

Goal: To contribute to economic growth through increased income and improved livelihoods of high-value vegetable growers in southern Philippines					
Purpose: To improve smallholder and industry profitability and market competitiveness of southern Philippines selected vegetable industries (including potato, tomato, brassica, leafy vegetables)					
C1: Soil and nutrient management	C2: Protected cropping	C3: Bacterial wilt	C4: Value chains	C5: Economics and policy	C6: Program management and integration
Objective Sustainable and cost-effective production systems that target market opportunities developed	Objective More profitable off-season production (particularly protected cropping) of high-value vegetables developed and implemented	Objective Major wilting diseases affecting yield and quality in solanaceous vegetables identified and managed	Objective Existing value chains analysed and enhanced and market linkages strengthened	Objective Improved program impacts through profitability information and understanding of policy constraints	Objective Program management fosters research and business linkages
Outcome 1.1 Integrated soil, crop, nutrient and water management practices best suited to local conditions for improving soil fertility and increasing vegetable production identified	Outcome 2.1 Appropriate and effective protected annual crop production systems in Leyte and Australia developed and tested	Outcome 3.1 Strains of <i>Ralstonia solanacearum</i> causing bacterial wilt in Mindanao identified and sustainable management strategies developed	Outcome 4.1 Existing chains described and evaluated where relevant	Outcome 5.1 Economic analysis of value chains for project vegetable crops and locations of interest	Outcome 6.1 Program management assists with all aspects of project design
Outcome 1.2 Agronomic management practices best suited to local conditions for improving soil fertility and increasing vegetable production disseminated to target farmers	Outcome 2.2 Determine the economic viability of protected cropping systems at a farm and market level	Outcome 3.2 Commercial and on-farm clean seed potato production established	Outcome 4.2 Incentives assessed at the farmer level for improved quality (technical, functional and service) across value chains	Outcome 5.2 Economic analysis of the program component impacts and their use to review research focus during the project and enhance information on the profitability of outcome	Outcome 6.2 Linkages with and between project leaders are encouraged and fostered
Outcome 1.3 Building scientific research capacity of collaborating staff to promote more sustainable and profitable vegetable production	Outcome 2.3 Promote adoption/modification of protected cropping systems in Leyte and Southern Mindanao	Outcome 3.3 Strains of <i>R. solanacearum</i> causing bacterial canker in Mindanao identified and sustainable management strategies developed	Outcome 4.3 Smallholder vegetable producers assisted to adopt effective market linkage mechanisms, via collaborative marketing arrangements and clusters	Outcome 5.3 Policy constraints analysed and implications for adoption of project results understood	Outcome 6.3 Communications plan designed and implemented for the multidisciplinary project
		Outcome 3.4 Best management practices and sustainable management strategies effectively disseminated and implemented by farmers	Outcome 4.4 Opportunities identified for value-chain intervention during the vegetable program life		

Note: These objective and outcome statements are drawn from the project logframe as presented with the design proposal.

Activities	Outputs	Final outcomes	High-level outcomes
Defining and assessing current situations	Educational materials, scientific papers, reports and publications; academic qualifications	Improved scientific research capacity	Purpose: Improve smallholder and industry profitability and market competitiveness of southern Philippines selected vegetable industries (including potato, tomato, brassica, leaf vegetables) Goal: To contribute to economic growth through increased incomes and improved livelihoods of high-value vegetable growers in southern Philippines
Research trials to develop and test improved technologies/approaches	Improved (sustainable and cost-effective) technologies/approaches suited to local conditions	Widespread on-farm adoption of improved technologies/approaches	
Data analysis (scientific, economic)	Farmers aware of and trained in new production technologies/approaches	Higher productivity and profitability of (selected) vegetable crops	
Demonstration, dissemination and outreach to farmers	Collaborative marketing arrangements designed and trialled	Strong and profitable supply chains (farmer-market linkages)	
Other capability development (training, scholarships, study tours, etc.)		Farmers benefiting from new technologies/approaches adopted	
Process: effective integration and management at whole-of-program level			

Figure 3 Indicative 'skeleton' theory of change

The exact mechanisms through which research findings were expected to result in improved farm-level outcomes are not always obvious from the logframe but were provided in more detail in the component design proposals. Across the 4 technical components, the main dissemination and impact strategies were:

- **Training and capacity building:** Training activities were commonly identified as a strategy to empower farmers with knowledge and skills. Farmer workshops would be arranged at research centres such as VSU. Other proposed mechanisms included farmer field schools and working with lead farmers to set up on-farm demonstration plots.
- **Participatory approaches:** All components emphasised involving farmers and farmer groups and adopting a participatory approach to maximise the impact of their research.
- **Engaging local stakeholders:** The value of working with and through other stakeholders and networks was also noted. These included LGUs and their agricultural extension workers, various producer and marketing groups, and existing participatory action learning groups and Landcare groups.
- **Communication materials:** Some components envisaged creating practical information packages to promote best management practices and technologies to farmers.

Dissemination activities are discussed in more detail under KEQ 3.

Assumptions

Assumptions at each level of the hierarchy are set out in the program logframe. The assumptions at Goal level were:

- interventions in various parts of the value chain translate to higher prices, increased market volume and better returns to growers
- increased volume of vegetables can be handled by the market
- superior quality attracts premium prices in a significant number of cases.

Assumptions at Purpose level were:

- increased quality and quantity translates to market competitiveness
- increases in market revenue flow through to growers.

At Objective level, the main assumptions revolved around the research successfully generating sound and viable recommendations that were adopted by growers and subsequently translated into increased grower returns.

Other key themes at Outcome and Output level included:

- farmers, businesses and other stakeholders being willing to participate and collaborate in project activities
- there being no significant constraints to the adoption of recommended crop technologies or management strategies – for instance, that farm inputs would be readily available and economic to transport and use
- that outputs from Australian research and other ACIAR projects would be transferable and applicable in the Philippines
- that policy decision-makers would be willing to support policy changes based on program findings (C5)
- that organisations involved and collaborations established during the program would remain stable and continue beyond the program's lifetime and that communication at all levels would be effective (C6).

Somewhat optimistically (and perhaps perversely), one of the assumptions underlying C2's ability to develop specifications for effective protected cropping structures in Leyte was that 'Strong winds and rain do not occur during the evaluation period'.

Management arrangements

Management structures for HORT/2007/066 are shown in Appendix 4. Ultimate management responsibility rested with ACIAR as the funding agency. Given the complexity of this program, which cut across several of ACIAR's core research programs, the HORT RPM (Les Baxter) took on the overarching coordination role within ACIAR as well as specific responsibilities for C2 and C3. The other 3 research components were initially managed by 3 separate RPMs. Between them, the RPMs were responsible for ensuring program consistency with key strategies and directions in Australia and the Philippines, and monitoring progress.

A program reference committee comprising ACIAR RPMs, PCAARRD and leads of the program-wide management component (C6) was to provide broad oversight and support. Few details are provided in the design documents but essentially this provided an opportunity to engage PCAARRD in management through formal quarterly meetings. Other PCAARRD roles identified at design stage were to manage funds for the Philippine collaborators through its foundation, and to work with C6 on monitoring and evaluation during implementation, including checking for consistency between program plans and PCAARRD's national R&D plan.

ACIAR commissioned NSW DPI (David Hall) to lead the C6 management component of HORT/2007/066 as Vegetable Program Manager.¹¹ His responsibilities included 'overall financial management, reporting, monitoring and evaluation, and developing integration/ synergies between and within the program components' (Hall 2008a:9). He was expected to meet with Australian implementing partners and ACIAR once a year, and travel to the Philippines twice a year to attend planning and review meetings and visit project sites.

To overcome the perceived disadvantages of the typical 'fly in-fly out' RPM model, ACIAR also appointed an in-country coordinator to be based in Davao, Mindanao. The role of Philippines Horticulture Manager (John Oakeshott) was seen as particularly important in the context of a multidisciplinary approach spread across multiple regions where ACIAR did not have an existing presence. Mr Oakeshott was tasked with managing day-to-day interactions and information sharing for both the vegetable and fruit programs, including managing stakeholder and collaborator relationships, identifying and developing commercial linkages, supporting implementation and monitoring and evaluation across the program, and fostering collaboration between program components (Hall 2008a).

Within each of the vegetable program's research components, the Australian Component Manager was responsible for managing implementation, budgets, reporting and relationships with the various collaborators in Australia and the Philippines. These component leads were to meet with each other and ACIAR annually in Australia for planning and review, and also annually in the Philippines with the in-country research leads.

Several informants interviewed for this evaluation noted the complexity of the program structures and management arrangements and the resulting challenges of operational management. One noted that this was the first time ACIAR had embarked on a multi-RPM program, although 'a collegiate approach was already there'. Overall, 'our management structure was heavy... a bit "busy", on paper and on the ground. And everyone was talking to people in-country.' In this context, the value of the Philippines Horticulture Manager – described by one interviewee as the 'front person for the program' – was indisputable. A research lead in the Philippines was especially effusive:

Without John Oakeshott, how would we move?! He was the coordinator – essential to the whole ecosystem. There were so many moving parts!

11 In parallel, the Queensland Department of Agriculture, Fisheries and Forestry was commissioned to manage the Fruit program, HORT/2007/067, although structurally Component 6 sat across both the vegetable and fruit programs.

While the descriptions of management arrangements in the program proposals emphasise Australian organisations and individuals, it is clear that the Philippines-based collaborators also played a significant role in managing and leading their components in-country, as well as (in some cases) actively pursuing intercomponent connections. At least some of the local researchers also pushed back against approaches proposed by their Australian counterparts where they felt these were inappropriate or unlikely to succeed. In one case, the compromise reached was that the Australian lead would focus on the Australia-based research while the Philippines-based work would be led locally.

Evolution and adaptation

Annual program planning and review meetings in Australia and the Philippines provided a forum to plan and adapt activities based on progress against objectives and emerging challenges and opportunities. Annual plans and annual reports were developed for each component (with the C6 report also providing a brief summary across all components). Changes in partners, personnel, activities and budgets documented in annual reporting are summarised in Appendix 5.

The main changes that took place over the lifetime of HORT/2007/066 were in terms of personnel, particularly on the Australian side. C1, C3 and C5 all had changes in Australian leads. The economics and policy component (C5) proved especially problematic after the retirement of its initial lead in May 2009 and the departure of his replacement just 5 months later. Difficulties securing a long-term lead resulted in the Vegetable Program Manager stepping in (somewhat reluctantly) as de facto C5 manager for much of the remainder of the program. These personnel difficulties compounded what was already proving to be a difficult component and contributed to changes in activities and budgets.

At least 2 partnerships anticipated at design stage did not eventuate (NorMinVeggies and Bureau of Agricultural Statistics. Catholic Relief Services (CRS) had to withdraw from C4 due to requirements of its funder, United States Agency for International Development, although key staff were able to transition into employment under C4. On a positive note, C2 in particular was successful in developing additional linkages and support from local organisations such as local government bodies and a private company.

The balance between research at the VSU site and research on collaborators' land evolved somewhat for C2. After an initial shift in focus towards the on-farm settings, there was a concern that collaborators were being asked to devote too much of their time to detailed data collection. The detailed research was therefore condensed into 2 main locations (VSU and Cabintan).

New topics of research interest were identified during implementation. For C2, irrigation (or lack thereof) proved to be a significant determinant of crop performance. For C3, difficulties producing seed potato free of soil-borne diseases led to a scoping study on aquaponics (soil-free production). For the program overall, post-harvest losses and quality emerged as major value-chain issues requiring further attention.

Two no-cost extensions took the program end-date from 30 April 2012 to 31 December 2012. Overall budgets changed only marginally during the life of the program. Gaps in personnel and activity under C5 resulted in savings that could be managed within the program without reverting to ACIAR. These funds provided welcome flexibility for program managers and enabled additional C2, C3 and C6 activity. C1, C3 and C4 also successfully navigated ACIAR approval processes to secure extra funding for specific activities.

The documented changes likely understate the extent to which ACIAR (and at least some of the implementing teams) were actively seeking to learn from experience and seize opportunities. The picture that emerged from key informant interviews was that, once the broad structures had been agreed, ACIAR was prepared to let program directions evolve and be shaped over the course of implementation, rather than having a clear sense at the outset about how best to achieve objectives. As a former ACIAR RPM put it, 'We set off on a wing and a prayer. This was new territory for most of us.' The Australian state departments tasked with program leadership helped with this as they could be flexible and draw in different forms of expertise if needed. For Australia-based personnel, awareness of who the key players were in-country and how change could best be supported was something that developed over time. However, changes in key personnel disrupted continuity including in knowledge building.

Follow-on projects

KEQ 1.3: What ACIAR projects followed on from HORT/2007/066 and have since been implemented in the southern Philippines vegetable sector?

Nine vegetable projects that have been implemented in the southern Philippines since 2012 and can be considered to follow on from HORT/2007/066 are listed in Appendix 6. These projects are described briefly below, grouped according to timing and/or ACIAR research program. Factors that influenced priorities and approaches after the initial program are discussed under KEQ 4.

Phase 2 program

The 4 projects that succeeded HORT/2007/066 (all dated 2012 but with actual start dates during 2013 and 2014) were conceived as a 'new phase of the ACIAR Southern Philippine Horticulture program' (McDougall 2019:7) (Figure 4). These vegetable projects, along with the contemporaneous suite of fruit projects, shared a common goal of improving food security and livelihoods for smallholder farmers (Box 1).

Other ACIAR projects in southern Philippines during the same period included 4 separate projects on fruits, following on from HORT/2007/067 (HORT/2012/019 on mangoes, HORT/2012/097 on bananas, HORT/2012/113

on papaya, HORT2012/095 on other tree crops such as jackfruit), one relating to landcare (ASEM/2009/044, building on ASEM/1998/052 and ASEM/2002/051), and one on extension methods in Mindanao conflict areas (ASEM/2012/063). These are not covered in this evaluation.

Good Agricultural Practices

During the later stages of the 2013–18 vegetable program, a further follow-on project was designed. **'Developing vegetable value chains to meet evolving market expectations in the Philippines' (HORT/2016/188)**, which is due for completion in 2024, focuses on helping farmers meet Philippines GAP standards (BAFS 2017), including food safety, and developing value chains for GAP-certified products. The project proposal describes it as a follow-on to the ICM project. However, given its strong value-chain framing (including post-harvest issues), it could be seen as a primary culmination of the 2013–2018 program for vegetables in Visayas (it does not cover Mindanao).

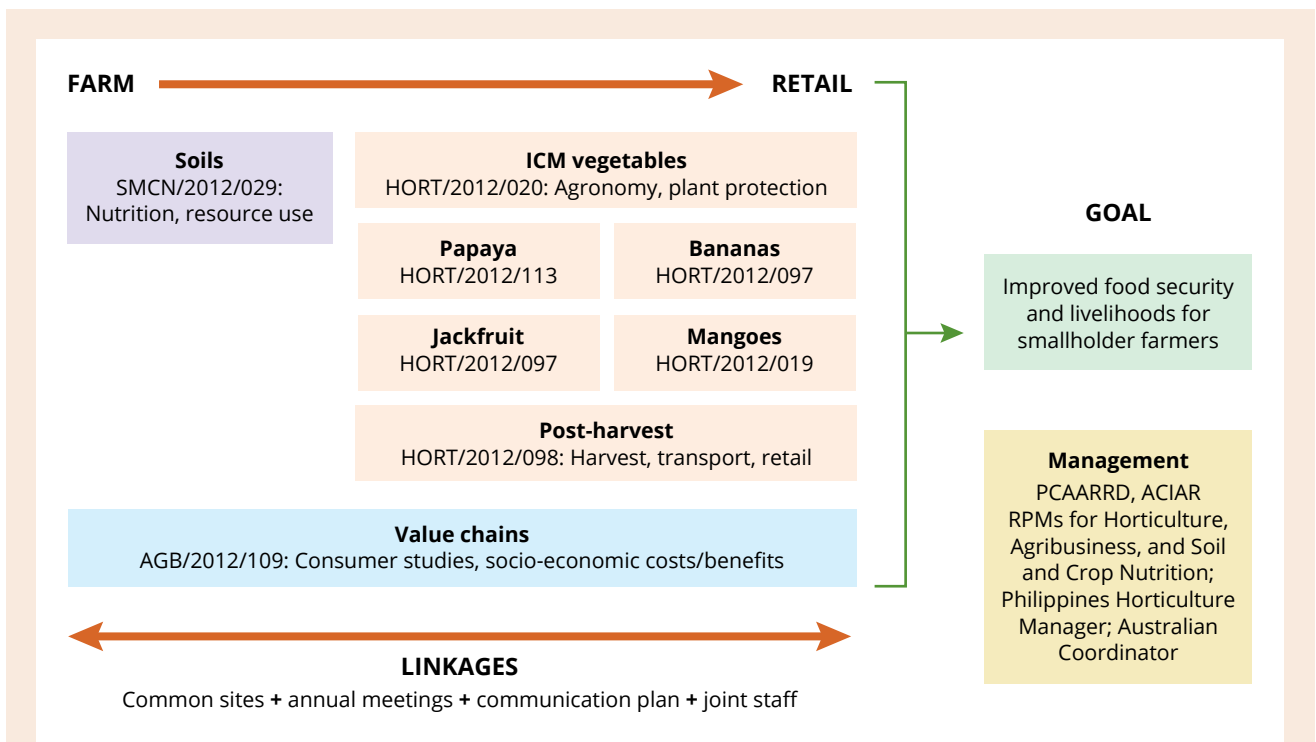


Figure 4 Structure of ACIAR horticultural research in the southern Philippines, 2013–2018

Source: McDougall 2019:7

Box 1: Vegetable projects under the 2013–2018 horticulture program

‘Developing vegetable and fruit value chains and integrating them with community development in the southern Philippines’ (AGB/2012/109) continued the explicit value-chain focus of the initial HORT program but shifted to ACIAR’s agribusiness portfolio. There were significant changes in Australian leadership (away from CUT to the University of Queensland) and approaches, as discussed under KEQ 4 and KEQ 5. On the Philippines side, UPMIn continued to be the lead, but VSU became increasingly involved as the focus turned more towards Visayas.

Like its forerunner, **‘Integrated Crop Management (ICM) to enhance vegetable profitability and food security in the Southern Philippines and Australia’ (HORT/2012/020)** took a multidisciplinary approach that further explored key issues identified during HORT/2007/066, particularly in the context of protected cropping structures, including pest and disease control, fertiliser use, mulching and drip irrigation. There was also a significant focus on producing disease-free planting material, including through aeroponic production of seed potatoes (building on C3 of the earlier program). The primary Australian partner was NSW DPI, while VSU continued its lead role from C2. The Landcare Foundation of the Philippines and East-West Seed took on major roles in farmer and community engagement.

‘Soil and nutrient management strategies for improving tropical vegetable production in Southern Philippines and Australia’ (SMCN/2012/029) built on the soil and nutrient management component (C1) of the earlier program although with somewhat different approaches. The Queensland Department of Agriculture, Fisheries and Forestry took over from NSW DPI as the Australian lead and VSU retained leadership on the Philippines side but with different personnel.

‘Improved postharvest management of fruit and vegetables in the Southern Philippines and Australia’ (HORT/2012/098) responded to this key issue identified during the original program. Applied Horticultural Research and UPMIn were the lead organisations.

Agribusiness value-chain activities

Meanwhile, in association with and immediately following the agribusiness value-chain project, at least 3 short research activities were approved:

- **‘Learning alliance approaches to scaling out vegetable value chains in the southern Philippines’ (AGB/2017/039)** (University of Queensland with VSU) focused on farmer collaboration (Visayas)
- **‘A theory of change for inclusive value chains in the Philippines’ (AGB/2019/100)** (UQ with CSIRO, UPMIn, VSU and Foodlink Advocacy Cooperative) was designed as a scoping activity to inform preparation of AGB/2018/196
- **‘Agribusiness master class: Philippines’ (AGB/2019/101)** (CSIRO with UQ and Food Advocacy Cooperative).

These short research activities led to a further major agribusiness value-chain project. **‘Agribusiness-led inclusive value chain development for smallholder farming systems in the Philippines’ (AGB/2018/196)** was led by CSIRO and involved the same organisations as the short research activities. In Mindanao, this inclusive value-chain project is now focusing on coffee and coconut. In Visayas it deals with vegetables, but is largely independent of the GAP project as its main focus is on inclusive business models and community development.

John Dillon Fellowships

It is also worth mentioning that a number of ACIAR-funded small (8–10 week) research projects have been (and continue to be) undertaken on vegetable and value chain topics as part of John Dillon Fellowships awarded to midcareer professionals in the Philippines. Several individuals involved in the various vegetable programs and projects implemented over the past 20 years have been John Dillon Fellowship participants (discussed further under KEQ 2).

KEQ 2: Scientific and other research impacts

Research and capacity building

KEQ 2.1: To what extent, and how, did HORT/2007/066 deliver on the intended scientific and other research impacts, including capacity building in partner organisations? Were those impacts enduring? Where possible and appropriate, what quantifiable impacts are identifiable? Were there unintended research outcomes?

The program contributed substantially to scientific knowledge on vegetable production and marketing in the southern Philippines, notably on protected cropping, bacterial wilt control and collaborative marketing groups. The collaborative research built strong relationships and contributed to professional and personal growth for researchers in both countries. Partner universities benefited both directly and indirectly through staff development, facility upgrades, research funding and higher rankings and status. Government partners also benefited from program engagement. ACIAR has remained engaged with the same institutions, and many of the same individuals, through subsequent projects. This has helped to sustain the research and capacity development impacts and professional relationships initiated under HORT/2007/066.

The strengthening of scientific and other research capacity in the Philippines was central to ACIAR's vision and objectives for HORT/2007/066 and an essential first step along the anticipated impact pathways. Program proposals identified that universities in the country's south were relatively neglected, and lagged behind Luzon in researcher profile and capabilities. While building research capacity in partner institutions was a means to an end (development impacts), it was also an explicit objective in its own right.

Activities designed to develop capacity in the collaborating universities included support from the Australian project teams with research trials, analysis, write-up and preparation of publications. Local researchers were encouraged and funded to participate and present findings at workshops and conferences, and opportunities were provided for short- and long-term professional development and postgraduate study.

Measures of success include documented tangible outputs such as publications and participation in capacity-building activities, as well as recollections and observations from key informants from Australia and the Philippines who were involved in the program.

This chapter focuses primarily on the outcomes for academic researchers and their institutions. The engagement of farmers in research and capacity building is addressed under KEQ 3.

Delivery on intended impacts

Capacity development

Collaboration and networking

Capacity development was progressed through a wide range of collaborative activities between researchers in Australia and the Philippines. All interviewees acknowledged that capacity development was a central focus of the program that enhanced the skills and capabilities of researchers and their institutions and built considerable human and social capital. Australian researchers emphasised that there were mutual benefits, and they also derived value from working closely with Filipino counterparts, learning from each other, and building strong relationships through research collaboration and mentoring. The Filipino researchers acknowledged professional and personal growth and positive career impacts.

Project engagement increased local researchers' confidence in their own abilities, including in the management of large complex research projects. 'Before I didn't have confidence, but with this project I gained confidence,' said one local component lead. More junior local staff benefited from opportunities the program provided for close interaction and mentoring from senior colleagues within their institution.

The ACIAR projects provided valuable networking opportunities both domestically and internationally. Many of the Philippines-based researchers interviewed reflected on the value of visits to Australia and other countries, including for international conferences on soil science, horticulture and agricultural economics. They met other professionals in their field and were exposed to new research methods and international best practices. They also shared their own expertise. For instance, a C4 agricultural technician was funded to visit Cambodia and Laos to provide information on clustering to governments, non-government organisations (NGOs) and farmers.

Closer to home, many HORT program researchers were able to participate in Philippines-wide national conferences and other events. 'We were able to present our results across the Philippines.' This helped build confidence in preparing and presenting papers and expanded researchers' professional networks. In addition, the in-country program coordinator organised cross-component and cross-island visits to expose researchers to other issues and contexts (e.g. sloping areas in Bohol, with Landcare support).

Researchers also learned the power of cross-institutional collaboration, with multiple local universities and other partners working together in new ways as networks expanded beyond the familiar academic circles. For instance through C4, UPMIn developed long-standing relationships with private sector players, such as the Jollibee Foundation, supermarkets and retail chains, and producers groups such as the Vegetable Industry Council of Southern Mindanao (VICSMIn).

Training

Formal capacity development activities for partner universities under HORT/2007/066 included training of undergraduate and postgraduate students and faculty members, provision of scholarships for overseas study, and study tours. Many students and faculty staff obtained research qualifications linked to their involvement (Table 7).

Both undergraduate and local graduate students were able to undertake their own research on project trial sites, while several promising research staff were awarded ACIAR scholarships (John Allwright Fellowships) for master degree or PhD study. Shorter professional development opportunities involving travel to Australia were made available through ACIAR John Dillon Fellowships, AusAID Australian Leadership Awards and Crawford Fund fellowships, as well as component study visits. Beyond these immediate program-related results, researchers were able to leverage their involvement to gain entry to courses elsewhere (e.g. Japan) or to tap into other sources of research funding.

In addition, each program component delivered or facilitated access to training for collaborating staff on specific scientific, technical or analytical topics relevant to that component. For example, C5 staff were able to attend courses on impact assessment at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in India and the International Rice Research Institute (IRRI) in Los Baños, Philippines. There was also significant attention devoted to research methods such as experimental design and statistical analysis.

Australian key informants noted that the existing approach tended to be 'we've got our money, let's start', and then 'this worked; that didn't'. By the end of the program, people were reportedly much more aware of the need for good planning and pre-reading before setting up trials, and they were asking 'why' particular results were observed.

Table 7 Partner university capacity building by program component

	C1	C2	C3	C4	C5	Total
Undergraduate students trained	2	2	n.d.	n.d.	9+	13+
Postgraduate students trained	1	4	1	4	n.d.	10
Faculty members trained*	25+	34	18	n.d.	7	84+
Scholarships received	2	2	1	n.d.	3	8
Participants in study tours	4	126	4	1	-	135

* Specific component related study tour, training workshop, etc.

Note: n.d. - no data

Source: Hall 2013:39

Institutional impacts

The academic institutions involved in the Philippines vegetable program benefited both directly and indirectly. In some cases, facilities were upgraded (for example, the soil-testing laboratory at VSU). ACIAR's research funding and the resulting publications also helped boost university rankings and status, including through formal government reporting channels such as the Commission on Higher Education and the Department of Budget and Management. The research funding was critical in its own right. Government universities such as UPMIn and VSU were not allocated any substantial research funds, so it was essential to attract external funding if staff were to be retained. Accreditation bodies also take account of the impacts of research, so evaluative work could have been useful in that regard.

HORT/2007/066 played an important role in curriculum development, contributing to the creation of academic programs related to agriculture, agribusiness and value chains. This ensured that knowledge gained from the ACIAR program benefited not only the educators but also their students. Researchers in UPMIn's School of Management (which managed both C4 and C5) were especially effusive about the impact of ACIAR collaboration, which helped the young university establish credibility and gain acceptance in sceptical (and initially somewhat hostile) more established academic circles. HORT/2007/066 'really got us on the map as value chain specialists', and 'all our papers and other outputs became part of the curriculum'. UPMIn convened a supply chain conference as an ACIAR program activity in 2008, and this has continued running annually. As one UPMIn academic put it, 'The School of Management is an Australian baby.'

At VSU, on-the-job training has been embedded in the curriculum. Students spend time working on site with farmer-collaborators from the original HORT program and subsequent ACIAR projects. VSU has since taken on a mentorship role for newer universities in Bohol and Samar that became junior collaborating partners in later ACIAR projects.

UPLB also benefited, particularly through its involvement in C3, which enabled it to build a strong team of bacteriologists. Many of those individuals went on to play roles in subsequent ACIAR projects.

Program engagement and capacity development were also aimed at influencing attitudes to agricultural research, both in the collaborating universities and at PCAARRD. One former ACIAR RPM noted that the attitude during the early stages of HORT/2007/066 was 'let's just do the research and write a paper', with little concern about impact as long as it was adding to knowledge. PCAARRD in particular was seen as being rather purist and 'intellectual' in its approach to research, and dissemination of findings to farmers

was not considered part of its mandate. In addition, PCAARRD, national government and other Luzon-based institutions tended to be focused on the more easily accessible northern regions. 'People in Manila didn't want to get muddy or go south', according to one former ACIAR staff member.

Interactions with the lead universities indirectly developed capacity in key Philippine Government departments. For example, value-chain and agroenterprise development terminology was adopted in the Department of Science and Technology (DOST) and the Department of Trade and Industry (DTI) and applied in their own programs. Staff trained through the UPMIn value-chain work have reportedly gone on to positions at DTI. Many agricultural extension officers developed new knowledge and skills.

Knowledge and experience developed during HORT/2007/066 has enabled and influenced subsequent support for partner agencies from other funders. For instance, Northern Mindanao Integrated Agricultural Research Center (NOMIARC) researchers observed the importance of temperature control for successful aeroponic production. This was a shortcoming of the small ACIAR-funded greenhouse, which remains on site but is no longer used. NOMIARC approached the Korea International Cooperation Agency, which has since provided several large high-tech greenhouses for aeroponics, complete with temperature controls and 'foggers'.

Given the high personal and professional value derived from being associated with the ACIAR vegetable program, it is perhaps unsurprising that there were isolated reports of favouritism and internal politics playing a part in determining local decisions on program staffing. For instance, 'a keen lady... wasn't allowed to do [this program role] and the person who was assigned had little interest.' More commonly, there were issues with staff 'getting pulled in other directions' and/or having inadequate time allocated to their program-related activities. Since ACIAR did not pay for senior staff time, there was always a risk of the local organisations' counterpart contributions coming under pressure from competing commitments. Such factors may have undermined the benefits resulting from some of the program's capacity development efforts.

Research findings and limitations

While the scope of this evaluation does not include judgements on the scientific quality of research findings, some specific aspects of the research highlighted both in program reporting and key informant interviews are worthy of mention.

Detailed and wide-ranging research under C2 compared many aspects of vegetable production under (different designs of) protective structures versus in open fields. Scientific analysis under C3

isolated and identified specific strains of bacterial wilt, developed a protocol for identifying infected areas, and experimented with a range of practical methods for tackling contributory factors. Economic analysis of collaborative marketing groups (clusters) formed under C4 demonstrated the strong financial benefits of cluster marketing. Gross margin and enterprise budgeting studies under C5 were well received, but difficulties accessing data meant some of these were completed rather late in implementation of the initial program.

The above examples were all issues of direct relevance to local farming communities. On the other hand, C1 was criticised for not focusing enough on 'actual issues facing farmers', notably soil acidity. The policy-focused modelling under C5 was also seen by some as being 'a bit descriptive and airy-fairy' and not readily understood by (or useful to) program participants. As noted under KEQ 1, individual researchers in the Philippines had somewhat different views on the extent to which their activities were primarily about the generation of knowledge and publications, or about delivering impacts for farmers. According to one cynic, 'For some, it's about getting trips to Australia and publishing.' From an Australian perspective, program managers generally regarded building in-country research capacity to solve problems locally to be the most appropriate and sustainable approach. However, one commented that the tension between building research capacity or achieving development outcomes is something that 'ACIAR struggles with in all its projects'. One local researcher also questioned whether Australian research methods were necessarily the 'best' for local circumstances. 'I made it clear that [their] way wouldn't work.'

Local contextual challenges sometimes hindered research progress or scope. For example, travel in Mindanao by the Australia-based researchers was often restricted due to security-related restrictions. This resulted in a narrower geographic focus for some activities, although the Davao-based coordinator and local researchers were able to draw on their networks

and information to travel safely. Even in more stable areas, unexpected issues could arise. For instance, C4 extension activities were restricted after a jail break near Malaybalay, Bukidnon, in early 2009. In Leyte, researchers visiting a field site to record results found a military tank blocking access, which significantly delayed component progress. Other challenges related to inadequate or poorly maintained equipment, like those that affected outcomes from the initial aeroponics trials at NOMIARC, and pests and diseases, which reduced the outputs from many research trials. Some of these issues were beyond program control, but reporting suggests they were exacerbated by limitations in experimental design experience, and in technical skills in pests and diseases management.

Program publications

Quantity: Researchers associated with HORT/2007/066 produced over 200 written outputs of various kinds, including refereed journal articles and book chapters, research papers, academic theses, conference and workshop papers, and internal documents such as visit reports. These are summarised in the final program reports, up to that date. However, publication output continued after the program concluded, assisted in at least some cases by continuity of research and funding under a follow-on project. As one researcher commented, 'It was hard enough keeping up with the regular monitoring and reporting, so most of the research papers were published later.'

The publication list provided in Appendix 7 and summarised in Table 8 includes all the outputs listed in the final reports, with additions from several of the lead researchers.¹² C1 claimed several articles in peer-reviewed scientific journals, whereas most other program publications were in conference proceedings. C4 stands out in this regard, contributing a total of 21 papers in the category 'Conference proceedings and research papers'. A former ACIAR RPM noted that while 'all components were good at short term research outputs such as conference papers, C4 and C5 wrote the refereed papers'.

Table 8 Summary of publications data by program component

	C1	C2	C3	C4	C5	Total
Refereed scientific journals	8					8
Peer reviewed conference proceedings and papers (published)	11	25	4	20	15	75
Peer reviewed conference proceedings and papers (unpublished)	12		6			18
Associated publications*	10	3	14	34	38	99

*Includes academic theses, unpublished workshop papers, internal reports and Web2 publications.

¹² Inevitably, some gaps may remain or, conversely, some publications included may pertain to research activity that extended into follow-on projects.

Collaboration: Among all project components, it is notable that virtually all publications were by multiple authors, most often led by the Filipino teams with Australian researchers in support roles, confirming that collaboration on reports and publications was seen as an important avenue for capacity building. The exception was C3, where two-thirds of the papers were Australian-led (possibly reflecting the lesser interest in publishing on the part of the Philippines lead). Collaboration was also a strong theme from stakeholder interviews. For example, the UPMIn team had a deliberate policy that everyone involved in the research was named as co-authors, including field staff such as agroenterprise coordinators. They also had a quota such that each person should lead one paper each year, and provided staff the incentive of travelling to a conference if they wrote a paper to present.

Citations: For externally published documents, Appendix 7 includes information on the number of times each publication has been cited in other articles or books. Citations are commonly used as indicators of research performance. While the number of citations is by no means a perfect measure of the quality, impact or influence of the research or the article in question, it can at least give a sense of how useful or relevant the article has been to the formal international research community (Aksnes et al. 2019). However, it does not capture total readership or other forms of influence, such as when the researcher presents their findings in a university seminar, policy forum or national conference.

Where citation data was applicable and available, all results were in the range 1–20, except for one article on green waste biochar as a soil amendment, which had 2,627 citations according to Google Scholar. However, although that article is listed in the C1 final report, it describes research in Australia and makes no mention of either the Philippines or ACIAR, so its inclusion as a project publication seems rather dubious.

Information was also gathered on the h-index of the lead authors of project publications.¹³ The lead author h-indices are generally below 10, aside from the author of the highly cited article on bio char (C1 initial Australian lead, Dr Yin Chan), whose current h-index is 30.

Other indicators of research quality include awards and career advancement. VSU's work on protected cropping (C2) won second place in a national research symposium, while UPMIn's work on C4 also led to an award for 'best research program'. Staff were able to gain 'publication points' that helped qualify them for academic promotions. Many researchers received awards of various kinds.

On a less positive note, the complexity of the program and a lack of clear reporting lines resulted in some issues with quality control. One interviewee noted that in some cases, even component leads were not always aware when written material was about to be made public, and there were a couple of instances where material had to be withdrawn at the last moment to avoid unsubstantiated or counterproductive recommendations being promulgated.

Overall, however, the volume and variety of written output attributable to the program is impressive. There can be little doubt that ACIAR funding contributed to the generation of new and relevant research findings across a wide spectrum of topics relating to the southern Philippines vegetable sector. In addition, individual researchers in the Philippines were guided, supported and funded to produce publications, reports and other papers that contributed to their professional development and career progression.

As one researcher reflected:

I would say that of all the research projects I have handled, my involvement in the ACIAR project was the most productive of them all, considering the bulk of research articles we have published and presented in various national and international conferences here in the Philippines and abroad. With this I will be forever grateful to ACIAR for the beautiful opportunity it has given me.

Sustainability of impact

Capacity development undertaken through HORT/2007/066 has had long-lasting effects. The researchers involved continued to benefit from the knowledge, skills and experiences gained long after the program's completion. Many obtained postgraduate degrees and promotions as a result, and have continued to share their knowledge with others in their universities, other organisations and communities. During consultations for this evaluation, individual examples were shared of new graduates joining the program as junior research assistants and going on to pursue master and PhD degrees (often with ACIAR support through John Allwright Fellowships) and securing progressively more senior academic/research roles. The universities themselves earned reputations in their fields that have persisted through to the present day.

Valuable professional relationships developed through HORT/2007/066 have also endured – both within the Philippines and between Filipino and Australian researchers – including through follow-up projects and other ACIAR activities such as John Dillon Fellowships.

¹³ The h-index (named after its developer, physicist Jorge Hirsch) measures both the productivity (number of cited papers) and the impact (number of citations) of individual researchers. Scopus was the primary source for data on the h-index, with Google Scholar used as an alternative.

It was evident from in-country observations that the links between VSU, UPMIn and UPLB have remained strong.

Other examples of long-term impacts mentioned during consultations included the program's role in stimulating and perpetuating interest in science among students, even at secondary-school level. For example, C1 at VSU helped 2 local secondary-school students conduct a research project on the effects of potassium biofortification on tomatoes under protective structures and open-field conditions. This project won Best Research Award in its division at VSU's Science Fair in 2011.

As outlined under KEQ 1, the research outputs and capacity developed under HORT/2007/066 also opened up other long-term opportunities for R&D in the vegetables sector of southern Philippines. Many researchers involved in the initial program have remained involved throughout subsequent ACIAR projects as well as in other separately funded research. The same is true for other institutional partners such as the Northern Mindanao Agricultural Crops and Livestock Research Complex (NMACLRRC) (formerly NOMIARC), whose current head formerly led that organisation's work on C3. Knowledge gained from that experience, for example, on temperature control requirements for aeroponics, is now being applied in experiments under large greenhouses funded by the Korea International Cooperation Agency at the NMACLRRC research centre in Bukidnon, Mindanao.

Some elements of the research and capacity-building work have **not** been maintained. In particular, the program's web-based platform (Web2), set up to capture research outputs and enable information sharing, appears to have lapsed once the project concluded. Some of the more detailed program documentation, such as research trial data, is now only accessible via the researchers' own collections.¹⁴

Likewise, the policy reference group established under C5 was only active during program implementation. Its role in disseminating research findings to government and industry and building the evidence base and capacity for policy and strategy development was limited. This was likely a reflection also of C5 being ACIAR-initiated rather than a response to demonstrated interest from Philippines policymakers. On a more positive note, at least one of the policy-focused studies – highlighting the effects of high transport costs on profitability of vegetable production – was reported to have been widely disseminated throughout the Philippines and was mentioned by key informants as a valuable contribution to knowledge.

Quantifiable impacts

Aside from the publication and training data presented above, the main quantifiable impacts pertain to research findings on ways of improving vegetable productivity and returns. Highlights referenced in the component final reports are summarised in Table 9.¹⁵ Further quantitative assessments are presented later in relation to the 2 case studies under KEQ 5 (protected cropping and marketing clusters).

Unintended research outcomes

As noted under KEQ 1, managers of HORT/2007/066 acknowledged that the program began with broad understanding of the issues needing attention and a strategy based on developing local research capacity, rather than fixed ideas of exactly what research outcomes would result. In that sense, many of the research outcomes achieved could be described as 'unforeseen' if not exactly 'unintended'.

Highlights that appear to have strongly exceeded expectations include:

- the demonstrated productivity benefits of growing vegetables under protective structures in Leyte (C2)
- significant advances in identification and biofumigation control of bacterial wilting diseases (C3)
- the extent to which value-chain and agroenterprise-development concepts were absorbed into standard government vocabulary and policy and program approaches as a result of UPMIn's work with C4.

The ultimate value of these and other research outcomes lay in their dissemination to, and adoption by, vegetable farmers, as discussed under KEQ 3.

¹⁴ Some project materials were apparently also filed on Meridio, ACIAR's archive site, but this is not externally accessible.

¹⁵ The C5 final report includes a summary table of economic analyses conducted by the various components.

Table 9 Examples of quantified research results by program component

Component	Quantified research results
C1	<ul style="list-style-type: none">• Capsicum response to single application of compost per crop over 5 crop cycles (with supplementary nitrogen fertiliser in later crops) compared to baseline of normal farmer practices:• 60 t/ha: BCR – 2.63• 125 t/ha: BCR – 3.33
C2	<ul style="list-style-type: none">• Average gross margin for open-field vegetable crops: PHP55/m²• Average gross margin under protective structures: PHP112/m²• Benefit-cost analysis of a 200 m² structure, assuming 5-year life: NPV – PHP29,825; IRR – 103%.• At one site, protected crops generated a NPV of PHP525/m² compared to PHP195/m² for open-field crops.• Regression analysis revealed that a protective structure would increase crop revenue by 84%. Other significant variables included skills training.
C3	<ul style="list-style-type: none">• Estimated value (gross margin) of full integrated disease management strategy for bacterial disease control:• Baseline: 133,000 PHP/ha• Full strategy: 365,900 PHP/ha
C4	<ul style="list-style-type: none">• Farmers have 18% more income from involvement in a cluster than non-cluster farmers.• Farmers increase income by 47% after joining a cluster.• Value of C4 research: BCR – 2.47; NPV – PHP 35.3M; IRR – 48.6%
C5	<ul style="list-style-type: none">• Estimated total value of fruit and vegetable research:• Low adoption (5% max): NPV – PHP1,405M; BCR – 11.3; IRR – 23%• High Adoption (20% max): NPV – PHP4,682M; BCR – 35.0; IRR – 30%

Notes: BCR – benefit:cost ratio; IRR – internal rate of return; M – million; NPV – net present value; PHP – Philippine peso; t/ha – tonnes per hectare

Gender equity and inclusiveness

KEQ 2.2: How did the research engagements affect gender equity and inclusiveness in the partner organisations?

Consultations with implementing organisations in Australia and the Philippines indicated that there was limited attention to gender issues at the commencement of HORT/2007/066, but a gradual increase over time in response to ACIAR requirements. The lack of a specific gender plan in the design led to limited research focus on gender-related issues. This is evident from the research publications produced under the program, where none of the publications assessed appear to have a specific focus on gender equality or social inclusion.

It is notable that the majority of component leads and senior researchers in the Philippines were female (and male in Australia). This reflects the preponderance of females in teaching professions in the Philippines, including in at least some tertiary institutions and faculties. While many informants commented positively on this feature of Philippines' academia, a local interviewee pointed out that academic salaries are relatively low and qualified men have greater success

than their female counterparts in securing higher-paid jobs in government or the private sector.

More than half of the lead authors of project publications (56%) were female, but this was likely a simple reflection of pre-existing university research staffing rather than a result of intentional efforts towards gender responsiveness.



The research program contained many components of direct engagement with farmers to promote adoption of new technologies.

KEQ 3: Dissemination and adoption

Activities to promote adoption

KEQ 3.1: What activities were undertaken through HORT/2007/066 to promote adoption of technologies tested in research trials?

Components 1–4 of the program saw **direct engagement with farmers through participatory research** as a key feature of their dissemination strategies. Demonstration trials and field days were conducted to showcase the technologies on farmers' properties so other farmers could visualise and adopt these practices. Farmer field schools and training workshops were carried out to empower farmers with knowledge and skills to share with others. Project teams developed written extension materials and videos. Municipal agriculture offices, local government units and individual extension officers played a central role.

C1: Soil and nutrient management

The C1 team carried out on-farm assessments and research trials on the land of 5 lead farmers (farmer-scientists) located in the main vegetable-growing areas of Leyte and Mindanao. Eight farmer field days were conducted including 6 at annual VSU and NOMIARC events. It was estimated that 5,000 farmers visited each VSU event, and 3,000 attended each NOMIARC event. However, there is no detail on farmer engagement with the C1-specific displays at these large events.

C1's main training effort centred on an EATWELL (extension advisor training with excellent learning lessons) workshop for 24 extension workers at NOMIARC in 2011. The EATWELL graduates and technical collaborators then delivered 4 farmer techno forums (3 in Mindanao, 1 in Leyte) that were attended by around 400 farmers. The workshop and techno forums were considered highly successful in building awareness of 'the importance of developing a site-specific nutrient management program based on the efficient utilization of available soil resources'. However, draft 'best bet' guidelines prepared and used for these activities were not finalised or further disseminated, apparently due to concerns over the quality of the research and consequent risks for farmers.¹⁶

C2: Protected cropping

The VSU research farm was an important showcase of protected cropping. The C2 team estimated that over 3,000 farmers, 1,500 students (including from the Department of Agriculture's Agricultural Training Institute) and 300 LGU staff visited the VSU trials during the lifetime of HORT/2007/066. In addition, 15 'farmer-collaborators' were progressively selected and C2 helped build a variety of structures on their farms, which became demonstration and learning sites for other farmers. Some of the collaborators joined component leads in sharing the technology with other farmers in the region (Figure 5).



Figure 5 Farmer-collaborator presentation for farmer field school

¹⁶ The C1 final report hints at these concerns: 'All farmer guidelines must be evidence based and use inputs from rigorous analyses of well-defined experiments because of the critical importance to farmers of accurate advice' (Dorahy et al. 2013:35).

There were also several farmer exchange visits involving the C2 collaborators and farmers from Mindanao and Bohol. Six hundred copies of a protected cropping video produced by the C2 team were distributed to farmers, LGUs and the Department of Agriculture, and had been viewed nearly 14,000 times on YouTube by May 2013 (ACIAR 2012). The project also prepared a leaflet on vegetable cropping under protective structures.

The C2 final report states that 131 farmers participated in training activities and/or study visits to other sites. Some training activities targeted the 15 farmer-collaborators while others aimed at broader dissemination. A Southern Leyte LGU hosted a field day for 50 farmers and combined with East-West Seed and VSU to run a 16-week farmer field school for 30 farmers. C2 also established close links with the EDC, which built additional structures and identified further trial sites and farmers.¹⁷ C2 made significant efforts to develop models appropriate to local farmers, including through a workshop focused on design of low-cost structures.

C3: Bacterial wilt

C3's approach was described as 'participatory action research approach', involving farmers, researchers, extension officers and Landcare groups. Research experiments were set up at the NOMIARC research station and on the farms of 3 established Mindanao potato growers. The main outreach activities took place during NOMIARC's annual field days, where research staff demonstrated detection and management of bacterial wilt in potato. These events attracted around 3,000 farmers each year, but (as with C1) no details were collected on the number who were engaging specifically on the bacterial wilt presentations. Additional farmer meetings, workshops and field days were conducted elsewhere in Mindanao to further spread understanding and knowledge. One of the collaborators described trials of 16 potato varieties on his land, with NOMIARC providing new, disease-free planting materials and monitoring results. At NOMIARC's request, he invited other farmers living nearby to see the trial. However, another key informant noted that the field demonstration of results to other farmers only happened once.

The C3 team also developed extension materials on bacterial wilt in local languages, including 500 copies of a humorous comic strip which was said to be well received (Figure 6).

C4: Value chains

Unlike C1–C3, which worked directly with small numbers of 'leading' commercial farmers, C4 aimed to support smallholder semi-subsistence farmers to develop more effective market linkages. C4 adopted the 8-step 'action research process' being applied across Mindanao by CRS to help farmers form small collaborative marketing groups or 'clusters'.

By the end of HORT/2007/066 in 2011, C4 had supported 29 clusters, comprising 342 smallholder farmers. A total of 69 capacity-building activities (training programs and technical visits) were conducted for 1,242 participants (755 men and 487 women) on topics such as cluster management, vegetable production and marketing. Cluster members were taken to visit traditional and institutional markets to make connections and understand market requirements and pricing structures. C4 developed close relationships with supermarkets and other buyers, with Philippines Landcare and with government agricultural agencies at national, provincial and municipal levels, which conducted training programs on technical aspects of vegetable production. In Bukidnon, East-West Seed helped by identifying a more suitable melon variety and making seed available for purchase.

C4 encouraged interaction and sharing of experience between the clusters and some cluster farmers mentored non-members who were struggling to access technical advice. Clusters were assisted with exchange visits and connections to UPM in supply chain expertise and local vegetable industry councils. These technical exchanges are said to have improved both productivity and product quality. C4 also prepared short case studies to highlight the benefits of cluster participation.

C5: Economics and policy

C5 did not have direct farmer dissemination activities, but aimed to provide information on the profitability of technologies and approaches researched through C1–C4 to strengthen extension messaging and encourage adoption. The final C5 report provides benefit–cost estimates for vegetable research under various assumptions, including low and high adoption rates, and concludes that the net economic benefits are positive under all scenarios (Hall 2022:43). However, the figures are hypothetical, not empirical.

17 The EDC is the Lopez Group's global and diversified renewable energy company, engaged mainly in geothermal power generation. It was created under the umbrella organisation of the Philippine National Oil Company.



Panel 1 of 7: The farmer is perplexed: he followed some advice but bacterial wilt has reappeared.

Green: What could you have done wrong?

Red: I do not know. I did what you told me about biofumigation and used clean seeds. At first, it looked okay and doing well. But now, this disease has recurred.



Panel 7 of 7: Problem resolved: the farmer now understands he must follow the full protocol involving multiple practices.

Red: Thanks to you, buddy, I will follow the exact protocol suggested. That way I will not encounter any serious problems in achieving higher crop yields. And the wife will be happy.

Green: You are truly right buddy!

Figure 6 Excerpts from comic strip on bacterial wilt management

C5 also aimed to identify constraints to adoption that could be addressed through policy initiatives. Communication and dissemination activities included university presentations and industry, agribusiness and economic conferences, policy briefs and component reporting.¹⁸ C5 also convened a policy reference group with representatives from the public and private sectors, NGOs and producer organisations. These individuals were not necessarily able to exert direct policy influence, but had an 'interest' in applying research findings and implications to improve smallholder livelihoods. There is no evidence that communication and advocacy activities continued post-project as foreshadowed in reporting.

C6: Program management and integration

C6 initiated an interactive workshop, led by the Queensland DPI, in response to a recognised need to improve extension skills and processes. More broadly, C6 endeavoured to bring research findings together and identify gaps, so farmers could receive coherent advice on ICM. C6 also provided a degree of quality assurance over research findings. These activities were often challenging, especially given the various components worked in somewhat different locations and with their own modalities. The C6 final report noted:

In some cases some recommendations were not subjected to basic checking of likely benefits within cropping systems (Hall 2013:39).

¹⁸ For example, the Philippine Institute for Development Studies prepared a paper on the potential contribution of the fruits and vegetables subsector to agricultural diversification, which identified aspects of regulation and monopoly power that might impede farmer adoption of new practices and technologies.

Evidence on dissemination and adoption

KEQ 3.2: What evidence is available on the extent, process, reasons and consequences of dissemination and adoption (including any gender equality and social inclusion factors)?

The program reported **hundreds of farmers trained, trial site visits in the thousands and wide variation in adoption across components**. There is strong evidence of positive impacts for the select cohort of individual farmer-collaborators, but mixed reporting on broader impacts. Research findings of direct relevance to farmers and with demonstrated major benefits were most likely to be adopted. Close engagement with local and national government agencies, producer groups, private sector operators and other support providers was critical to spreading program impacts. Farmers' limited access to capital and shortages of required inputs impacted adoption, as did a range of individual, social and contextual factors. There is little evidence that gender-specific needs were considered in dissemination activities.

Extent of dissemination and adoption

An overall summary of dissemination and adoption through HORT/2007/066 is provided in Table 10. These estimates should be interpreted with caution. The program's final report notes:

This data was not always collected and/or documented actively and comparisons between components should not be made (Hall 2013:39).

Each component had a different level of commitment to recording outputs (Hall 2013:43).

In general, the final project reporting focuses more on dissemination activities – outlined in the previous section – than on providing firm evidence of adoption. The exception is C2, which provides detail at individual and third-party provider level.

C1: Soil and nutrient management

The C1 team worked most closely with 5 farmer-scientists and spread messages more broadly through awareness-raising activities. They assumed that the number of adopters was the same as the number of visitors to trial sites (150) but this is unlikely.

C2: Protected cropping

C2 estimated 169 adopters by the time of program completion in 2012 and documented 'a proliferation of structures inspired by the current ACIAR project' (Rogers 2013:55). Individual farmer-collaborators had undertaken their own design modifications, built additional structures and guided other farmers in doing the same. Another farmer converted all his poultry houses into protective structures for vegetable production. At least 13 self-financed structures were recorded.

Table 10 Farm-level capacity development activities and adoption estimates by program component

	C1	C2	C3	C4	C5
Farmers trained (no.)	400	131	nd	1,242	0
Workshops (no.)	5	3+	nd	14	nd
Field days (no.)	17	1+	12	nd	nd
Farmers visiting trial sites (no.)	150	4,000	3,000 (including students)	nd	nd
Estimated adopters of new strategies (no.)	150	169	50	1,242	nd

Note: nd – no data. The report notes that these are minimum estimates. Visits by students to trial sites have been deleted where separated from farmer visits (C1 and C2) but C3 did not disaggregate by visitor type.

Source: Hall 2013

On a larger scale, a Deutsche Gesellschaft für Internationale Zusammenarbeit project with local LGUs resulted in construction of a further 48 structures, and a new project financed by EDC with VSU was also focusing on protected cropping and supporting new construction in Leyte. The Catholic Diocese in Ormoc was also funding some structures. Towards the end of HORT/2007/066, additional Leyte LGUs were seeking technical support for their own protective structure projects for vegetable production.

Further afield, farmers from Mindanao and Bohol who participated in study visits to the Leyte and Southern Leyte sites reportedly went on to build their own structures, although some raised concerns about the costs of materials. The DA and a regional development council were also planning to adopt and promote the technology in areas affected by heavy rains.

Further detail on dissemination and adoption of protective structures, including through the projects that followed HORT/2007/066, is provided in the case study under KEQ 5.

C3: Bacterial wilt

C3 reportedly 'increased awareness and knowledge' and highlighted the potential for 'future' adoption of management strategies to bring a range of farm-level and environmental benefits. One key informant explained:

Pathways to adoption wasn't such a focus. It was more about getting the message out that it's a complex problem – if you do one thing wrong, you fail.

Another noted the lack of follow-up with farmers once the on-farm experiments had concluded, but also reflected that perhaps this was the role of extension agents rather than project partners. As one lead researcher put it, C3 was primarily about research, but further work through subsequent projects put greater emphasis on farmer engagement. The basis for the estimate of 50 adopters in Table 10 is unclear (C3's own final report does not provide an adoption estimate).

C4: Value chains

C4's adoption estimates equate to the number of individuals who participated in training programs and technical visits (1,242), that is, 100% adoption. Of these, 342 were members of the clusters formed during the project lifetime. It is unclear whether all the others went on to form clusters themselves, perhaps with LGU support, or whether 'adoption' referred to some other cropping technology on which training had been provided. It was evident from fieldwork that some form of clustering has continued to be applied in a range of vegetable production and marketing contexts. This is discussed in more detail in the KEQ 5 case study.

C5: Economics and policy

The final C5 report made several recommendations to improve technology adoption, including greater attention to assessing financial benefits and sharing that information with farmers and extension workers, and further exploration of factors influencing adoption. It also recommended future research focus on innovations with strong likelihood of adoption, to maximise economic returns.

Factors affecting adoption

As outlined under KEQ 2, the expected impact pathways for HORT/2007/066 involved:

- scientific and on-farm research
- demonstration, dissemination and capacity development for farmers aimed at fostering adoption of the new technologies and practices researched.

There can be little doubt that the research and resources provided through HORT/2007/066 generated significant new knowledge and demonstrated the potential benefits of a range of improved technologies and practices. The various activities undertaken to spread awareness and encourage adoption had already spurred considerable take-up even by the time the program concluded in 2012. Follow-on ACIAR programs and projects since then have further strengthened these impacts, as discussed under KEQ 5 for the protected-cropping and marketing-cluster/value-chain work. However, these strong results were not universal across the program. Some of the characteristics of the dissemination process and other factors that might have affected adoption are outlined below.

Dissemination and extension approaches

Several main themes emerged across all program components. The first is that dissemination activities that directly involved farmers and enabled them to see and experience the results of new technologies and approaches were most likely to have an impact on their future practices. 'Farmers don't believe if they only hear; to see is to believe,' said one informant.

A C3 lead noted the importance of helping farmers understand the reasons behind particular results, rather than simply setting out best practices. This was reinforced by the enduring memories of both project staff and farmers of the DA plant pathologist who took her microscope into the field to show farmers the tiny organisms affecting their plants.

Another project lead highlighted the important distinction between scientific research trials that are managed as such (with experimental rigour including controls) but happen to be located on farmers' lands, and engaging with the farmers as full participants. Program reporting and evaluation interviews suggest that C1 focused more on the science, while C2's scientific trials involved farmers as core team members. One of these collaborators did, however, point out that 'Because it was research, I had to do things (such as open-field production) even if I knew it wouldn't succeed.' For C4 (according to lead researchers), 'pure' scientific method was subsidiary to development outcomes. 'We were very worried about farmers being objectivised. It's more than just a research paper, it's people's lives!' C4 therefore chose not to study a non-participant control group.

Selection of individual farmer-collaborators was an important first step in the research-to-adoption process. In Leyte (C1, C2), the VSU project teams sought assistance from the relevant LGUs to identify lead farmers with entrepreneurial attitudes, interest in innovation and learning, and ability to take risks and co-invest. Capacity development provided for VSU staff through HORT/2007/066 included advice about on-farm research methods. Many of the dissemination activities described in the previous section, particularly for C2, centred around the on-farm demonstration sites and or the farmer-collaborators themselves, some of whom took on de facto technical adviser roles and took the initiative to propose improvements to the researchers' approaches. As one of the former C2 collaborators put it:

The good thing is the ideas came from the field. I have knowledge and I'm a practitioner, not just a professor.

However, he went on to add that the researcher-practitioner collaboration benefited both parties:

That's the good thing about having the project. If I have a problem, a student can do research to solve the problem as their thesis.

C3 also used lead farmers but most of the 'showcasing' took place at NOMIARC's research station in Bukidnon. It took a while to build strong understanding. One of the collaborators explained that, while farmers initially learned that biofumigation was important to control bacterial wilt in potatoes, they did not accept it also had relevance to 'cousins of potato' such as eggplant and tomato.

The C3 final report noted the need for further economic analysis to assess the relative importance of individual elements of integrated disease management practice (for example, clean seed, clean soil, rotations, variety, biofumigation and weed control), to underpin some 'smart graphics' in extension materials. Other accessible materials such as videos and PowerPoint

presentations were also recommended to support knowledge transfer.

Overall, research findings of direct relevance to farmers and with demonstrated major benefits were more likely to be adopted. Farmers invited to visit NOMIARC greenhouses could only marvel 'that technology is very expensive – we can't apply it here', said one relatively wealthy farm business entrepreneur. C2's farmer collaborations produced affordable protective structures that significantly increased the feasible growing season and increased returns by 2–5 times. In contrast, despite also favouring on-farm trials, C1 was criticised by some interviewees for failing to undertake enough analysis on the soil issue most critical to farmers, namely soil acidity. Further, not enough thought was put into how research results might translate into practice changes, rather than simply feeding into research papers.

Partnerships

A second major theme is that close engagement with third parties such as LGUs, Department of Agriculture, producer groups, private sector operators and providers of other similar or complementary programs was critical to spreading program impacts beyond the immediate target beneficiaries and their direct contacts. One LGU informant in Leyte said:

Sometimes the VSU people had their research and we said to them, how will that reach the farmers if not presented through us?

Also in Leyte, the EDC became aware of ACIAR's protected cropping work and initiated the Ormoc Konunga Range project as part of their corporate social responsibility obligations. In Mindanao, regional vegetable councils (VICSMIn, NorMinVeggies) were important partners for marketing work.

Consistency with local government priorities increased the likelihood of further adoption beyond the immediate project sites. However, these priorities vary over place and time depending on local politics and budgets. As noted above (and under KEQ 5), Ormoc and Maasin City administrations in Leyte have funded their own programs to provide protected cropping structures to selected farmers. Towards the end of HORT/2007/066, at least 2 other Leyte LGUs sought technical assistance from C2 for similar initiatives.

In other cases, LGUs may not directly prioritise agriculture but can provide other enabling support. For example, when the program was first working in the mountainous Cabintan area of Leyte, poor road quality was a significant hindrance to marketing. The LGU has since funded road improvements, and other levels of government increased their own services in response to the clear development potential of the area.

In Impasug-ong (Bukidnon, Mindanao) – where C4 supported marketing clusters – agriculture graduates have recently been hired as agricultural extension workers and assigned to each of the 30 barangays. The LGU also has soils specialists and testing capability, and offers free testing to interested farmers. This network, along with ATI, is well placed to disseminate and support new technologies and practices. Feedback during fieldwork suggests this high level of LGU servicing of farmer needs is well above the norm across southern Philippines LGUs. Many other LGUs have only a few technical agricultural staff and those are often only on a contract basis, which may make them ineligible for the extension worker training provided through ATI.¹⁹

Beyond the individual LGUs, national government agencies also played a vital role. DOST-PCAARRD representatives highlighted that the ideal process is for proven technologies to be taken up by DA and integrated into their training, including through ATI. While extension services are devolved to municipal level, much of the training of extension workers runs through ATI.²⁰ PCAARRD itself is also seeking to strengthen collaboration with DA, noting that some technologies developed in DOST are not adopted. Many of the government informants interviewed commented on their close and long-standing relationships with the technical specialists at universities such as UPM and VSU, ensuring that research findings continue to be promoted long after program completion. Another government training coordinator, the Technical Education and Skills Development Authority, draws on expertise at local universities and also pays accredited farmers to host training sites, making it a further important potential conduit for project technology transfer.

Given limited funding and the challenges of servicing individual farmers, LGUs and DA mostly support registered farmer groups, such as associations or cooperatives. Some also actively support a ‘clustering’ approach to production and marketing, although their definition differs somewhat from the original CRS and C4 concept. (This is further discussed in the KEQ 5 case study.)

Access to support and inputs

Limited access to capital is another recurring theme that impacted adoption of project-supported technologies. Farmers directly funded to innovate and demonstrate technology were happy to do so, but others often struggled to meet any up-front costs even if they were convinced that likely returns outweighed the risks of investing. Researchers had to

be aware of the conditions under which farmers might be persuaded to invest their own money, including their capacity to cope with crop failure. As one LGU informant put it, ‘If farmers had resources, some technologies were adopted.’ A C5 participant noted that one of the intentions of their economic research was to provide better information about the economic potential of various cropping technologies. ‘Our assessments could have been useful,’ said another.

Perhaps paradoxically, awareness of potential sources of financial support might have affected farmers’ willingness to invest themselves. A frequent comment during fieldwork was that many farmers would like to adopt practices such as protected cropping, but they were waiting and hoping for an external funding provider. In one instance in Leyte, the evaluation team heard of a farmer group that had received materials from their LGU but were adamant that they should be paid for their labour to build the structures – and so the materials were lying unused.

Some grant schemes were (and are) available to farmers, such as machinery from DA or seeds from the LGU, but these tend to be limited and may not suit specific needs, circumstances and preferences. Some LGUs have significant agriculture programs, covering production, processing and marketing assistance, but these are subject to the priorities of individual elected mayors and may not outlast political cycles. In other LGUs, staff may be keen to collaborate but have no budget and are therefore reliant on project support.

National procurement laws can restrict the usefulness of in-kind support from LGUs. One municipal authority explained that, despite having clear insights into farmer preferences for a particular variety and brand of seed, the DA procurement process resulted in a cheaper version being provided. ‘We know the problem, we try to help but we’re tied by existing laws.’ Some of the farmers interviewed confirmed that such handouts will either be discarded or used for home gardens rather than commercial plots.

The availability of required inputs has constrained adoption of some research results. This is especially notable in the case of potato cultivation in Mindanao, where the lack of bacterial wilt-free planting material at commercial scale is a major constraint. Even now, NMACLRC can only provide up to 60,000 seed potatoes per year, and no private sector provider has emerged. Farmers are advised to replicate their own seed for 4 crop cycles (generations), but when prices are high these are often sold instead, and NOMIARC is unable to replenish the planting material. The complexity of bacterial wilt control means that even if some good

19 One informant explained that inviting only permanent staff to training means that the younger generation of agricultural extension workers (who are on contracts) are missing out.

20 At the time of HORT/2007/066, ATI trained farmers directly, but now it focuses on training extension workers who are then expected to take the information to the farmers.

disease management practices are adopted, any missing link (such as clean seed) can render these ineffective. Bacterial wilt remains a significant issue in Mindanao and has contributed to many farmers moving away from planting solanaceous crops such as potatoes, tomatoes and bell pepper.

Several interviewees noted the need for continued capacity development in areas such as disease diagnosis for extension workers (and their trainers), so that good advice can reach farmers. Individual farmers often struggle to access information and training, since LGU and DA technicians generally visit only those who are members of registered groups (associations or cooperatives). Low budgets and allowances for extension staff, and the vagaries of local politics, can seriously affect the extent of technology transfer. Support from private sector providers, such as East-West Seed, remains an important supplement but commercial imperatives will inevitably drive what activities are prioritised. Other groups such as Landcare and NGOs also played important roles in supporting outcomes from the ACIAR programs.

Individual, social and contextual factors

Group dynamics can affect technology adoption and its longevity. Some of the non-ACIAR protected cropping activities in Cabintan, Leyte, targeted the CALCOA association (now a cooperative) but initial difficulties in equitable sharing of responsibilities and rewards within the group resulted in production arrangements being modified towards more individualistic approaches.

The C4 work with marketing clusters identified the following requirements for success:

The cluster must: (i) offer a comparative advantage; (ii) cluster members must have a common goal; (iii) have multiple buyers; (iv) strong leadership; (v) be transparent and have timely communication; (vi) have trust and social cohesion; and (vii) have strong institutional support (Batt and Concepcion 2013:7).

Both internal and external factors impeded success, including:

(i) extreme weather events; (ii) a lack of knowledge; (iii) a lack of capital; (iv) market impediments; (v) institutional impediments; and (vi) poor infrastructure (Batt and Concepcion 2013:7).

In addition:

A lack of commitment among cluster members, poor leadership, conflict between cluster members and the lack of trust have been evident (Batt and Concepcion 2013:72).

As outlined under KEQ 5, very few of the original C4 clusters were able to survive once project support ceased.

Some informants suggested farmers are too 'lazy' to follow extension advice, such as preparing organic fertiliser, even if this could save them money. The convenience factor and the implicit value of family labour can play an important part in adoption decisions. In common with farming areas elsewhere in the world, many young people are prioritising education and off-farm careers, so access to labour can be a significant issue for the ageing farmers who remain. An associated risk is that farming knowledge will be lost: 'As farmers age, the next batch needs to be trained,' noted a DA interviewee.

In a similar vein, interest in trying new farming techniques depends on the relative importance of farming for particular individuals and groups. For instance, one group invited to a farmer field school also had non-farming activities, so it was 'harder to get them focusing on farming [and they] didn't really take home learnings', according to a project organiser.

Aside from input availability, other local contextual factors can impede adoption and benefits. C4 struggled to generate interest in cluster development in one of the areas initially targeted outside Davao, reportedly due to 'too many disruptive and competitive influences in the area' (Batt et al. 2009). A DA scientist mentioned the introduction of large-scale banana plantations, which, among other things, used high levels of chemical spraying that affected nearby vegetable production. Further north in Bukidnon, interviewees complained about multinational pineapple companies finding loopholes in land laws to gain access to large tracts of prime land, forcing smaller farmers to move higher into the surrounding hills. The appeal of contract farming for such companies was identified as a factor influencing some farmers to move out of vegetable farming.

Consequences of dissemination and adoption

The evaluation team found strong evidence of consequences for individuals directly involved in program activities, and mixed reporting on broader impacts. One ACIAR RPM suggested that greater farmer impacts could or should have been achieved through more attention to relevance and scale-out. An overview of the available evidence is provided below. The 2 standouts highlighted by many interviewees – protected cropping (C2) and value chains (C4) – are described in detail in the KEQ 5 case studies.

Individual collaborators

Component reporting and evaluation team interviews revealed numerous stories of **individual successes** derived from adoption of program-related technologies and practices. One C2 collaborator 'built a new house from his profits, [another] paid off debts and paid for his daughters' college education.' Others were able to finance further protective structures or irrigation

systems, or contribute to family medical expenses. In Mindanao, one of C3's collaborators reportedly achieved a 50% increase in marketable yield from his potato crop and has continued to practise bacterial wilt control methods introduced by the project.

The close project engagement by the collaborators increased not only their technical knowledge and skills, but their **confidence and self-esteem**. For C2 in particular, the lead farmers were critical participants in both the research and outreach activities. They shared their experiences with other farmers through site visits and workshops, and achieved recognition among peers, their communities and in government and academic circles. A C2 collaborator received a DA award and was elected president of the local vegetable growers' association and others were recognised at VSU anniversary days. One said proudly, 'The ACIAR project gave me the best knowledge. Professors now are retiring so people ask me for advice.'

A C3 collaborator received an 'outstanding farmer' award in 2009 for his control of diamond back cabbage moth, and travelled abroad to Chile and Kenya to promote the technologies there. Another built on his exposure to 'natural farming' techniques during potato variety trials with NOMIARC, which gave him new ideas and shaped the methods he has applied through to the present day. He has been able to expand his farm and has also used the proceeds to invest in an on-site cafe and shop to take advantage of increasing traffic volumes and local tourism.

Farmers participating in C4's marketing clusters were found to have gained 'significant benefits', including average income increases of 47% (Batt and Concepcion 2013). Their improved understanding of market requirements and greater bargaining power increased the productivity and profitability of their vegetable farms, and led them into more value-adding activities, such as sorting, grading and packaging.

The HORT/2007/066 farmer-collaborators also benefited from increased capabilities in farm management and decision-making, including the detailed recording of crop inputs, outputs and growing conditions; management of pests and diseases (with reduced chemical use); and the development of marketing strategies. One successful collaborator in Leyte expanded his market by giving presentations to school students on the importance of vegetables, and then offering lettuce for sale. He also packed vegetables in small quantities to make them affordable to consumers. A C1 researcher noted improved farmer awareness of the importance of ICM, including how to manage and supplement soil nutrients to improve yields.

Broader benefits

C3 made a significant contribution to the understanding of bacterial wilt, not only for researchers but among extension workers and farmers. C3's reports and publications provide detailed technical results from the various on-farm and research station trials undertaken and key findings were widely disseminated. Most important was the need to adopt a comprehensive control protocol, including biofumigation, healthy seed material, appropriate rotations and companion crops. Varieties with greater resistance were also identified. Farmers growing susceptible crops are now more likely to understand that although some of the control methods are laborious, they are essential to prevent crop failure.

Side-benefits have sometimes resulted even when the primary purpose of a technology has not been fully achieved. For example, biofumigation was found to be less effective in hot-weather field conditions, so the use of green residues such as brassicas (cabbage, cauliflower, broccoli) and wild sunflower served more to improve soil biomass than to control bacterial wilt – but still reportedly helped improve yields.

C4 assessed that clustering benefited not only the farmers but also buyers and the broader economy. Buyers gained direct communication with growers and assurances of quality and quantity. Increased production led to higher demand for local labour and transport services. The concept of farmer clustering has been taken up by many LGUs and farmer associations, at least in Mindanao, albeit with somewhat different definitions and organisational models.

The dissemination process was both beneficial to, and benefited from, institutional actors, such as agricultural extension workers and others running agricultural support programs in city agriculture offices (CAOs) and other LGUs. One technical officer in Leyte explained that, although she had prior skills as a horticulture graduate, she and most of her colleagues were generalists so they would approach the VSU horticulture department for advice on specific problems. Most of those VSU researchers were involved in the ACIAR program and keen to build the knowledge and skills of extension staff who would provide ongoing advice to farmers.

Aside from actual adoption of technologies and practices, another interviewee pointed out the importance of providing more options for farmers. For example, LGUs and farmers can now select from a variety of proven protective structure designs that can enable vegetables to be successfully grown despite increasing climatic extremes. Similarly with bacterial wilt, there is improved awareness of the types of practices that can help with control, but also many different variants depending on the materials, rotations and inputs available and suitable in a particular area.

Some of the locations targeted during HORT/2007/066 have undergone rapid development. Despite devastation from multiple typhoons, a VSU researcher described the transformation of the Cabintan area since their first visit in 2008 – from subsistence farming, poor housing and ‘terrible’ roads to farmers now having their own vehicles, concrete houses and even satellite connections. The area is now being developed for eco-tourism. ‘It all started with that project,’ she said.

Similarly in the hills near Davao, Mindanao, an informant noted the significant improvement in infrastructure since the initial project, including mobile phone connections enabling farmers to communicate with buyers, as well as road networks and rural electricity. It is conceivable that ACIAR’s activities and engagement with local governments may have helped raise the profile of these areas, but no direct attribution can be claimed. Regardless, better infrastructure and communications would have strengthened the ongoing development impacts of program activities.

Limitations

Some concerns were expressed in documentation and interviews about the risks of promoting technologies and practices that had been inadequately assessed. At one review and planning meeting, C5 representatives cautioned:

There is often no consideration of production risk and income variability in the ‘results’ that are being presented by the scientists at field days and demonstrations... [C5] are concerned the program drive for ‘impacts’ may result in risky or partially formed recommendations being promoted to growers.²¹

While no specific instances of adverse consequences were identified during this evaluation, a key informant noted that quick action had to be taken to avoid some inappropriate recommendations relating to soil nutrients being promulgated to farmers.

Natural disasters have underscored the risks faced by producers. Much of the progress made in Leyte during HORT/2007/066 with the roll-out of protected cropping structures was wiped out by Typhoon Haiyan in November 2013. The trajectory of rebuilding and further take-up since then is discussed in the KEQ 5 case study. In short, much was learned from the typhoon experience about the optimal materials and design of the structures, and a combination of humanitarian relief and new longer-term projects aided rebuilding. Some individuals rebuilt their own structures, but others preferred to wait and hope for outside funding.

Bacterial wilt remains a problem, particularly in lowland areas, despite ongoing efforts through C3 and later projects. Farmers in search of uncontaminated soils are opening up new areas in the mountains, which can lead to environmental damage. One of C3’s lead potato farmers in Bukidnon, Mindanao, explained that it is ‘not really practical to control bacterial wilt on a large enough scale’. Supplies of inputs such as young sunflower weed (for biofumigation) are difficult to obtain in the quantity required and other brassica residues are less effective. He was able to grow 4 successive crops from the original NOMIARC seed potato, but by then the bacterial wilt had crept back in and there was a long wait for clean NOMIARC planting material. He decided to abandon potato farming and instead move into high-value vegetables, such as cauliflower, which are not susceptible to wilt and for which seeds are more readily available. This is apparently a common scenario.

Very few of the farmer clusters initiated by C4 have survived, suggesting significant sustainability challenges of the cluster model. This is contrary to the optimistic note in the C4 final report, which reported that most of the clusters were intending to continue and, in some cases, strengthen their operations and encourage others to copy the approach. As C4 wound down, all the clusters identified potential alternative sources of support such as their LGU, CAO or DA, but these would not have provided the intensive assistance apparently required. In some areas, there were reports that some farmers had transitioned away from farming activities to other occupations that offered better income opportunities.

On the policy front, government interviewees could not identify any changes attributable to ACIAR, although some of C5’s research papers were reportedly widely disseminated and found useful (for example, SEARCA’s transport study). C5’s final report stopped short of claiming consequences from its analyses, instead saying:

Hopefully [emphasis added] the policy briefs and research notes will be used by policymaking bodies to reform existing policies or create new policies which will contribute to improvements to the livelihoods of smallholder farmers (Hall 2022:59).

It also suggested that the Policy Advisory Reference Group (influential people from government and industry) were interested in applying the research findings in their work with government programs to improve smallholder livelihoods (Hall 2022:57).

21 This quote comes from a summary of discussions of researchers and colleagues in supply chain, soils, entomology and pathology and economic workshops during ACIAR-PCARRD review and planning meetings in Ormoc in August 2010. The unpublished notes were prepared by David Hall.

Gender equity and social inclusion

Overall, HORT/2007/066 predominantly applied a gender-blind or 'household-based' approach, inadvertently neglecting the distinct needs and roles of men and women within farming households.

Evaluation fieldwork provided valuable insights on the roles assumed by women and men in farmer households and agricultural activities. Women are heavily involved in activities such as weeding, pruning and harvesting, and engage actively with their husbands on crop selection. Women tend to manage the household budget, but men hold the final decision-making authority on farm management and budgeting, including payments for labour and purchasing inputs. Women consider themselves to have a more profound understanding of market dynamics, although men often assert their authority in deciding prices based on their understanding of farm costs. These insights highlight potential areas for promoting more equitable decision-making processes within the household.

Components 1, 2 and 3 of HORT/2007/066 generally limited their direct farmer engagement to selected (male) farmer-collaborators who were identified as having the capability, resources and innovative mindsets that would enable them to actively contribute to research trials set up on their land. In contrast, C4 deliberately targeted smaller-scale, resource-poor farmers (including many women) who were struggling to engage effectively with markets. This distinction in approaches translated through to some extent in dissemination and adoption, although attempts were made in some cases (for example, protective structure designs) to modify approaches to suit a wider range of farmer circumstances and constraints.

Gender equity and social inclusion (GESI) was not given prominence in program planning, resulting in a significant oversight in acknowledging and responding to gender-specific needs. For instance, there was no effort made to devise a targeted approach for inviting women participants to capacity-building events, or to incorporate a gender-transformative approach in forming or supporting marketing clusters. Consequently, women were not adequately considered or represented in most of the knowledge and dissemination activities. There was a lack of data capturing the disparity in access to information or the extent of knowledge improvement between women and men farmers throughout the project.

The program did acknowledge the importance of empowering women, albeit in a very limited way, primarily by aiming to retain women farmers throughout program implementation. However, the ratio of representation typically leaned heavily towards men, with a common ratio of 6:1. Nevertheless, there was a notable instance where researchers intentionally pivoted their strategy to target women prompted by insights obtained during knowledge dissemination activities. One researcher said:

One of the things that struck me on the first trip was the men looked important but the women made the decisions. So we targeted the women.

There was a positive shift in recognising the importance of GESI as HORT/2007/066 progressed, responding at least in part to ACIAR's increasing emphasis on gendered approaches. Approaches were strengthened during follow-on projects such as the ICM project (HORT/2012/020) and the value-chain project (AGB/2012/109), and GESI has been given greater attention during implementation of the current GAP project (HORT/2016/188) in order to meet the requirements of GAP accreditation. This indicates a learning curve for the researchers involved in successive projects in understanding and integrating GESI considerations, and underscores the continuous reflection and adaptation of GESI approaches throughout the period.



A programmatic approach to research enhanced cross-program understanding and perspectives. However, integrating individual components proved challenging.
Photo: Jeffrey Maitem

KEQ 4: Programmatic approach

Efficiency and effectiveness

KEQ 4.1: To what extent did the multidisciplinary programmatic design and management structures of HORT/2007/066 support efficient and effective achievement of intended objectives?

The programmatic approach was well-intentioned, sensible in principle and added some value. Program-wide annual meetings, technical workshops and online information sharing fostered camaraderie and helped broaden cross-component understanding and perspectives. Some synergies arose from commonalities of institutions, experimental sites and (in a few cases) staff across multiple components. However, there were many **challenges and missed opportunities**. The diversity of research themes, crops, organisations and locations made for a challenging coordination task. Most researchers' interests and loyalties centred on their own component, and some found the directive to collaborate with other components irksome. There was no program-wide approach to monitoring and reporting. Administrative, financial and decision-making complexities reduced potential efficiencies. A common view was that more attention was needed at design stage to build a common understanding of vegetable sector challenges and how individual research efforts would contribute as part of a broad coherent strategy.

Benefits of programmatic approach

ACIAR initiated the program with laudable intentions of tackling key issues facing vegetable growers in a coherent fashion. While HORT/2007/066 was in effect a pulling together of 4 separately designed technical projects, plus economics and management overlays, 'close interactions' were anticipated across components in terms of focus crops, research topics, locations and partner organisations. Former ACIAR RPMs were generally positive about the programmatic structure.

The linking of the components under a single programmatic structure had some benefits that would otherwise have been more difficult to achieve. Program-wide annual meetings organised by C6 and the Philippines Horticulture Manager brought senior researchers together and enabled sharing of lessons learned across components. This was widely viewed as useful and constructive, helping to broaden understanding and perspectives across the different players. The meetings also helped with adaptive management, in the sense of identifying potentially different routes

to achieving objectives, such as different partner organisations. They were used also as opportunities for technical workshops on topics such as pathology, entomology, soils and value chains.

All interviewees appreciated the role and value-add of the in-country coordinator (Philippines Horticulture Manager) in maintaining momentum and managing the in-country researchers, given the 'fly-in-fly-out' roles of ACIAR RPMs and Australian leads. One explained, 'He was the conductor. We researchers are all prima donnas, we are difficult to manage!' The coordinator also supported milestone delivery:

He solved the problem of researchers that had to make reports to ACIAR, to PCAARRD and to our university – with different formats for each. He helped with that.

The closest synergies were through commonalities of institutions, experimental sites and, in some cases, staff, across multiple components. The final program (C6) report identifies these commonalities as the main source of potential value-add for the programmatic approach. VSU was the Philippines research lead for C1 and C2 and

participated in C5, UPMIn led C4 and C5, and C1 and C3 were linked through the NOMIARC research station and UPLB. VSU's on-campus research facility enabled a range of trials under protected and open-field conditions, including for management of soil nutrients, pests and diseases.

Cross-institutional interactions within the Philippines were also reported. VSU and UPLB research leads from C1, C2 and C3 all confirmed working together, at least during the later stages of the program. For instance, while bacterial wilt was not initially an issue for the C2 activities, it gradually infiltrated and resulted in up to 75% mortality in tomatoes and capsicum. The C3 lead visited and advised on control treatments. An LGU interviewee in Leyte recalled that the C2 researchers were subsequently able to provide advice to their protected cropping farmers on control of bacterial wilt. One of the farmer-collaborators appreciated the 'broad' project', saying, 'people from other components could help too. For small farmers, rain isn't the only problem.'

C4 hosted cross-visits from C2 farmers to see Mindanao examples of protected cropping. A C4 researcher noted their access to the technical expertise of other vegetable program researchers, which complemented UPMIn's socioeconomic approaches. 'It was easier for us to find technical help because we were part of the mega-project.' One of the C4 field staff described engagement with other components to address production problems as 'very good'.

The program's Web2 intranet was developed as an ongoing platform for sharing data, analyses and reports among the program researchers in both countries. Resource material such as technical or extension notes prepared by one component was able to be used by other components. Most program participants viewed Web2 as having worked well.

From a management perspective, the C6 final report notes the 'opportunity to view and review project leadership styles' as another benefit of the multicomponent structure. The Vegetable Program Manager and Philippines Horticulture Manager also played a vital role in quality assurance for the other components. The program structure also enabled unallocated funds, including savings due to C5 staffing vacancies, to be readily redirected to other components or for additional in-country activities.

Challenges and missed opportunities

The program design process was not ideal. Integrating separate project designs into a coherent program framework was a complex task, requiring retrofitting of overall goals and finding commonalities to bring to the fore. Further, the ACIAR/NSW DPI design team was

under pressure to finalise the program design to enable funding to flow from 1 July 2008. In the circumstances, components were 'as connected as we could make them' said one former RPM.

Not all program researchers were fully on board with the programmatic approach and the directive to collaborate with other components. Many had devoted considerable efforts to designing their own standalone projects and some resented the perceived interference. They were very loyal to their projects and had little incentive to divert their attention to collaborative activities that were not explicitly part of their responsibilities or milestones. Of the 4 technical components (C1–C4), only C2 mentioned other components in its final report.

A review of the program undertaken in late 2011 concluded that the components were, for the most part:

regarded as separate individual projects with discrete research objectives, expected outputs and milestones. Although the projects were well implemented in most cases, there is a need to promote a conscious effort from all participants to contribute to a common objective. There is therefore a need to provide a unifying theme so that project components do not appear as stand-alone projects.²²

Interviews for this evaluation confirmed the review findings. 'Although the separate projects became components of a program, everyone thought of them as projects in their own right,' said one manager.

A degree of academic and/or personal rivalry may have been involved. One in-country lead noted that 'Each person has their own specialisation and wants to get credit as an individual – whereas if they're working together, then it's a group output.' The same individual mentioned that their attempts to work jointly with another research lead had been rebuffed, and yet their own data was later used in that person's publication without acknowledgement.

In addition, some researchers found it challenging to get across the breadth of issues addressed within the program. 'We had to understand all the technologies... But it's complicated for each person so we tended to just focus on our bit.' Another suggested that while the program had 'all the right parts', the roles, responsibilities and coordination mechanisms were not always clear to everyone involved.

A common view emerged that the programmatic approach was sensible in principle but needed more attention at design stage, including involving all relevant parties to build a common understanding of the challenges and capture complementarities. An extreme comment was that 'it was a total mess from

22 Unpublished review of Chapman K, Batugal PA and Davies L (2011) HORT/2007/066 Final review [finalise publication details?], dated 26 June 2012.

the outset', that results would have been better if the 4 technical projects had each operated independently, and that the economic policy work was irrelevant. An in-country lead suggested more diplomatically that the design was not 'holistic' enough, and that some individuals involved had little interest in coherence and therefore some parts worked and others did not.

I was frustrated in the end – I wanted it integrated, but everyone worked alone. This was not what we envisaged during scoping.

While many researchers were willing to collaborate and provide support on request to other components, a few regarded joint activities as an imposition that distracted from their core business, were beyond their contractual obligations, and added no value for them. A C4 researcher complained that potential benefits from being part of the program did not eventuate:

We had growers that needed that technical expertise but no, other components had their own agendas and partners.

Other interviewees reported that it was easier to access local technical support, such as from LGUs, the Department of Agriculture, private agri-input suppliers or within-component resources (for example, a staff member who was a trained entomologist). Despite the aspirations and exhortations of cross-component collaboration, the C6 final report reflects:

The opportunities to utilise skills in one component to assist other components is an opportunity that needs to be progressed in new projects... in the future this needs to be more proactive (Hall 2013:25).

The diversity across the components in terms of research themes, crops, organisations and locations made for a complex coordination task. Security-related travel restrictions in Mindanao reportedly convinced some of the Australia-based researchers to confine their activities to Leyte. Moreover, the technologies, approaches and crops prioritised in one location were not necessarily appropriate or prioritised in environmentally different areas. For example, a C3 potato researcher spoke with their C2 counterpart on screen house design, but to be useful for potatoes such structures would need to be aphid-proof, which was not a consideration in C2's work. C4 assisted its clusters to source materials for rainy season protected cropping, but noted there was no distinction in the market between crops grown within or outside such structures, so this was not considered a priority focus.

There was no program-wide monitoring and evaluation framework, nor consistency in monitoring and reporting.

Who, what and when details are essential to effectively undertake M&E [monitoring and evaluation] and review

of complex project components with many researchers and stakeholders.²³

While the program logframe did include indicators and means of verification at various levels of the objective hierarchy, it did not assign responsibilities and there is little sense that component leads were expected or required to report against it. Each component reported separately and it was the role of C6 to extract highlights for program-level reporting. Results indicators and data quality were not consistent across the program.

The C6 final report acknowledges that greater benefits could have been derived from the annual whole-of-program gatherings, including expanding the opportunities for 'interaction, scientific debate and sharing of resources' (Hall 2013:26). Consistent with adaptive management principles, a clear strategy or process would have enabled useful suggestions made during these meetings to be acted upon within the life of HORT/2007/066, rather than being 'parked' for attention in the follow-up program. A former component lead in Australia noted that additional activities beyond the annual meetings were needed to build synergies across components. There were also reflections that better use could have been made of Australian expertise to conduct technical capacity development workshops.

The component that struggled the most to achieve its intended objectives was C5. C5 had very explicit cross-program objectives, including

- value-chain analysis for the 'crops of interest' in the program
- estimating the profitability of new technologies developed as a means of estimating industry-wide impacts and to enhance adoption
- identifying any policy constraints that might affect adoption of those technologies.

Applying these analyses was intended to 'inform the direction' of research resources in other components towards high-value outcomes, help support extension efforts and encourage longer-term policy reform that would support a vibrant vegetable industry.

Despite this description, C5's place in the program was evidently not well understood or accepted. 'It wasn't clear at the start what our role was,' said one Australian C5 researcher. Some economists had been initially embedded within technical components and thus there was a perceived or real overlap of roles. C5's activities were hindered by high turnover of its Australian staff, but there were also significant challenges obtaining data from other components. The technical component researchers were reportedly 'often unconvinced of the value of ex-ante analyses' and resented the distraction from their own experimentation and analysis. There

23 Unpublished review of Chapman K, Batugal PA and Davies L (2011) *HORT/2007/066 Final review*, dated 26 June 2012, p. 13.

was also a feeling that C5 was trying to assess the value of C1–C4.

C5 did prepare an ‘interim report’ on protected cropping, which suggested the technology was too expensive to be viable or worth pursuing. This was not well received by C2, criticised as being ‘too early in the project cycle to provide advice on possible farmer benefits’.

With hindsight it relied on people who generally had little experience with protected cropping production systems and the risks involved with protected cropping.

C2 subsequently published their own analysis independently of C5. Similarly, C4 carried out their own economic and value-chain analyses. The C5 economists were unable to complete an ex-ante analysis for C1 because ‘the component was reluctant to provide data and/or their designs did not allow an easy interpretation of results’ (Hall 2022:37). Likewise, no economic analyses were carried out on C3’s bacterial wilt research.

C5 therefore ended up focusing on policy topics, far removed from farm-level assessments of more immediate relevance. C5 researchers themselves acknowledged the lost opportunities. ‘If they had been

embraced by the other components, their very talented economists could have contributed more.’ Moreover, C5 had little evident buy-in from those with real policy influence, which constrained its impact.

For C6, attempts to foster adaptation and flexibility had limited success, either because of inherent attitudes, or misconceptions that once funds were allocated, nothing could or should change. Instances were also reported of institutional issues in terms of decision-making authority between the various players including ACIAR, PCAARRD, university bureaucracies, and the Australian and in-country leads. The finance system was complex and funds often travelled slowly through the long chain from ACIAR to PCAARRD (in the early stages until the PCAARRD link was removed) to the university or other lead and then to other partners (it is unclear if this was exacerbated by the programmatic structure). Similarly, dealing with both ACIAR’s and PCAARRD’s reporting requirements was burdensome. ACIAR’s internal system for reporting was designed for more standard project modalities. No program-level reporting template was available, and the system apparently struggled to cope with multiple reports being generated under the single HORT/2007/066 ‘project’.

Learning, collaboration and relationship building

KEQ 4.2: Did the multidisciplinary programmatic approach produce identifiable outcomes relating to learning, collaboration and relationship building?

As with KEQ 4.1, there is somewhat mixed evidence on outcomes relating to learning, collaboration and relationship building from the programmatic approach of HORT/2007/066. **Strong professional and personal relationships were fostered and many have endured. However, collaboration and learning across components was rarely prioritised** given time pressures and unfamiliar subject matter. Divides were especially evident between the biophysical science (C1, C2, C3) and social science (C4, C5) components, and between researchers pursuing ‘pure’ science versus impacts for farmers. Strong personalities both in Australia and the Philippines likely exacerbated differences.

Positive findings

HORT/2007/066 undoubtedly contributed to some strong and enduring professional relationships among agriculture-sector researchers and practitioners in the Philippines. One of those involved with program coordination believed a key feature was the ‘qualitative side of relationships we built and how we brought teams together’. This involved individual researchers and organisations, as well as new relationships between academic researchers, the private sector, NGOs and other projects. The role of the in-country

coordinator was critical to successful relationship building and knowledge sharing.

The annual meetings were important opportunities for researchers across the program to meet and learn from each other. Organisers also used the occasions for team building, having fun, and developing camaraderie and personal friendships. The Australian researchers had their own annual program meeting (initially with a PCAARRD representative attending) and Australian leads participated in the annual in-country meeting. Bringing biophysical and social scientists together helped expand awareness beyond the narrow

component boundaries. Some researchers also found the Web2 information-sharing platform helpful in building knowledge across disciplines.

When we gathered and heard the reports of the technical teams, that was especially interesting. It opened the eyes of researchers as to what farmers must have to deal with. [Otherwise] every individual researcher is just focused on their area of interest. It forces you to look at the intersections. We can't just focus on our micro-area. Research shouldn't have that kind of boundary, it's a disadvantage for knowledge. (Philippine component lead)

Former ACIAR RPMs agreed these interactive program events worked well and were the highlights from the programmatic perspective. In addition, the technical workshops convened after annual meetings 'helped scientists and extension officers who had similar interests to meet and develop better working relationships' (Hall 2013:26). One interviewee noted the importance of researchers learning to collaborate across universities and also with other organisations such as LGUs and national government agencies.

Many of the professional and personal relationships initiated within the Philippines during HORT/2007/066 have endured and been further strengthened through subsequent collaborations, including on follow-up ACIAR research programs and professional development opportunities such as John Dillon Fellowships. While researchers in the Philippines appreciated the regular visits and support from their Australian counterparts, there was a sense that the in-country relationships mattered most. 'We were not affected by the structures higher up – we just collaborated directly among ourselves.'

For ACIAR, HORT/2007/066 was 'a good experiment in getting RPMs to work together' – including sharing funding – in ways that had not previously been attempted. RPMs considered this to have worked well, and it was seen as an appropriate response to the fact that 'no problems are ever single discipline'.

Challenges

Given the relatively limited cross-component collaboration outlined above, it would be fair to say that there was far more learning within each component than between them. Components tended to look internally or to third parties (LGU, DA) for technical inputs, and the intended contribution of C5 to identifying economically viable technologies for other components to focus research on was not achieved.

One of the former ACIAR RPMs said that it was 'really hard to get people interested in other people's projects' and it was difficult to predict in advance what the 'glue' would be across the components. They suggested this might have been easier if there had been less 'distance' between academic disciplines. In addition,

there were 'always the dynamics, and competition between organisations'. One of the Filipino researchers suggested rivalries were primarily an issue on the Australian side: 'It was the Australians who didn't get along well with each other... There was competition between Australian institutions.'

The benefits of program-wide meetings were limited in the early stages of the program, when only component leads attended. There were just 2 all-staff events, in 2010 (Ormoc) and 2011 (Cebu). One of the non-lead researchers said they had little idea what other components were doing until they saw the annual reports. Another said the Cebu event was 'the first time most of us met in the same room'. However, they acknowledged that 'given it was such a large group, logistics were a nightmare' – noting also that the virtual technologies available now would have made regular interactions far easier.

Further, the Web2 sharing site was not universally adopted, with one in-country lead describing it as 'difficult to use'. It is worth noting that C2 developed its own project website, described in the C2 final report as 'a showcase for the project and as a platform for project team members to exchange files and information, with a section for general public' (Rogers 2013:61). It is not known whether C2's platform was linked to the program-wide Web2.

Initial expectations or assumptions that components implemented in similar locations would maximise cross-learning were not fully realised. The VSU component teams (C1 and C2) 'weren't really working together even though they were from same university', explained one observer, despite program attempts to convene regular meetings for them. There was minimal sharing of research sites, with some sites only suitable for one component and different activity timing making it hard to coordinate.

C3 was largely on its own geographically and institutionally (led in-country by UPLB). Australian researchers described it as 'a bit isolated'. While there were interactions during program meetings, 'in the field we didn't often cross paths [with other components]'.

C4 and C5 were both housed within UPMin's School of Management. While the institutional and disciplinary closeness enabled the local researchers to interact regularly, this did not translate into close component-wide working relationships. A C5 economist mentioned during an interview that, even within the C5 team, there were sensitivities about 'outsiders' (from Australia) questioning local approaches and perhaps inferring their methodologies or capabilities were inferior.

Resentment at the imposition of the programmatic structure, and apparent lack of advance warning, caused ructions at the program launch meeting when it emerged that some of C4's expected budget was to be diverted to C5. The C4 lead told ACIAR they could not go

ahead with inadequate budget. C4 was also concerned that other components intended to work with 'their' farmers. 'That would be okay if properly scheduled, but if every day new people were coming, that would dazzle and confuse the farmers,' explained one of the C4 team. C4 henceforth had (and cultivated) a reputation

as 'an explosive bunch'.²⁴ A C4 interviewee quipped that 'team building *within* our component was the strongest thing that came out of it!' On a more serious note, this was an unfortunate tone on which to begin program implementation and foreshadowed some ongoing friction in intercomponent relations.

Gender equity and social inclusion

KEQ 4.3: In what ways did the project engage with issues of gender equity and social inclusion and what influence, if any, did this have on partners and collaborators?

As noted earlier, GESI issues were not a significant focus of HORT/2007/066. Despite the active involvement of a substantial number of women in partner organisations, gender-disaggregated data were not consistently gathered. This hindered the program's ability to understand and assess the full scope of women's involvement and contribution. However, a notable transformation was evident during program implementation in terms of increased participation by younger researchers and staff, including many women.

Challenges relating to social inclusion emerged as a key aspect of the program's dynamics. Social issues, particularly security concerns, posed impediments to engaging effectively with some partners. The inconsistency in visits to specific areas, such as Bukidnon in Mindanao, reflected these restrictions, highlighting the complexity of achieving comprehensive social inclusion. Security and logistical issues also limited access to remote areas, exacerbating the challenges of extending the program's reach and fostering more inclusive partnerships.

Factors affecting follow-up projects

KEQ 4.4: What factors determined arrangements for follow-up projects from 2012?

Directions and approaches for follow-up projects from 2012 were shaped by evolving high-level strategic objectives and priorities, and the lessons emerging from implementation of HORT/2007/066.

As outlined under KEQ 2, a 'second phase' vegetable program was implemented in 2013–2018. This program included a value-chain project (AGB/2012/109), an ICM project (HORT/2012/020), a soils and nutrient management project (SMCN/2012/029) and a post-harvest management project (HORT/2012/098). One Australian interviewee described it as a 'no-brainer' to plan for follow-up work on vegetables in the southern Philippines, since the initial program provided many benefits, had excellent buy-in from the Australian collaborating organisations and also generated a lot of publicity.

The findings of a comprehensive review of HORT/2007/066 in 2011 (summarised in Table 11) were fundamental to determining the directions of the new program and its component projects.

Strategic consultations

The other key driver of the new program was the strategic objectives of the governments of the Philippines and Australia – specifically, PCAARRD and ACIAR. During late 2011, ACIAR embarked on an intensive period of consultations in the Philippines with a view to finalising its new country strategy and research program for 2012–2016. ACIAR representatives met with PCAARRD and several other Philippine Government agencies, including DA and the Bureau

Program review

²⁴ C4 printed its own T-shirts featuring the C-4 explosive.

Table 11 Review findings relevant to future programming by program component

Component	Key findings and recommendations
C1	Further research is needed on soil nutrients and both organic and inorganic fertilisers, coupled with cost and return analysis, to determine optimum soil and nutrient management protocols. Research findings should be disseminated via technology guides to key groups including farmers and extension workers to enhance project benefits.
C2	Irrigation is critical, with inadequate water supply being a significant cause of poor crop performance. Irrigation pumps can be expensive but gravity-based systems for use in summer months need further exploration. Stronger linkages are needed between work on protected cropping and value chains/marketing. Additional farmer-collaborators in Leyte would ideally be close to urban areas, to maximise market opportunities and minimise transport costs. Further work on protected cropping should expand to 4 additional low-income provinces, such as Southern Leyte, Samar, Biliran and Bohol, and involve the relevant state colleges and universities.
C3	Further research is needed to help farmers adopt the disease management technologies developed, particularly for economically constrained smallholders. Conduct further trials on bacterial wilt suppression via crop rotations, with on-farm demonstrations if successful.
C4	Stronger linkages are needed between work on protected cropping and value chains/marketing. Institutional markets require quality product, which is unlikely to be achieved without access to the right types of seed, access to capital, agronomic skills and market knowledge.
C5	The split between technical and economic components in HORT/2007/066 did not work well. While policy research and modelling remains important, the priority for the 2013–2017 program should be providing economic services for the farm-level research within each project, in areas such as farm budgeting, gross margins and market/value-chain analysis. This would be best accomplished by embedding an economist within each technical component from the outset, so they can be involved in research planning and ex-ante impact analysis and have ready access to results data for subsequent economic analyses. One economist could potentially straddle more than one component if appropriately skilled. An overall coordinator of economists and their work across the program could sit within the management component and regular cross-project economist meetings should be arranged. Training and mentoring should be provided both for the designated project economists and also (at basic level) for some non-economic staff.

Source: Chapman, Batugal and Davies 2011. The review also covered the parallel fruits program, HORT/2007/067.

of Agricultural Research, as well as VSU and UPMin, to discuss respective research strategies and priorities. ACIAR RPMs then consulted existing and potential new partners, including those in local government and private sectors. These initial meetings helped ACIAR identify potential collaborative research topics for the 2012–2016 period.

In late November 2011, more than 40 research partners from Philippine Government agencies, state universities, DFAT, AusAID and ACIAR convened for further review and discussion of how and where ACIAR could best focus its research support. The proposed research program was broadly supported, and Philippines Government representatives raised the possibility of greater co-investment in the future as a result of the new administration's substantial increase in agricultural research funding. Some concerns were raised about ACIAR's resources being spread too thinly: 'ACIAR should prioritise, focus and make sure it stays

within its areas of expertise' (unpublished report on ACIAR–Philippines Country Consultation, 28 November 2011). Participants recommended 'whole of ecosystem' approaches that linked production (including soil management and crop nutrition), marketing (including post-harvest issues) and policy, noting also the importance of climate change adaptation and risk management for farmers as cross-cutting themes. The DA's prioritisation of organic agriculture was also highlighted. Other significant comments in the context of new program design included the need for ACIAR to 'remain focused on the development of knowledge and technologies oriented towards the priorities of resource-poor farmers', and the 'need for more work on adoption and extension approaches'.

Design workshops

In light of the program review and these strategic discussions, ACIAR turned its attention to the design

of a new program to succeed HORT/2007/066. An initial meeting in Canberra (January 2012) agreed on broad parameters for a 'vegetables and value chains' initiative, and a programmatic management framework. A second workshop in Davao (February 2012) gave in-country researchers an opportunity to provide feedback and contribute further detail. Finally, key Australian and Filipino researchers were brought together in a design workshop at PCAARRD in Los Baños (May 2012).

This collaborative design process may have been a response to feedback, including within ACIAR, that a programmatic approach requires all parties to be involved from the start to agree on key challenges and capture complementarities. Ensuring key stakeholders were on board was especially important in the context of budget limitations and the recognised need to target research in areas with prospects for greatest impact.

A unifying theme emerged around resilience, decreasing vulnerability to poverty, increasing farmers' income and improving livelihoods, with a focus on opportunities rather than problems. Initial thinking was that research components should cover value chains, post-harvest issues, soil management, ICM and 'clusters/sociology'. Some features of HORT/2007/066 were highlighted for retention, including the emphasis on research capacity development, partnerships and multidisciplinary approaches. However, for the future program, the multidisciplinary was recommended *within* each project (including production and marketing, economic analysis and GESI), and there was greater emphasis on strengthening impacts for farmers through more applied research, better understanding of factors influencing adoption and participatory extension methods.

Scoping studies

The design process for the new program drew also on dedicated studies of topics that were emerging as priorities for further research, including pests and diseases, post-harvest issues, and new approaches to value-chain development and marketing.

Experience during HORT/2007/066 highlighted the significant impacts of pests and diseases. Limitations in pest and disease management skills apparently contributed to some experimental trials failing. Concerns emerged regarding the standard of pest and disease research and the relatively limited input of Australian expertise. Unexpended C5 funds were used to fund visits by a pathologist and an entomologist from NSW DPI to investigate these issues, provide advice and training, and identify research priorities for further work.

Post-harvest losses and variable product quality emerged as significant unresolved issues during HORT/2007/066, especially in light of the work of

C4 on cluster marketing and C5 on transport and market analysis. C5 found that an average of 11–12% of tomatoes and lettuces transported to market deteriorated and could not be sold due to inadequate transport services, and poor handling and storage practices. Lack of consistent quality sorting and grading was a further factor affecting returns. Between late 2011 and early 2012, C6 was able to draw on unexpended funds to scope research opportunities on these topics.

C4 leads (CUT and UPMin) put together a follow-on proposal to test a new 3-phase agroenterprise planning design for clustering and introduce a quality control system for clusters to help overcome consumer concerns about chemical residues in vegetables. However, ACIAR decided that a different approach to value-chain development, with a fresh Australian team, was required. UQ was engaged as a new partner and funded via a year-long small research activity to familiarise itself with the Philippines context, scope opportunities and approaches, and prepare a detailed project proposal.

New vegetables program

As a result of the various processes outlined above, ACIAR and program managers recognised there was more work to be done, but in somewhat different directions, responding to emerging priorities and building on lessons rather than simply continuing on with 'more of the same'. At the same time, managers did not want to lose the researcher relationships and expertise developed through the first program. Issues such as soils, pests and diseases clearly needed more work, but other topics, such as protected cropping, had been proven successful and could be incorporated into further projects rather than being standalone.

The new vegetables program in southern Philippines comprised 4 parts (again mirrored by a parallel program on fruits). Each was defined as a separate project, rather than as a 'component' as in the 2007 program. However, a programmatic overlay was retained, including a management function with the same individuals (John Oakeshott and David Hall) continuing to 'link, coordinate and persuade' in the Philippines and Australia, respectively. The program managers tried to improve the standard of experimental design and implementation with the aid of a checklist for researchers, and to strengthen quality assurance processes for publications.

The follow-on soil and nutrient management project (SMCN/2012/029) involved a new team in both Australia and the Philippines (although still VSU). This reflected concerns in ACIAR and the management team over the research quality and usefulness of C1 at a number of locations.

An ICM project (HORT/2012/020) built on the strong results obtained from the C2 research and the broad interest in protected cropping in Leyte and Southern Leyte (see also KEQ 5 case study). However, rather than testing or promoting protective structures per se, HORT/2012/020 took an interdisciplinary approach to establish best practices under a range of conditions, including protected and open-field production. C2's limited attention to pests and diseases was rectified in the project design by a strong focus on identifying knowledge gaps, developing capability and implementing new research and extension activities relating to pest and disease management (Hall 2013:26). Bacterial wilt had become an issue affecting tomatoes under protected cropping, so management techniques including grafting were introduced via former C3 researchers. HORT/2012/020 also had a stronger emphasis on irrigation technologies than C2. Some of the farmer-collaborators involved in the 2007 program continued on under HORT/2012/020, but a decision was made to focus on readily accessible and progressive farmers, primarily in the Ormoc and Baybay areas.

A new project proposal – 'Improved postharvest management of fruit and vegetables in the Southern Philippines and Australia' (HORT 2012/098) – was developed in light of the recognised need for further attention to this topic, drawing on the scoping work outlined above. A former DPI post-harvest researcher involved in the scoping became leader of this new project.

The 2012 project 'Developing vegetable and fruit value chains and integrating them with community development in the southern Philippines' (AGB/2012/109) was viewed as a follow-on from C4 and involved many of the same researchers in the Philippines, even though the Australian lead organisation changed from CUT to UQ. However, AGB/2012/109 moved away from the cluster-formation focus of C4 and did not follow the CRS clustering process for its work with marketing groups. Instead, it sought to develop full value chains that could be leveraged to build sustainable livelihoods for communities. 'We wanted the agribusiness part of the project to support the community development part of it', as one of the research leads put it. A combination of the community-level focus and the exacerbation of security tensions in parts of Mindanao previously involved in C4 (Bukidnon and South Cotabato) resulted in AGB/2012/109 retaining just one of C4's Mindanao clusters and adding a second, both in Davao municipality. AGB/2012/109 also worked in parallel to HORT/2012/020 in Leyte, helping ensure that production-oriented projects took place within a broader market context. More details are in the case study under KEQ 5.

There was no standalone economics and policy project in the 2012 program, but farm-level economic and

market assessments were built into the other projects in line with recommendations.

2016 and beyond

The process of review and refinement described above was repeated towards the end of the 2012 vegetable program, when it was agreed that over-spraying of vegetables with chemicals was a safety risk for human health. This, along with the Philippine Government's promotion of organic and Phil-GAP-certified production, led to a new GAP project (HORT/2016/188) to support farmers capable of achieving GAP standards for vegetable production.



This project has been made possible by funds from



Australian Government
Australian Centre for
International Agricultural R

Development of protected cropping system in the Philippines

Farmer Cooperator: Eng.
Farm Location: Pamahawan

In collaboration with



Visayas State University
Visca, Baylisan, Cebu
Philippines

Farmer cooperater, 'Boie' Gerona, played a significant role in testing and modifying the protective structures.

KEQ 5: Impact case studies

Introduction to the case studies

KEQ 5.1: What impact highlights can be identified in follow-on projects that had their origins in HORT/2007/066?

ACIAR's long-term engagement and partnerships have reinforced and extended the impacts of the initial vegetable program, while LGUs and others have taken up some of the practices and technologies trialled. **Two impact highlights were protected cropping and cluster marketing.** These are discussed in detail through the 2 case studies in this section.

As outlined under KEQ 4.4 above, many of the research and dissemination activities initiated under HORT/2007/066 were continued in some form in later ACIAR-funded projects. In addition, third parties such as LGUs and other development partners have taken up some of the practices and technologies trialled. ACIAR's long-term engagement and partnerships have reinforced and extended the impacts of the initial vegetable program. Given the breadth of the initial program and the many subsequent interventions, evaluation questions on farm-level impacts are addressed through 2 case studies that trace the evolution through to the present day.

Throughout the consultations for this evaluation, the 2 impact highlights that were consistently mentioned by a variety of respondents pertained to **protected cropping** and **cluster marketing**. Protected cropping was the focus of C2 in the initial HORT/2007/066 program and has continued to underpin the subsequent ICM and GAP projects in Leyte. Cluster marketing was promoted through C4 and continued to play a role in AGB/2012/109, albeit with a different emphasis and approach.

As with the rest of this evaluation report, the descriptions and assessments that follow are based on program and project documentation, key informant interviews with Australian research leads, and in-country qualitative fieldwork by the Alinea-UPLB team. In addition, UPLB led further survey

work in 2 southern Philippine communities. The UPLB research sought to identify any lasting economic and food security impacts on farming households from the adoption of protective cropping technology (Leyte) and market-clustering schemes (Davao City). Both sites have farms that cultivate certain upland vegetables like bell pepper, lettuce and cabbage, and are also known to produce lowland vegetables like tomato, eggplant, *pechay* and string beans.

The case study in Leyte looks into farmer-level development impacts of the adoption of low-cost protected cropping structures.²⁵ Located on the eastern side of the country, the province of Leyte is vulnerable to typhoons and frequently exposed to high winds and excessive rainfall, thereby limiting vegetable production activities to the dry season. In consequence, production area and volume trends for Leyte show very low performance (Appendix 9). The introduction of protective structures enables cultivation of vegetables even during the wet season. The technology is deemed to lower the risk of crop failure and raise harvest volumes while increasing the number of production cycles. These anticipated advantages are expected to contribute to income and food security outcomes.

Protective structures were demonstrated at the VSU campus research farm in Baybay City, and on farmer-collaborator sites in Leyte and Southern Leyte. Initial evaluation field visits and interviews were conducted

²⁵ The case study does not look at protective structures tested in Australia, or the demonstration protective covers tested in Samar or Bohol islands.

with collaborators and non-collaborators mainly in Cabintan, Baybay and Bontoc municipalities. For the vegetable farmer survey, direct and indirect beneficiaries of the protected cropping activities, along with those who were not exposed, were sampled in the municipalities of Baybay and Ormoc.

The case study in Davao City examines similar development impacts at the level of farmers. As HORT/2007/066 promoted market clustering in the local vegetable supply chain, participating farmers are deemed to benefit from targeted management of the seasonal variability of vegetables. The measures of success at the level of farmers in this case would likewise be improved income and food security.

Case study 1: Protected cropping

ACIAR's programs and projects played a major role in testing and promoting protected cropping practices, which have proven benefits for vegetable farmers in Visayas. Protective cropping structures enable farmers to grow vegetables under a wider variety of climatic conditions than with open-field production, significantly enhancing production and productivity. The applied research demonstrated that building structures alone will not achieve maximum benefits without integrated management of soils and nutrients, water supply, pest and disease control, and marketing. Modifications to structure design and materials improved suitability for a range of purposes and financial capacities. The expertise of leading farmers and partnerships with local government and others have been vital in supporting wider adoption.

Rationale for C2 protected cropping research

Prior to embarking on HORT/2007/066, ACIAR established that the Eastern Visayas region (including Leyte) was producing only 45% of its vegetable consumption, with the balance brought in from Mindanao or Luzon.²⁶ The main limitation on year-round production was high rainfall (average 2.4 m/year) and typhoons with destructive winds between June and February. These weather conditions physically damaged leaves, flowers and fruit, encouraged disease, and made planting, spraying and harvesting operations very difficult. Weather also constrained vegetable production in Mindanao, but to a lesser extent.

VSU showed during an early research project (2002–2006) that high-quality lettuce and tomato crops could be produced during the wet months, when prices can be up to 4 times higher, using various structures that protected crops from wind, rain, and pest and disease damage. Local farmers were already experimenting with protective structures. ACIAR's scoping identified opportunities for farmers to produce high-quality, high-value vegetables, such as broccoli, under such structures. Budget analysis indicated that potential additional gross revenue in Eastern Visayas could be in the order of AUD25 million per year, leading to net economic gains far in excess of project cost. For farmers, an investment in (relatively low-cost) protective structures was expected to be worthwhile, if accompanying agronomic and socioeconomic issues could be resolved.

The C2 design identified a range of protective structures, from screens and windbreaks to crop covers, and greenhouses that could be linked to soil-based or soil-less production systems. Given this diversity, the selection of appropriate and cost-effective technology would be complex. There was a need to test the appropriateness of various structure designs, develop appropriate cropping systems, assess potential marketing chains and carry out a thorough economic analysis on the whole production system.

The overarching aim of C2 was to develop, evaluate and implement a protected cropping system that would lead to higher farm incomes by allowing farmers to produce crops (including high-value crops) during the wet season when prices were high. Specific objectives related to:

- developing and testing appropriate and effective protected annual crop production systems
- determining whether the production of vegetable crops using protected cropping systems in Leyte was economically viable at both farm and market levels
- promoting adoption and modification of protected cropping systems in Leyte and Southern Mindanao.

Protective structure establishment and modifications

C2, with support from LGUs, constructed and evaluated 34 structures of various designs in 5 municipalities of Leyte and Southern Leyte, including on farmer-

²⁶ Data from the Philippine Statistics Authority, formerly known as the Bureau of Agricultural Statistics.



House-type structure



Tunnel/igloo structure, curved roof



One-piece curved roof design



Modified curved roof system



Modified curved roof system



Modified curved roof system

Figure 7 Types of protected cropping structures

collaborator sites and at VSU.²⁷ An open-field control site was included at each location. Six self-funded structures were also built by 3 adopters. Drip irrigation systems were used at VSU and also in some of the farmers' fields. The VSU sites were mainly used for

experimentation of crop suitability, pests and disease impacts, and nutrition. The farmer sites were mainly used to collect information to support the assessment of economic viability and to monitor the emergence of new production challenges.

²⁷ Bato, Baybay (VSU), Bontoc, Maasin and Ormoc.

Two main types of structures were tested:

- *house-type structures*, built from bamboo or coco lumber, with an effective growing area of 200 m² (5 m × 40 m)
- *tunnel/igloo-type structures*, made of bamboo or steel frames, with plastic or net coverings and a growing area of 60 m² (1.5 m × 40 m) (Figure 7 on page 64).

Tunnels are suitable for crops such as leafy vegetables and low-growing melons, whereas house-type structures are used for tall or climbing crops, such as tomatoes, sweet pepper and *ampalaya* (bitter melon).

Many modifications were made to the original bamboo structures during and after HORT/2007/066, including (Rogers 2013):

- nails replaced with binder clips and, more recently, quick-release fasteners
- bamboo posts placed in concrete to reduce rot
- scrubbing of plastic covers to reduce mould and algae build-up
- testing of different bamboo varieties, lengths and ages for their impact on strength
- adoption of curved roofing to reduce the wobbling of the plastic during wind
- setting the plastic widthwise rather than lengthwise to reduce replacement costs.

Early modifications of the structures were done at VSU, following project workshops in which Leyte farmers devised affordable structures making use of local materials such as bamboo, and developed roof coverings that are easier to remove when high winds or storms are expected.

VSU and the ACIAR team worked with several farmer-teacher collaborators who actively led local farmer groups and hosted farmer field days. East-West Seed and the Landcare Foundation of the Philippines jointly ran an initial farmer field school in Leyte, and East-West Seed took on the follow-up engagement with the farmers in this group. East-West Seed subsequently ran farmer field schools with 5 other farmer groups. During C2, 1,006 farmers were trained, of whom 35% were provided inputs. Forty-eight per cent of farmers trained were female.

The follow-on project, 'Integrated crop management (ICM) to enhance vegetable profitability and food security in the southern Philippines and Australia' (HORT/2012/020), was intended to capitalise on the outcomes and the collaborative partnerships of HORT/2007/066 and help further improve the livelihoods and food security of smallholder vegetable farmers in the southern Philippines.

While the ICM project was not confined to protected cropping, protective structures underpinned much of the ICM research. Additional structures were built

at VSU to allow the agronomy, plant pathology and entomology research groups to each have at least one high, plastic-roofed, open-sided bamboo structure with a neighbouring similar-sized open-field area for paired experiments. The ICM project continued to research, evaluate and train on protected cropping in conjunction with the farmer-collaborators and sites established by C2, as well as more widely in Leyte, Samar and Bohol. VSU developed 6 trial areas and 16 tunnels on 5 farms. They also conducted 5 trials of new, stronger structures to test typhoon resistance.

The ACIAR GAP project (HORT/2016/188) followed the ICM project and was also influenced by 'Improved postharvest management of fruit and vegetables in the Southern Philippines and Australia' (HORT/2012/098) and 'Developing vegetables and fruit value chains and integrating them with community development in the southern Philippines' (AGB/2012/109). HORT/2016/188 aims to improve the capacity of selected vegetable supply chains in the Philippines to deliver vegetables that better meet consumer expectations in terms of quality, food safety, nutritional value and price. As with ICM, much of the work being carried out under the GAP project utilises protected cropping systems. This project was still ongoing at the time of fieldwork, so final results were not available.

Partners and collaborators

Key partners and collaborators for C2 and subsequent projects included VSU, LGUs and the private sector (as outlined under earlier KEQs). VSU has been involved from the start, providing technical expertise and contextual understanding. LGUs have been connecting ACIAR and VSU to the intended beneficiaries – the local farmers. In turn, projects have provided capacity-building training to LGU staff, especially the agricultural extension workers, who have then been providing support under their own projects. A notable example is the Baybay City LGU, which initiated its own project based on the experiences and insights from the ACIAR program. The LGU project was expected to provide materials to at least 72 farmers in Baybay, of which 49 were installed or constructed as of mid-2023. During the current GAP project, institutionalisation efforts are being made by Baybay City LGU to support sustainability.

During Typhoon Haiyan in 2013, protective structures established by C2 were wiped out by strong winds and floods. Post-typhoon investments from IsraAID in the Cabintan area introduced new and more robust structures that provide greater flexibility (covers can be removed and replaced as needed) and stronger framing materials (steel rather than bamboo) to withstand cyclone winds. These structures are still being used.

East-West Seed has been a key partner, providing technical support to project team members on current commercial vegetable-growing practices. East-West

Seed also provided valuable 16-week farmer field schools that trained project farmers and LGU staff in basic commercial vegetable production skills. EDC was also highly supportive of the project, providing in-kind support, building structures, and providing sites and farmers to collaborate with the project team in the Philippines. The VSU team evaluated the performance of 2 EDC structures and assisted with the construction of a curved roof structure.

Impacts of ACIAR projects on protected cropping

KEQ 5.2.1: To what extent, and how, did HORT/2007/066 and its successor(s) achieve their intended impacts on the selected farming and/or marketing practices? What factors affected results?
KEQ 5.2.2: Where possible and appropriate, what quantifiable impacts are identifiable?

Higher yields

Vegetable crops grown under protective structures, regardless of design and type, overwhelmingly yielded higher compared to those grown in the open field. Average yields were higher under protected cropping for cauliflower, green onion, lettuce, chilli pepper, tomato, sweet pepper, bitter melon, *pechay*, muskmelon, broccoli and string beans. There was no impact on yield for sweet corn, cabbage, watermelon, bottle gourd, cucumber or winter squash. The project reported that protected cropping can result in higher yields in both the wet season and the dry season. Higher yield was highly dependent on crop management, especially in relation to the choice of crop, irrigation management and pest control. Foliage diseases were easier to control under protected cropping structures, but whiteflies, aphids and mites were more difficult to control.

Higher gross margins

The yield improvement under the protective structures, especially in the wet season, usually resulted in higher gross margins. Economic analysis of data collected from commercial farmer cooperators showed that positive and higher gross margins were achieved for crops grown under the protective structures as compared to crops grown in the open fields, but there were some exceptions to these, especially during the dry seasons. Moreover, growing vegetables in the open field during the wet season is either not possible or not economically viable in most circumstances.

Specifically, C2 reported that, with a discount rate at 20%, it is financially viable to grow vegetables under

Table 12 Annual receipts, expenses and gross margin with and without structure

Item	Receipts (PHP/m ²)	Expenses (PHP/m ²)	Gross margin (PHP/m ²)
With structure (A)			
Year 1	122	59	63
Year 2	142	41	100
Year 3	174	44	130
Mean	156	44	112
Without structure (B)			
Year 1	56	49	7
Year 2	107	39	67
Year 3	93	34	58
Mean	95	38	57
Mean difference (A-B)			
Year 1	66	11	55
Year 2	35	2	33
Year 3	81	10	71
Mean	61	6	55

Note: The number of observations each year was not the same. More farmer cooperators entered the project over time, therefore the mean of all observations does not equal the average of years 1,2 and 3.
 Source: Rogers 2013

protected cropping, given the structure design and costs. The average net present value from investment in structures is approximately PHP30,000, with an internal rate of return of approximately 100%. The top 3 farmer-collaborators obtained higher gross margins both inside and outside the structures compared to the average, but their additional gross margin from investing in the structure was twice that of the average farmer-collaborator (112 PHP/m² compared to 55 PHP/m²) (Table 12).

Gross margins from top performing farmer cooperators were attributed to timing of planting, choice of crop planted and good management skills, which enabled them to attain higher yields and prices of vegetables sold. This observation was confirmed by a regression analysis of economic data, which showed that, in addition to the positive effect of protective structures, other important factors that affect farmer profitability are:

- choice and timing of crop
- management skills of the farmers
- control and prevention of pests and diseases
- rainfall (cropping season).

The analysis showed that a 10% increase in management ability would increase returns by around 10%, equivalent to about a 33% increase in net present value of the investment or PHP10,000 for a 200 m² structure. This gave a strong indication of the value of farmer training.²⁸

The follow-up ICM project was reported to have improved annual farm income by 50% among farmers participating in project-run farmer field schools. Findings of the agronomy component suggest that appropriate cultivars for each area, use of protective structures, efficient water delivery systems for irrigation, effective method of raising seedlings in different cultivation practices, suitable mulching materials and proper soil amendments are important considerations to improve production of vegetables.

The use of protective structure regardless of type increased yield of tomato, sweet pepper, eggplant, *ampalaya*, lettuce, *pechay* and kangkong. UV-stabilised plastic roofing of the structure effectively protected the plants from rain and hence minimised plant disease, provided continuous growth and development of plants, retained soil nutrients and improved yield. A frame of galvanised iron pipes with net roofing material withstood strong winds, slightly minimised rain droplets and effectively avoided soil splash towards the crop, which enhanced the yield of *pechay* and lettuce.

Current situation: Leyte survey findings

The Baybay area of Leyte has been a major focus for ACIAR protected-cropping work from C2 to the present, given its proximity to VSU. Aside from the direct beneficiaries of C2, other local farmers could be considered as indirect beneficiaries. These local farmers benefited from the similar projects subsequently implemented by the Baybay City LGU. Several key informants interviewed noted that the design and implementation of the Baybay project was guided by the fundamental principles of C2 of HORT/2007/066.

Quantitative survey results for a sample of direct, indirect and non-beneficiary respondents in Leyte are shown in Table 13 and Appendix 9. The average age across all respondents was 49 years, reflecting the current challenge in the Philippines of ageing farmers. Although there are still young farm operators and labourers in the study site, keeping youth engaged in local agriculture remains challenging due to availability of more lucrative opportunities especially in urbanising areas. Education levels of most respondents (and their spouses) were relatively high, consistent with the wide availability and low cost of primary and secondary education in the Philippines. Nearly half (48%) of the indirect beneficiaries interviewed, and 62% of non-beneficiaries, were female, reflecting the high participation of women in the agriculture industry in Baybay, including many who acquired protective structures through their LGU.

Several farmers interviewed reported that with the benefit of protected cropping, along with the support of cooperative arrangements and market access, farming could be profitable. This could lead to an improvement in their livelihood and their family's overall socioeconomic welfare.

There was a clear disparity in income levels between the groups, with households of the 2 direct beneficiaries (long-term ACIAR farmer-collaborators) earning over 3 times as much as the indirect beneficiaries, who in turn earned over 3 times as much as the non-beneficiaries (Table 13). Income from farming (per hectare) was also significantly higher for the direct beneficiaries – 2.4 times that of the indirect beneficiary group and over 10 times that of the non-beneficiaries. All respondent groups were earning a significant proportion of their household income from activities other than farming.

While these income differentials cannot be directly attributable to the ACIAR projects, it is clear that those who have had access to support either through ACIAR or subsequent LGU projects are better off than those who have not yet received assistance.

Table 13 Household income by type of respondents, Leyte

Household income	Direct beneficiary (n = 2)		Indirect beneficiary (n = 33)		Non-beneficiary (n = 29)	
	PHP	%	PHP	%	PHP	%
Farm income (per ha)	525,000	41	215,888	56	50,207	49
Non-farm income	722,000	56	157,394	41	40,462	39
Other income	35,500	3	13,339	3	8,163	8
Off-farm income	-	-	1,818	-	3,741	4
Total	1,282,500	100	388,439	100	102,574	100

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Box 2: 'Boie' Gerona

Boie Gerona, with ACIAR staff, played a significant role in testing and modifying the protective structures in the Philippines. He was assigned by the ACIAR program to conduct trials on his land to compare the yield of different crops under protected and open-field cultivation. The idea was later validated by PCAARRD for research. The high-tech approach included protective structures that added on elements such as soil fertility, humidity control and underground water distribution, while the low-tech approach involved using local bamboo and recycled materials to cover crops. The structures lasted around 3 years.

The controlled environment under protective structures allowed work during rainy periods and extended growing seasons for vegetables such as solanacea, cucurbits and lettuce compared to crops grown outside.

ACIAR's support brought significant improvements to Mr Gerona's farming practices, introducing protected structures, advice on pruning and improved pest management. Mr Gerona's long-term vision includes fostering younger farmers and improving agricultural practices.



'Boie' Gerona on his farm.
Photo: Lucio 'Boie' R Gerona

A specific example is a farmer-collaborator who was interviewed for both the qualitative and quantitative fieldwork segments, who demonstrated that with the use of protective cropping he increased his income by achieving higher yields and reducing crop failures (Box 2).

Benefits derived from protected cropping are illustrated in Table 14 for the 30 sample farmers growing tomatoes, a high-value, climate-sensitive crop. Farmers with at least some protective structures were able to plant twice or 3 times per year, compared to a

single dry season crop for those with no structures. Yields per cropping cycle were significantly higher for beneficiary groups, and prices received were also higher, reflecting the off-season marketing and perhaps also better quality compared to open-field production. In the case of the direct beneficiary (farmer-collaborator), his experience, profile and greater production volumes may also have given him greater bargaining power. Similar price differentials were achieved for sweet pepper (PHP132, PHP92, PHP57, respectively).

Table 14 Tomato production characteristics by type of respondents, Leyte, 2022

	Direct beneficiary (n = 1)	Indirect beneficiary (n = 15)	Non-beneficiary (n = 14)
Area planted (100 m ²)	1	5	4
Area covered by protective structure (%)	100	54	-
No. of cropping cycles per year	3	2	1
No. of cropping cycles with protective structure	3	1	-
Yield/cropping cycle (kg/100 m ²)	50	72	31
Yield/year (kg/100 m ²)	150	110	31
Product sold (percentage of total production)	90	73	76
Price achieved for tomatoes sold (PHP/kg)	80	52	47

Sustainability of impacts

KEQ 5.2.3: Were those impacts enduring?

Continuity of research partnerships and personnel

HORT/2007/066 established partnerships with local organisations in the region, which were strengthened through the years. Specifically, connections have been maintained with key staff members of VSU, who have been continually taking active roles in the implementation of different ACIAR research projects in the region. As a relatively small ecosystem, and with the location of a key university, skills and capacity gained through research and capacity building have stayed within the research and program community. Aside from being research partners, young faculty and staff members from VSU have been given opportunities through various learning modalities (for example, postgraduate education, fellowships and ACIAR Learn). In addition, farmer-collaborators of the project are currently working and participating in various capacity-building activities of ATI and LGUs. They are now able to help and support other farmers within and outside their respective communities to learn the benefits of the protective structures along with other technologies that were extended through the ACIAR projects.

Continuity of impact at farmer level

The sustainability of the impacts could be linked with the existing partnerships among various institutional actors. These institutional actors include both public and private organisations. The strong partnership among these institutional actors resulted in a local network that continually works on the development of the local agriculture sector within the project sites. As earlier elaborated, the results of the ACIAR program implemented during 2008–2012 provided and opened opportunities for the implementation of succeeding projects within the region. The original program, followed by the ICM and GAP projects, responded to the different concerns and problems of local farmers in the region. This progression on the design of the follow-through projects has enabled the continuation of project outcomes at different levels, both individual and sectoral.

The sustainability of project outcomes and impacts could also be traced to the cooperation and network among the local farmers. Through C2 of HORT/2007/066, several local farmers were supported and trained, and they assisted other local farmers who wanted to improve their production through the use of the protective structures. This support environment illustrates a network of ‘farmers helping farmers’ (Box 3).

Box 3: Albert Rosillo

Albert Rosillo operates a farm with a protective structure that he developed with support from ACIAR. He cultivates fish, corn, rice and fruit. LGUs have helped him with fishpond construction and fingerlings. He adopted protected cropping with ACIAR’s assistance in 2015. His structures can withstand cyclones and the plastic lasts up to 6 years. He assists other farmers and has established the Baybay Farmers Association, which has grown from 25 to 200 members. Mr Rosillo diversified his crops to minimise risk and adapt to market fluctuations.

VSU involved him in the original ACIAR program on the recommendation of the LGU. VSU conducted a workshop in 2014 that Mr Rosillo attended. Local farmers were invited and then ACIAR asked to visit his farm. His farm became a learning site for ATI in 2016, attracting regular visitors until the pandemic. He shares knowledge and benefits with others, advocating for the advantages of protected structures and secure farming practices. The LGU has used his design for the structures it has funded: 50 m long, 4.6 m wide, costing around PHP40,000.

His personal gains from the ACIAR investments include improved farming skills, financial stability and demonstrating that agriculture can be profitable. He encourages youth involvement and has inspired older experienced farmers to adopt similar practices.

His income has increased since 2010–2012 due to higher yields and reduced crop failures, although bacterial wilt remains a challenge. LGU agricultural technicians now seek his advice on management and production aspects. He employs 2 full-time staff members and sometimes hires additional labour.



Albert Rosillo on his farm.

Photo: Alinea International

Challenges in sustaining impacts

Local politics and priorities

Changes in local administrators can have important consequences for sustainability of impacts. In the Philippines, a municipal or city mayor, otherwise known as the local chief executive, has a term of 3 years and can be re-elected for 3 consecutive terms. Each local chief executive has their own priority programs and policies, which are highlighted and enumerated in their term's executive legislative agenda. The priority programs and policies therefore have a higher allocation in the LGU's budget. In the implementation of HORT/2007/066, especially in relation to the promotion of the protected cropping structures (C2), the case of Baybay City illustrates the importance of having strong support from the LGU and its leaders when it comes to project sustainability. Among the different municipalities and cities within the region where the protected cropping structures were installed, Baybay City showed the highest support by providing protective structures to a large number of local farmers. This LGU-initiated project materialised because the agriculture sector has been among the priority sectors of this LGU. However, potential re-allocation of the LGU budget to other sectors (such as tourism, an increasingly important rural sector in the Philippines) is possible when there is a change in the local chief executive. This critical political dimension should be considered when designing the succeeding projects in the country.

High dependence on external support

Smallholder farmers in the Philippines, including those located in the project sites in Leyte, have been continually challenged by the vulnerability of the agriculture sector to extreme weather conditions. With this climate vulnerability, local farmers, both beneficiaries and non-beneficiaries, considered the protected cropping structure as a necessary intervention that could support their livelihood. However, as emphasised by the local farmers, the construction costs of protective structures were too high, especially for smallholder farmers. With the occurrence of extreme weather conditions in the area, it is also crucial to consider the cost of maintaining a stable protective structure. With the added concern of high input costs, local farmers tend to have ongoing demand and dependency on the support services being provided by various government instrumentalities (i.e. LGUs and national government agencies) along with the private sector and international relief organisations. This could have an influence on the continuity and sustainability of impacts.

Innovation and future opportunities

The protected cropping structure has been widely recognised by local farmers in Leyte as an important technological innovation that could improve their livelihood in terms of production and income. It is seen as a mechanism that could significantly assist the local farmers in responding to challenges related to extreme weather conditions. The benefits of adopting the protective structures were recognised not only by the ACIAR farmer-collaborators and the beneficiaries of the LGU-initiated project. Non-beneficiaries also reported that acquiring protective structures would mean that they could crop all year and were less likely to lose crops due to weather conditions. With these considerations, future increases in adoption of protective structures among local farmers could be expected, especially if costs become less challenging.

The experiences from HORT/2007/066 and later projects illustrate that innovations are not only emanating from research and academic organisations, they can also come from the grassroots level. Farmer-led innovations improved an introduced technology, likely contributing to its success through grounding in context-specific needs – environmental, economic and social. The modifications on the original design using alternative materials and specifications were dictated by the required durability against local climatic conditions as well as the costs that local farmers could afford. This example demonstrates the value of co-design approaches in the implementation of agriculture-related projects.

Future opportunities could also come from linkages and partnerships established through ACIAR programs and projects. The involvement of LGUs and LGU officials played a critical role in expanding reach. In Baybay, the LGU continues to provide funding for structures while in Ormoc, the City Agriculture Office is focusing on inputs such as seeds. The involvement of other partners, both local and international, is a critical element in creating agricultural innovations that could further support the needs of the local farmers. This has been shown by the contributions of EDC and IsraAid in improving the protective structures, especially through the additional technologies such as drip irrigation. There are also future opportunities for project continuity through co-funding with national government agencies in the Philippines such as DOST-PCAARRD.

In summary, the project involved designing and implementing various agricultural structures, leading to increased production, improved income and sustainable farming practices among local farmers in the Leyte region. These practices are continuing with the support of the LGU in some areas, and in some cases farmers themselves are funding construction of new protective structures on their own farms as they understand that protected crops (when teamed with informed ICM) produce a significant total net income benefit.

Unintended outcomes and impact distributions

KEQ 5.2.4: Have there been unintended outcomes?

KEQ 5.2.5: How equitable was the distribution of impacts within targeted communities?

As outlined elsewhere, C2's direct farmer-beneficiaries were a small number of progressive male farmer-collaborators. Information on the gender or social distribution of broader impacts is not available, although nearly half of survey respondents who received LGU support were female. In addition, successive projects endeavoured to modify the structure designs to be more widely affordable and user-friendly.

At research level

ACIAR's support for protected cropping under successive programs and projects has resulted in several benefits, including both those that were part of the project objectives along with some unintended consequences. At the research level, this could be illustrated in relation to:

- the progression of the research projects
- the capacity building among the involved researchers.

HORT/2007/066, which was implemented over a decade ago, has continued to contribute to the development of research culture of the partner institutions, such as the involved colleges of VSU. As discussed, the program enabled the implementation of succeeding projects, which are aimed at responding to different challenges of the local agriculture sector. The continued collaboration between researchers from Australia and the Philippines has led to a wide range of co-learning experience. It has led to an international research community where mentoring exists at different levels. The Philippine-based researchers also acquired strong international linkages from working with the ACIAR program and its succeeding projects, and many of the young members of the Philippine research team were able to pursue higher learning at Australian universities.

At farmer level

The capacity-building activities provided to the local farmers as part of the introduction of the protected cropping structures have led to numerous outcomes. These include the generation of other livelihood opportunities for some farmers in the area, outside their regular farm production. In particular, some adopters of the protective structures are currently earning extra income by assisting other farmers to construct new tunnels. HORT/2007/066 and its succeeding projects also created opportunities for farmer-collaborators to work with the LGU and the DA's Agricultural Training Institute as technical partners (as described in Box 2 and Box 3).

Case study 2: Marketing clusters

The 29 marketing clusters established and supported in Mindanao under C4 of HORT/2007/066 were **introduced to new institutional markets**, provided **training in production and marketing** (including negotiation skills), and linked with **input suppliers**. Product quality improved and the cluster managed aggregation and marketing, enabling its smallholder members to secure **far higher prices** than through traditional markets. Participating farmers **increased their income by an average of 47%** during project implementation, while the average household income of cluster farmers was **18% higher** than non-cluster farmers. Farmers also reported **improved social capital** resulting from collaboration both within their community and with external partners. However, the C4 team recognised that **sustaining these gains independently might be challenging**.

When HORT/2007/006 concluded, the new value-chain project led by UQ (AGB/2012/109) took a broader approach to enhancing community livelihoods. The focus **shifted away from C4's clusters**, many of which **discontinued their activities once external support ceased**. Farmers' ability to connect and supply to institutional buyers diminished. Some stopped planting vegetables in favour of other crops or off-farm activities. The qualitative and quantitative evidence gathered for this evaluation indicates that **the boost to productivity, market access and incomes achieved during the project period has had little lasting impact**. Nonetheless, **key elements of clustering** – such as production and marketing planning, product aggregation and advisory support – **remain a feature of current LGU programs promoting formal farmer associations and cooperatives**.

Marketing cluster support: background and evolution

Efforts to enhance specific vegetable value chains in the Philippines, supported by ACIAR, have been underway since 2001 with the commissioning of 'Improving the efficiency of the agribusiness supply chain and quality management for small agricultural producers in Mindanao' (ASEM/2000/101).²⁹ The project conceptualised the vegetable industry in the Philippines into 2 separate value chains: one catering to traditional wet markets with lower-quality products, and the other serving supermarkets and other institutional buyers with higher-quality produce.³⁰ The project created an agribusiness systems model.

A follow-up scoping study, 'Linking smallholder vegetable producers in the Philippines to institutional markets in metro Manila – a scoping study' (ASEM/2005/062), was conducted during 2005–2006 to explore opportunities to link smallholder vegetable producers to profitable institutional markets.³¹ Smallholders were typically selling at low prices through the traditional marketing system and faced significant financial, technological and information constraints which impeded their ability to procure quality inputs and produce quality output and consistent supply. The study emphasised the importance of smallholder farmers consolidating their production and marketing efforts to meet the growing institutional market demand. It identified 6 existing

vegetable value chains that were well-suited to further ACIAR project attention.

CRS was already helping establish collaborative marketing groups, or 'clusters', of smallholder farmers in Mindanao to improve productivity and market linkages. Clustering was identified as an appropriate first step in helping farmers address production and marketing challenges, along with support to establish connections with institutional markets and meet buyers' specifications.

This approach to enhancing farmers' marketing practices aligned with ACIAR's priorities in the Philippines at that time, specifically the goal of 'strengthening partnerships among fruit and vegetable suppliers, processors, institutional buyers, and markets' (Hall 2013). The marketing cluster project was launched as C4 (Analysis of selected value chains in southern Philippines) within the HORT/2007/066 program. Its research objectives included assessing the institutional market for higher-quality vegetables in Mindanao and Visayas and the performance of traditional and institutional vegetable value chains in southern Mindanao. Two objectives focused on direct assistance to smallholder vegetable farmers to improve their capacity to better fulfil the needs of traditional and institutional buyers, and the adoption of effective market linkage mechanisms via collaborative marketing arrangements and clusters. At policy level, C4 aimed to identify and propose potential interventions at the farmer and market intermediary level to improve

29 ASEM/2000/101 was jointly carried out by Muresk Institute of Agriculture, CUP, UPMIn and SEARCA.

30 The institutional market is defined as the sale of fresh produce to market intermediaries, wholesalers and distributors, retailers, food processors and manufacturers, fast food chains, restaurants and resorts (Batt and Concepcion 2013).

31 The study was conducted by CUT with support from the University of the Philippines in Diliman, UPMIn and Benguet State University.

the performance of value chains in the southern Philippines vegetable industry.

As previously outlined, 2 follow-on projects had their origins in C4. 'Developing vegetable and fruit value chains and integrating them with community development in the southern Philippines' (AGB/2012/109) (2014–2018) aimed to investigate and develop models that integrated value chains and community development in ways that enhanced smallholder farming community livelihoods. The Australian research lead changed from CUT to UQ, with UPMIn and VSU as in-country partners. The new design recognised the need for an interdisciplinary approach within the project – covering agronomy, markets and finance – rather than between separate components, as seen in HORT/2007/066. Production scheduling and improved methods of production and post-harvest handling were adopted to minimise risk and increase income. In Mindanao, one of C4's Davao City clusters continued to be supported and one more was created. More generally, the new project moved away from CRS-style cluster formation and instead collaborated with existing cooperatives, forming subsets with fewer farmers. This was aimed at facilitating more efficient monitoring of production, marketing and scheduling.³² AGB/2012/109 also conducted a broad analysis of the entire market for vegetables of interest, allowing investigators to identify the relative attractiveness of alternative distribution channels.

Meanwhile, 'Improved postharvest management of fruit and vegetables in the southern Philippines and Australia' (HORT/2012/098) (2013–2019) was implemented to develop post-harvest research capacity in UPMIn and VSU, as well as reduce losses and maintain quality of fruit and vegetables after harvest, thereby increasing farmer incomes and encouraging increased purchase by consumers. Although HORT/2012/098 did not directly intervene in value chains, it concentrated on improving the quality during the post-harvest process, which was essential to help farmers in meeting the strict quality requirements of institutional buyers (Ekman 2019). In this sense it complemented the value-chain activities of AGB/2012/109.

Case study data collection and limitations

Marketing clusters supported under C4 of HORT/2007/066 were located in Davao, Bukidnon and South Cotabato in Mindanao, while those involved in the follow-on project (AGB/2012/109) were in Ormoc (Leyte), Claveria (near Cagayan de Oro), Davao, and Samal Island (Figure 8). A subset of the stakeholders consulted for the evaluation – approximately 7 in Australia and 33 in the Philippines (including 5 focus group discussion groups) had some association with,



Figure 8 Locations of marketing cluster projects

and/or views on, marketing cluster work. In particular, the evaluation team visited marketing cluster groups in Marilog, Davao City, and a farmer cooperative that currently practises some aspects of cluster marketing in Cabintan, Leyte. A site visit to South Cotabato was not advised due to security concerns.

The team attempted to locate former or current cluster members in Bukidnon, but this proved infeasible as the clusters no longer exist, individuals have died or moved away, and some former vegetable areas are now occupied by plantation crops. The quantitative survey therefore focused only Davao City farmers. Even there, direct C4 beneficiaries were difficult to locate, as many have shifted out of vegetables to other crops, or gained employment in the city or local tourism resorts.

Overall, it became evident that a substantial portion, if not the entirety, of C4's marketing cluster activities are no longer being actively pursued. Other changes affecting market access include new highways connecting former project sites with major urban centres. These changes since C4 implementation make it challenging to comprehensively evaluate ongoing impacts and make meaningful comparisons between adopters and non-adopters of marketing cluster approaches in the current context.

³² Key informant interview with University of Queensland representative, 3 November 2023.

Marketing cluster definitions and modifications

The term 'marketing clusters' has been applied and interpreted somewhat differently over the years by a variety of organisations, with implications for resource allocations, approaches and collaboration strategies.

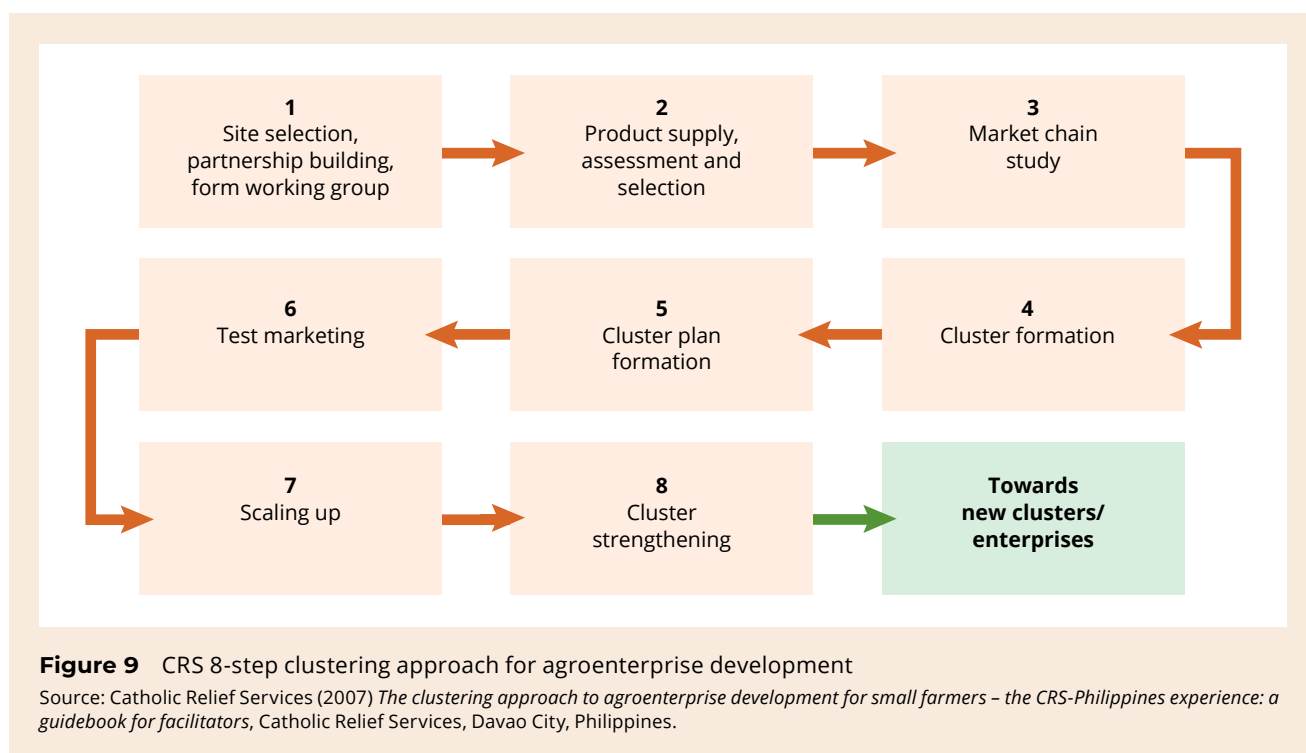
CRS-Philippines developed an 8-step clustering approach to agroenterprise development based on the Territorial Approach of the International Centre for Tropical Agriculture (CIAT) (Figure 9). They organised farmers into clusters of 5 to 15 farmers who were committed to establishing a market-linked agroenterprise within a defined territory.

CRS argued that smaller groups enable farmers to adapt better to changing markets, which may require constant innovations in production and post-harvest practices. Smaller groups also make it easier for each member to engage actively and have their voices heard during meetings. By concentrating on a defined territory, farmers can establish partnerships with local development entities, like LGUs, to promote sustainability and enhance the precision and efficiency of planning and monitoring within the clusters.

The cluster territory can be a *sitio* (subvillage), *barangay* (village), a group of *barangays* or the whole municipality (Catholic Relief Services 2007).

Northern Mindanao Vegetable Producers' Association (NorMinVeggies), an association of vegetable farmers and stakeholders established in 1995 in Northern Mindanao, practised a marketing cluster approach from around 1998 to 2015, including collaborating with CRS and a local NGO in Bukidnon before HORT/2007/066 began.³³ Farmers formed clusters comprising around 15 households based on a specific commodity. For example, in a lettuce cluster, the farmers' main crop was lettuce but they were allowed to grow other crops in smaller volumes. They developed a quality assurance plan for each product, had training in good agricultural practices, and designated lead farmers to serve as quality managers and coaches. This approach was adopted to attain the volumes to deliver to the institutional markets and to benefit from economies of scale in terms of transporting their produce, gaining access to government and NGO support, exchanging market insights, as well as sharing knowledge on production and post-harvest technologies.

C4 applied CRS's 8-step clustering approach and also collaborated with NorMinVeggies. The clusters could be commodity-based or area-based, where adjacent farmers join forces to market multiple vegetables.



33 Key informant interview with NorMinVeggies representative on 9 August 2023. Also Concepción et al. 2008.

The clusters established planting schedules to ensure a weekly harvest. The cluster structure included a leader and marketing specialists responsible for taking crops to market. Cluster members had to allocate at least 60% of their production to marketing through the cluster, and were free to handle the remaining 40% as they saw fit (Batt and Concepcion 2013). However, in the follow-on project AGB/2012/109, farmers had autonomy, under supervision of the project team, to decide the allocation of their products to buyers. Additionally, agronomists provided support to each project site.³⁴

Towards the end of HORT/2007/066, C4 proposed improvements to the CRS approach by grouping the 8 steps into 3 discrete phases:

- establishment
- building resilience
- implementing an exit strategy.

The exit strategy was added to ensure the resilience and sustainability of the clusters following the withdrawal of external support.

During evaluation fieldwork in Mindanao and Leyte, the team found that some LGUs are currently promoting marketing clusters, although their interpretation differs from C4. LGUs focus on encouraging farmers to form legally constituted organisations, beginning with associations and eventually evolving into cooperatives. Such groups are better able to access government services than individual farmers. Some informants used the term 'clusters' to refer to any farmer grouping. For Mindanao LGUs and VICSMIn, new 'clusters' are umbrella organisations comprising 2 or more farmer associations or cooperatives located in close proximity, with no limit on farmer-member numbers.³⁵ This clustering strategy is viewed as a strategic approach for production planning to mitigate the risk of production exceeding market demand (for instance at the Davao Food Terminal), while also empowering farmers by enabling their direct access to institutional buyers such as shopping centres and hospitals.³⁶

Farmer respondents mentioned that a significant characteristic of current marketing groups is the consolidation of produce. To ensure each member benefits equally, there is an allocated volume of production per member, and production and marketing are differently scheduled to avoid over-supply. The second important element is establishing and maintaining relationships with major institutional buyers.

Stakeholders involved

Critical stakeholders who participated in and/or supported the marketing cluster activities included:

- industry associations: NorMinVeggies and VICSMIn
- institutional buyers: New City Commercial Corporation (NCCC) supermarket in Davao City, and for Visayas, buyer chains from Cebu and supermarkets such as Gaisano
- wet-market traders (wholesale/retail intermediaries, often supplying institutional buyers)
- government: LGUs (for example, municipal or city agriculturist offices) and local DA offices.

The activities and roles of these various groups are detailed in Appendix 8.

Project impacts on marketing practices and farmers

KEQ 5.2.1: To what extent and how did HORT/2007/066 and its successor(s) achieve their intended impacts on the selected farming and/or marketing practices? What factors affected results?

Support to beneficiaries

Implementation of HORT/2007/066 C4 resulted in 29 marketing clusters being formed in Davao, Bukidnon and South Cotabato, Mindanao.³⁷ In Davao, the clusters were further grouped into a confederation to achieve the volume requirements of an institutional buyer.

Prior to clustering, most smallholder vegetable farmers dealt with local traders who collected their produce from the roadside or other predetermined collection point, or else the farmer chose to deliver it directly or indirectly to the buyer. Farmers had a weak bargaining position and were usually price takers. Communication and financial flows were only between the trader and the farmer, and the farmer had little knowledge of the market beyond that – especially with regard to institutional markets.

The clustering initiative endeavoured to address this gap by providing training to farmers to help them independently assess market chain options. Farmers were taught negotiating skills, which fostered an increase in their confidence and their capability to negotiate prices, volume and quality with both

34 Key informant interview with AGB/2012/109 researcher, 3 November 2023.

35 Examples were found both in Lantapan (Bukidnon) and Davao City. The Lantapan 'cluster' has 80 members.

36 Key informant Interviews with staff in the Municipal Agriculture Office of Lantapan, the City Agriculture Office in Davao City and VICSMIn, August 2023.

37 AGB/2012/109 subsequently worked with 7 cooperatives with 12 clusters in Visayas and Mindanao.

institutional and other buyers. C4 staff facilitated their participation in a market survey where they interviewed a range of potential buyers, allowing the clusters to make informed decisions about their preferred selling partners. Technical advisory support was a key component of C4's approach, providing farmers with the necessary knowledge and guidance to optimise their agricultural practices including production and marketing planning. Nearly 70 training programs and technical visits were provided, including advice on pest and disease control, soil management, and specialised training provided by experts from the project team and/or partners, such as the crop pathologist from the local DA office. A manual was distributed to help cluster members identify quality characteristics and classify vegetables accordingly.

C4 also linked the clusters to the local city agricultural office, aligning their production and marketing plans with broader regional strategies. Recognising the foundational importance of resources, the city agricultural office supplemented their efforts by providing seeds and various other inputs essential for cultivating a thriving agricultural landscape. This holistic support system aimed not only to enhance the productivity of individual farmers but also to fortify the overall resilience and sustainability of the clusters.

Impacts on farmers

The key benefits from clustering at the farmers' level can be categorised as economic, social and environmental. Factors affecting project performance included differences in farmer orientation, community dynamics and partner organisations' capabilities, as outlined below.

Economic

According to C4 reporting and feedback from key evaluation informants, the work with marketing clusters empowered farmers with knowledge and resources and led to tangible and positive outcomes, ultimately improving their livelihoods and the economic landscape of the community. Economic benefits reportedly included higher prices for products, lower costs, higher income, improved market access, improved access to technical information and capacity building, greater access to production inputs (seeds and fertilisers) and greater access to working capital.

Within the clusters, some members were designated to lead marketing and production efforts, streamlining operations and minimising costs. Usually only one representative from each cluster was tasked with taking the produce to market, thereby reducing marketing time and cost for other cluster members. The clusters also took on many of the functions that were traditionally performed by the traders, such as consolidation and aggregation, grading, sorting and packing.

Farmers gained enhanced knowledge of production techniques and market standards, leading to a notable improvement in the quality of their vegetables. This improved their opportunities to secure better prices. The project also helped build connections with institutional buyers such as NCCC supermarkets who were willing to pay premium prices. Average prices paid by institutional buyers in June 2012 ranged from 1.5 times higher than traditional markets for carrots to 3 times higher for squash (Batt and Concepcion 2013:58–59). This contributed to participating farmers increasing their income by an average of 47% during the course of the project.

The increased income from vegetables enabled farmers to acquire assets for personal use and farming. This was evident in the way farmers made substantial upgrades to their living conditions, as farmers transitioned from wooden to semi-concrete structures and installed metal roofing for their houses. Farmers could better afford to send their children to school, with some going on to graduate from higher education.

In terms of agricultural assets, farmers strategically invested in resources such as motorcycles and horses for more efficient transportation. This not only enhanced accessibility to the farm but also streamlined the process of moving vegetables from the fields to the pickup or consolidation area. The purchase of a horse provided valuable assistance in transporting larger quantities of vegetables.

In some clusters, the farmers reinvested a portion of their profits into a cluster fund, demonstrating a cooperative ethos within the group and increasing familiarity with the concept and practice of saving. C4 also reported improved capacity of cluster members to access finance from microfinance institutions and banks, since they now had a more stable market as well as useful supporting documentation such as planting schedules, marketing plans and gross margin estimates.

During C4 project implementation, it was noted that the rise in vegetable production not only provided employment opportunities within the cluster for tasks such as planting, weeding, harvesting and sorting, but also extended beyond cluster members. For example, the transportation of the products to the market created additional jobs in the community.

However, both the qualitative fieldwork and the quantitative survey results indicated that this scenario has changed, with many former cluster members having either ceased such activities or transitioned to other economic pursuits within or outside the region. This is discussed further in the 'Sustainability of impacts' section on page 80.

Social

The primary emphasis of the cluster marketing interventions was to empower farmers for independent engagement with diverse buyers, deviating from the conventional practice of contract farming. The most significant impacts on farmers' lives were realised through enhanced connections and newfound opportunities. Originally confined to a single outlet through jeepneys, the project's substantial influence was in introducing farmers to various traders, universities, avenues for finance and new market channels. A better understanding of the market enabled the farmers to develop improved relationships with buyers, overcoming much of the distrust and apprehension that had been present in the traditional market.

Clusters also managed to enhance connections with other organisations, such as a government-supported project. Nonetheless, they conveyed concerns about the administrative requirements of LGUs and other government entities, such as the Bureau of Internal Revenue. Consequently, the clusters found it challenging to access major existing programs, such as those offering trucks and large equipment, and could only access smaller support, such as seeds and other agricultural inputs like fertilisers.

A noteworthy success of the project was the promotion of collaboration among farmers, encouraging joint production and/or marketing. Farmer members reported that they grew as a community due to ACIAR and UPMIn interventions. This included relationship building and the recognition of organisational dynamics as pivotal to leadership and the strength of their organisation. The learning extended to the significance of registration, facilitating access to information and various programs, such as assistance and grants. The United Bisaya and Lumad Farmers Association took proactive steps to register with the Department of Labor and Employment, resulting in support from DA for a water system.

The follow-up project, AGB/2012/109, took this further, with the objective of transitioning towards more effective operational practices and decision-making processes, all geared towards benefiting the community. This strategic shift aimed to enhance the clusters' overall performance and contribute to the collective welfare of the community, drawing on a broader spectrum of opportunities beyond the confines of a single market.

Environmental

The adoption of natural farming technologies and contour farming practices had a positive impact on the environment. Cluster members maintained the fertility and health of their soil through green manuring and crop rotations, contour farming and using naturally produced insect repellents and attractants.

Success factors

C4 identified essential success factors for clustering, including:

- a common goal
- alternative markets
- strong leadership
- open communication
- trust and social cohesion
- strong institutional support.

The cluster had to be able to offer some comparative advantage and benefits to its members that were greater than those the members could obtain by acting independently. Underpinning each of these pillars was the need to build the capacity of each member of the cluster to make better informed decisions.

The major advantage of clustering was the improved flow of information and the opportunity for farmers to negotiate directly with the focal buyer. Through clustering, the farmers had a better understanding of market dynamics, why prices increased or decreased, and the product specifications they had to meet to satisfy their downstream buyers' needs. Having the capacity to negotiate with buyers and establish market linkages enabled the clusters to diversify their markets and their product range. Farmers were often able to receive a higher price for their produce as a result of grading and sorting, improved post-harvest handling and better negotiation skills. However, as the focal buyers often had very specific quality and quantity requirements, the clusters needed also to maintain their relationships with traditional or alternative buyers to dispose of product that failed to meet specifications, was surplus to the focal buyer's requirements or where the focal buyer failed to honour their commitments. Maintaining multiple marketing options was an effective strategy to maximise returns and minimise risks.

Challenges

The project worked with different clusters, each with unique characteristics, and the extent of success varied.

C4 encountered initial resistance from some farmers who were hesitant to relinquish their individual control and embrace the clustering approach. Coordinating staggered planting schedules and enforcing signed agreements among farmers proved to be another difficulty, underscoring the complexities involved in fostering unified practices among smallholder farmers.

Another challenge was potential conflicts between the clusters and buyers, particularly institutional buyers. It took time for the smallholder farmers to acquire knowledge about market operations and requirements, while some urban-based institutional buyers appeared to have limited understanding of the challenges faced by smallholders. Another concern was the practice known locally as 'pole vaulting', where some farmers opted to sell their products to passing buyers instead of adhering to the cluster agreement. These various factors sometimes resulted in misunderstandings and/or a decline in trust between buyers and farmers.

Maintaining group solidarity proved to be another major challenge. Effective clustering required cohesion and collaboration within the group, and any disruptions in the group dynamic could impede the smooth progress of marketing initiatives. The ability to lead and manage people, including handling interpersonal conflicts and managing potential jealousy among members towards leaders, became a critical concern. Variations in cluster structures or a lack of quality and experienced staff could trigger concerns about money management and transparency.

After the completion of C4 and resultant loss of project-based support services, some clusters were functioning more as a social group than a business enterprise, which led to the possibility of financial losses. While the farmer cluster in Marilog (Davao City) was able to put aside collective funds in a bank, this later led to jealousies and intrigue among members.

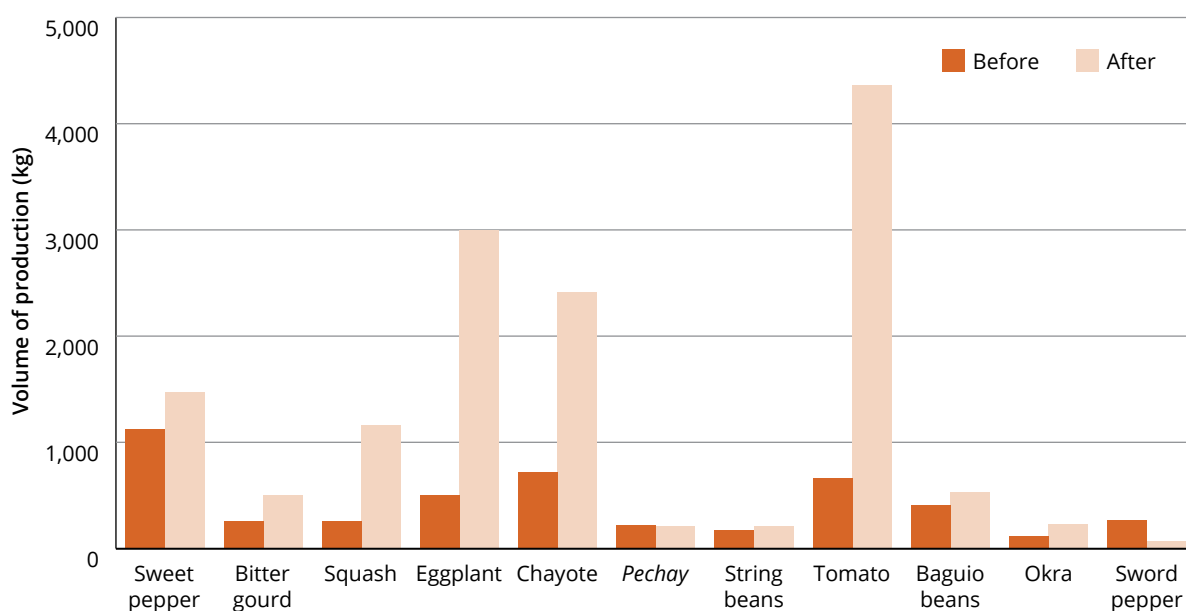


Figure 10 Volume of production before and after clustering, July 2009 – June 2012

Source: Batt and Concepcion 2013:58

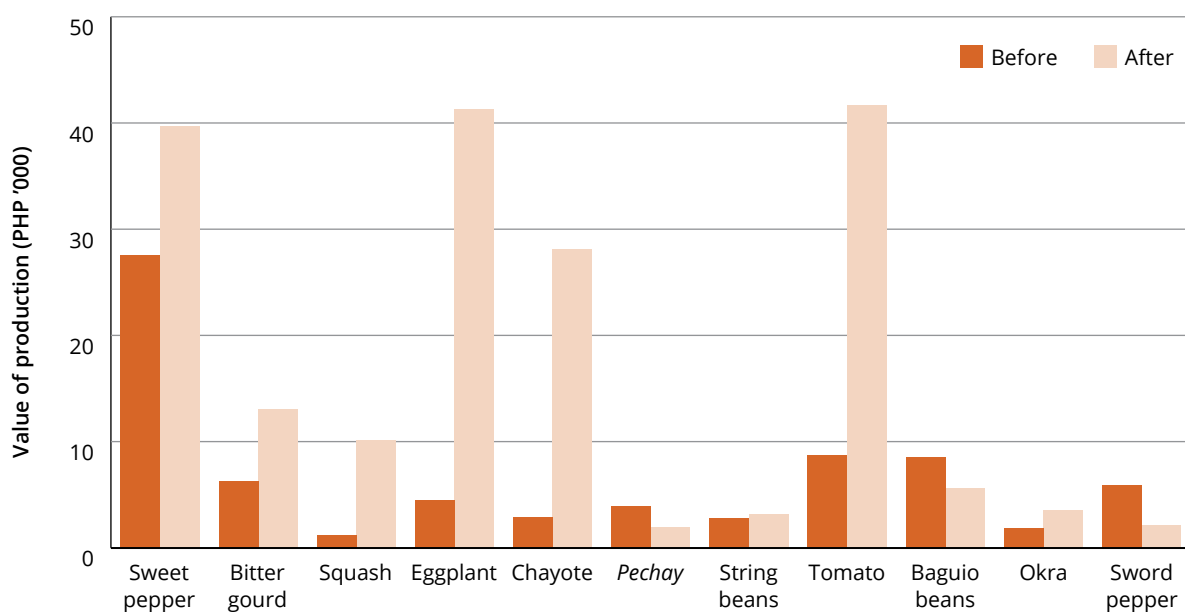


Figure 11 Value of vegetable production by cluster and non-cluster farms, July 2009 – June 2012
Source: Batt and Concepcion 2013:58

Table 15 C4 benefit-cost analysis

Indicator	No adoption		With adoption	
	Farm-level	Spillover	Farm-level	Spillover
Net present value (PHP million)	35.3	46.5	106.9	134.1
Internal rate of return (%)	48.6	77.8	81.5	144.3
Benefit:cost ratio	2.47	2.93	3.80	4.51

Source: Batt and Concepcion 2013:76

Quantifiable impacts

KEQ 5.2.2: Where possible and appropriate, what quantifiable impacts are identifiable?

C4 data

The C4 final report presented quantitative evidence on the benefits to farmers of cluster participation (Batt and Concepcion 2013). Production volumes were found to have increased after clustering for 9 of 11 commodities (Figure 10). Higher volumes, coupled with the significantly higher prices achievable through the clusters, resulted in cluster farmers having higher output value than non-cluster farmers for 6 commodities, of which tomato, eggplant and sweet pepper were the standouts (Figure 11). Overall, participating farmers were found to have increased

their income by an average of 47%, and the average household income of cluster farmers was 18% higher than non-cluster farmers.

The final C4 report also provided benefit-cost assessments for C4 under various adoption scenarios and assumptions about 'spillovers' to the broader community (for example, additional employment resulting from the increased production). Total investment into the C4 component was around AUD1 million (ACIAR AUD799,990, CUT AUD193,035, project partners AUD 31,522). With an assumed planning period of 20 years and a discount rate of 8% per annum, the internal rate of return was 48.6% and the benefit:cost ratio was 2.47 in the no-adoption, no-spillover scenario. These estimates became far stronger when a 5% technology adoption rate and/or spillovers were assumed (Table 15). However, these estimates were of course based on an assumption that cluster activity would be sustained over that 20-year period.

Table 16 Market outlets by crop and beneficiary type, Davao City, 2022

	Beneficiary						Non-beneficiary					
	Tomato (N = 15)		Squash (N = 12)		Bitter gourd (N = 9)		Tomato (N = 19)		Squash (N = 2)		Bitter gourd (N = 3)	
	n	%	n	%	n	%	n	%	n	%	n	%
Consolidator	8	53	6	50	5	56	6	32	1	50		
Wholesaler	7	47	5	42	4	44	7	37				
Trading post	2	13			1	11						
Retailer	1	7					5	26			3	100
Wholesaler-retailer			1	8			1	5				
Consolidator-retailer							2	11				
Consolidator-wholesaler									1	50		

Note: Multiple responses were possible.

Table 17 Production, marketing and net income for tomatoes and squash, Davao City, 2022

	Tomatoes		Squash	
	Direct beneficiary (N = 15)	Non- beneficiary (N = 19)	Direct beneficiary (N = 12)	Non- beneficiary (N = 2)
Area planted (100 m ²)	20	34	64	65
No. of cropping cycles per year	2	2	1	2
Yield/cropping cycle (kg/100 m ²)	46	44	28	39
Yield/year (kg/100 m ²)	70	88	39	58
Product sold (percentage of total production)	85	88	77	88
Price achieved for product sold (PHP/kg)	58.17	63.82	46.74	48.23
Net income (PHP/100 m ²)	2,027	3,091	1,046	1,571

Table 18 Household income by type of respondents, Davao City, 2022

	Beneficiary (N = 27)		Non-beneficiary (N = 30)	
	PHP	%	PHP	%
Farm income	92,482	48	158,000	44
Other income (incl non-farm/off-farm)	100,230	52	199,723	56
Total	192,712	100	357,723	100

2023 survey data

Given the sustainability challenges identified during evaluation fieldwork and the many other changes that have taken place in the project sites since the completion of C4, it is not possible to provide simple before-after or with-without comparisons. Nevertheless, the quantitative survey undertaken

in Marilog, Davao City, in September 2023 provided interesting insights on livelihoods, vegetable production and marketing for the 2022 cropping season for beneficiaries of C4 (i.e. those who participated in C4 clusters) compared to those with no project connection (non-beneficiaries). (See Appendix 10 for further tables.)

The vegetables most commonly grown in the district now are tomatoes, squash and bitter melon. It was found that beneficiary respondents most commonly sold their vegetable produce to consolidators, followed by wholesalers and trading posts (Table 16). The external consolidators are now evidently playing the role that was previously undertaken within the marketing clusters. Aggregation is critical for accessing institutional buyers who require greater volumes than most individual farmers would produce on their own.

Table 17 illustrates differences in production, marketing and net income from tomato and squash production between C4 beneficiaries and farmers with no project connection in Davao City during 2022. For both parameters, the non-beneficiaries reported better results when compared with the beneficiaries. For both vegetables, net income was higher for the non-beneficiary group than for the former project beneficiaries. These results are a stark contrast with the results reported at the end of C4 implementation.

Consistent with the crop-specific findings, the former project beneficiaries interviewed in Davao City have significantly lower income from both farm and other sources than the non-beneficiaries (Table 18).

The differences between the immediate post-project results and the present are likely related to the discontinuation of the cluster marketing approach among the previous farmer-beneficiaries of C4. Research participants observed that many cluster members were highly dependent on the market assistance provided through the ACIAR project. When the project ended, many of these cluster members changed their livelihood (for example, shifted to cacao production) or even went out of farming. Given that the cluster members had no established market outside of the connections provided by C4 and input assistance also ceased, the cluster members had difficulties in maintaining their farm activities. This was in contrast with the non-beneficiaries, who maintained existing market linkages and showed less dependence on external support mechanisms.

In addition, other institutional, social and economic factors would have contributed to the differences between the 2 sets of respondents. This is especially since it has been almost 2 decades since HORT/2007/066 was implemented. It should also be noted that the survey sample was not large, and the beneficiaries interviewed were those who could still be located in Davao City. Other beneficiaries may have had greater long-term success and moved away – as may also have been the case with former Bukidnon (Impasug-ong) cluster members, none of whom could be located at the project site.

Notwithstanding the caveats, it is evident from both qualitative and quantitative fieldwork that the boost to productivity, market access and incomes achieved during the project period has had little lasting impact on at least some of the smallholder farmers previously involved. On the other hand, some key elements of C4's clustering approach – such as production and marketing planning, product aggregation and advisory support – remain a feature of current LGU programs promoting formal farmer associations and cooperatives.

Sustainability of impacts

KEQ 5.2.3: Were those impacts enduring?

Continuity of research institutions and personnel

As outlined elsewhere in this report (particularly KEQ 2), there has been significant continuity of research engagement from the early 2000s through to the present. Research institutions at universities in both the Philippines and Australia are currently carrying out follow-on projects, and these initiatives continue to receive funding from ACIAR. Some personnel were able to secure research-based awards such as John Dillon Fellowships and postgraduate scholarships. On the Australian side, however, the involvement of CUT as C4 research lead ended with the conclusion of HORT/2007/066, and a new team from UQ took over the work on value chains (AGB/2012/109) including some engagement with clusters, as noted above.

Continuity of impact at farmer level

Cluster marketing initially led to better and wider market access, improved prices, reduced costs, improved human and social capital, and higher incomes. During C4, linking a smallholder farmers' group with a supermarket marked a significant step, but it was acknowledged that this connection alone did not conclude the narrative. The group needed to understand the competitive dynamics within the market, recognising challenges such as ensuring timely delivery. The C4 team recognised that the clustering process may not lead to sustainable cluster marketing without support, and may lead to dependency (Murray-Prior et al. 2011).

One of the key objectives of C4 and the follow-on projects was to empower clusters to be independent and engage with various buyers. Although there were reports of achieving this during project implementation, this objective has evidently not been sustained in the post-implementation phase.

Before the project, smallholder farmers had difficulty engaging in negotiations with institutional buyers, securing agreements and meeting volume requirements. During project implementation, access to institutional buyers was facilitated by the project team. Key informants and farmer groups interviewed for this evaluation noted that UPMIn in particular played a critical role in assisting and often negotiating on behalf of the farmers with NCCC and other institutional buyers. The farmers largely remained on the sidelines, generally providing input only when asked about the acceptability of the negotiated terms. This experience prompted a belief, which to some extent has persisted until now, that intervention from UPMIn was necessary to negotiate with institutional buyers on their behalf. This underscored the reliance on external assistance for negotiating with institutional buyers and navigating the complexities of market transactions, which brings into question the sustainability of many of the gains recorded during project implementation.

After the project concluded, most market clusters no longer received tailored assistance provided by external stakeholders and many market clusters discontinued their activities. The farmers no longer engaged in cluster meetings and their ability to connect and supply to institutional buyers diminished. Some farmers stopped planting vegetables altogether, deciding that they could make more money from planting other crops or engaging in off-farm activities, or by leasing their land to corporate agribusiness enterprises.

Some farmers interviewed for this evaluation expressed a desire to resume cluster-based activities in the hope of attracting renewed support. The absence of other groups providing assistance prompted a call for UPMIn's involvement once again to help revive the cluster and overcome obstacles hindering its continuity.

Since the conclusion of C4's support in the Greater Davao City area, there has been a significant decline in vegetable production among smallholder farmers, at least around Marilog, where some clusters were located. The exceptionally high prices of essential agricultural inputs, including labour, have placed a considerable strain on the financial viability of smallholder farming operations, leading to a notable reduction in overall production. The farming population is ageing as the younger generation opt for alternative off-farm opportunities, leading also to a scarcity of farm labour. Other factors include increasing challenges with pests and diseases, a reduction in land available for agriculture as a result of the expansion of urban development, and a shift away from vegetables to cultivation of other more lucrative crops such as ornamental plants and fruit trees, targeting the local tourist market.

In contrast, some farmers in the region of Cagayan de Oro in Northern Mindanao have managed to thrive, backed by substantial support from their city agriculture office. Their success was contingent on their alignment with the LGU's development plan. The Cagayan de Oro farmers demonstrated an ability to produce an extensive variety of vegetable offerings and achieve safety certification. The government played a pivotal role by providing them with retail space and supporting them with small vehicles for product transportation and sales to employees. The success was achieved through a combination of connecting with the right traders and leveraging government programs. The effectiveness of this approach relied heavily on establishing connections within the local community.

Unintended outcomes

KEQ 5.2.4: Have there been unintended outcomes?

At research level

During fieldwork, it was discovered that the previous agroenterprise coordinator for the C4 project transitioned into a government-certified trainer for farmers. Furthermore, he established his own cafe-farm, which also functions as a learning hub, especially for the farming community. The former staff member shared that the insights gained during his time with C4 played a significant role in the establishment of his cafe-farm.

At farmer level

No unforeseen consequences were identified at the farmer level.

Distributions of impacts

KEQ 5.2.5: How equitable was the distribution of impacts within targeted communities?

At research level

A comprehensive gender plan was not formulated for the overarching HORT/2007/066 project. It is noteworthy that, unintentionally, the Philippines-based researchers were predominantly women.

In follow-on projects, there was a gradual integration of a gender perspective. For instance, in the AGB/2012/109 project, although gender was not strongly emphasised during the design phase, it naturally found its place due to one of the Australian researchers having a background on gender and community development. This resulted in a notable emphasis on gender in the project, enhancing the project team's understanding of the roles, opportunities and constraints regarding women in the value chain.

In the HORT/2016/188 (GAP) project, there was a designated staff member with expertise in gender, and gender training was conducted as an integral part of the project.

At farmer level

The quantitative survey included an equal number of men and women as both beneficiaries and non-beneficiaries. This reflected relatively equal opportunities for men and women to enter the local agriculture industry, especially in reference to vegetable production.

At the farmer level, through training and exposure under the project, an appreciation of the respective roles and contributions of women and men in vegetable farming was highlighted. This is exhibited in shared decision-making at the organisation or cluster level, as in the case of Pamuhatan in Marilog. It was also articulated in the focus group discussions and key informant interviews that, within the household, decisions regarding management of the farm and household are also jointly discussed, although this may not be directly attributed to the project.

Evidence on activities and time use in vegetable farming revealed that tasks were shared by both men and women household members. However, the application of chemical inputs, and those requiring greater strength (for example, hauling) are mostly done by the men. Women worked side by side with their male partners/spouses on the farm. However, food preparation and other household chores are still mostly done by women. This includes care duties (for example, child rearing).

Also, beneficiaries of the cluster marketing project had improved financial literacy, particularly on the value of savings, and access to formal financial services. Farmers, notably women farmer-beneficiaries, opened savings accounts post-project where they deposited their farm income and savings and accessed small loans from rural banks to finance their vegetable farm or household projects. This may have been influenced to some degree by gaining more familiarity with the formal financial sector during the operations of the cluster, particularly for clusters that opened bank accounts.

KEQ 6: Lessons for ACIAR and PCAARRD

Improving future investments

KEQ 6.1: What can ACIAR and PCAARRD learn from the design and implementation of HORT/2007/066, decisions on appropriate follow-ups and the highlighted case studies, to improve future investments? What where the factors enabling and hindering impact?

This evaluation has provided a detailed assessment of ACIAR's HORT/2007/066 vegetable program in the southern Philippines and selected aspects of successor programs and projects. **The key lessons relate to the programmatic approach itself, factors affecting on-farm impact, the importance of people and partnerships, and the duration and sustainability of effort.**

Many of the findings from this evaluation are common to other programmatic reviews. For example, the synthesis findings on ACIAR's Transformative Agriculture and Enterprise Development Program in Papua New Guinea and the Agriculture Sector Linkages Program in Pakistan underscored the importance of a program-level theory of change, diverse perspectives, knowledge-sharing and strategic relationships to influence policy (Davis and Hanley 2023). Monitoring and evaluation frameworks focused on outcomes were recommended, and communication strategies were deemed essential for program visibility and recognition. Each of these elements resonates in the context of the southern Philippines vegetable programs.

Multidisciplinary, programmatic approaches

A long-term, multidisciplinary systems approach is necessary, but not sufficient, for maximising impacts. Issues affecting vegetable production in the southern Philippines are complex and multifaceted, and often not amenable to a simple technical 'fix'. While pure scientific research is often on the basis of 'all else remaining equal', applied research leading to farm-level impact cannot simply ignore confounding influences. Experience in HORT/2007/066 reinforced that a value-chain project needs to be built on sound technical production fundamentals, while a production project will have limited impact if no account is taken of the market opportunities and farmers' ability to meet

requirements. Enabling policies are also critical. ACIAR's determination to bring in diverse perspectives and avoid 'silo' mentality through a coherent multidisciplinary approach was appropriate and laudable. However, the good intentions were not matched by the design and implementation of HORT/2007/066.

A programmatic design is more likely to succeed if it is intentional from the start, rather than being superimposed later. HORT/2007/066 was based largely on existing project proposals. This was not ideal and led to both confusion and resentment among some participants that affected efforts to build programmatic collaboration during implementation. The economics and policy component (C5) was especially affected by being a later add-on, lacking full support from other component teams.

A programmatic design needs a clear structure and hierarchy of objectives – ideally, a program-level theory of change developed during design consultations. Contributing to the overarching theory of change helps build ownership and understanding of the full extent of the challenges being addressed, how the various activities fit in to the bigger picture and where the complementarities are. Despite the extensive preparatory work underpinning design of HORT/2007/066, it was difficult for ACIAR to build a shared vision among key stakeholders. The final review of the program found:

There is a need to promote a conscious effort from all participants to contribute to a common objective. There is therefore a need to provide a unifying theme so that project components do not appear as stand-alone projects.

A program-level theory of change would provide a strong foundation for monitoring, reporting and evaluation of program outcomes, reinforcing both the contributions of each component and the critical synergies between them. It is notable that throughout HORT/2007/066, reporting was on a component basis and was only pulled together through the C6 report, usually in the form of pasted executive summaries and descriptions of coordination activities. This reinforces the perception that the component was the primary unit and the program was an afterthought.

Dedicated resourcing for program management and coordination (including sharing and learning across the program) is essential for realising the potential benefits of a programmatic approach. Having an overall program coordinator representing ACIAR 'on the ground' in the southern Philippines was critical, given the complexity of the program, particularly in light of the lack of established relationships at program commencement. ACIAR's in-house RPMs and commissioned organisations could only operate on a fly-in-fly-out basis, which would have made day-to-day management and partnership building very challenging. Resources and incentives for program collaboration also need to be factored in at component level. Understandably, the priority for most researchers was to meet the agreed performance indicators for their own component rather than spending time helping other components. Program managers need to ensure component leads are playing their part to support and advocate for the program within their research teams.

ACIAR systems need to support programmatic approaches. At the time of HORT/2007/066, ACIAR's management and reporting systems were geared towards projects rather than programs. This was one factor taken into account during design of the follow-on vegetable activities, with the decision to revert to a project modality within the overall 2013–2018 'program'.

Managing for impact

Adaptive management mechanisms provide the flexibility to adapt to changing circumstances, be innovative, and adopt new approaches in response to challenges and emerging or unexpected opportunities. Having a program 'under-designed' (i.e. not locking in all the details) and retaining a degree of budget flexibility allows managers to be creative, 'fund the serendipity' (as one former RPM put it) and pursue outcomes that may prove transformative.

Research-for-development principles and practices need to be well understood by program partners. While research for development has always been ACIAR's mandate, the balance between pure and applied science – or between developing in-country research capacity and having an impact on-farm through dissemination and adoption – was somewhat variable across the HORT/2007/066 components. Some researchers viewed success primarily in terms of publications and academic recognition; others had an eye to farmer impacts and advocated for farmer-centred approaches, but were frustrated by limited opportunities. Some researchers in the Philippines expressed concerns about farmers simply being 'objects of research'. 'We should not use farmers' lives for the improvement of our publications,' said one. A program theory of change would help clarify the extent to which research is an end in itself or a means to longer-term impacts.

Research findings of direct relevance to farmers and with demonstrated major benefits are more likely to be adopted. Dissemination activities that directly involve farmers and enable them to see and experience the results of new technologies and approaches are most likely to have an impact on their future practices. However, widespread adoption of technologies does not automatically follow from successful research trials and collaboration with selected 'lead farmers'. New technologies and approaches also need to be shown to be cost-effective and affordable for more resource-constrained and risk averse smallholders. To translate research results into influence, behaviour change and impact, programs need well-developed communication strategies targeting key groups, including extension services, training providers, local R&D centres and farmers themselves.

An explicit GESI strategy and incorporation of a GESI lens is essential to ensure a more inclusive, equitable and impactful approach. The participation of various genders and social groups should be systematically measured and documented throughout. This is crucial for accurately assessing and analysing the extent of engagement by women, men and vulnerable groups, and understanding their contributions and needs. An adaptive approach to monitoring and evaluation that consistently assesses the effectiveness of GESI is crucial too. Project leaders should be ready to make strategic adjustments in response to emerging challenges and opportunities. This adaptive stance enhances the project's ability to evolve and optimise its GESI strategies over time, ultimately contributing to more effective and impactful GESI outcomes.

Climate change and extreme weather events can be severely disruptive, but also instructive and catalytic. For example, there was little attention to water supply during trials of protected cropping under HORT/2007/066 (C2), but low-cost drip irrigation is

now recognised as essential to success. The structures have also proved helpful for summer cropping with the addition of temporary shading to counteract increasing heat intensity. Typhoon Haiyan in 2013 flattened many of the protective structures provided under C2 and the follow-up ICM project, leading to the entry of additional players such as IsraAid, which became a key partner. Design modifications since then have enabled management practices that reduce susceptibility to high winds, such as quick removal of the plastic sheeting.

Other local contextual factors need to be understood and factored in where possible. Limitations on availability of critical inputs can reduce farmers' ability to adopt improved practices. For example, NOMIARC was unable to meet demand for disease-free potato planting material, leading some Bukidnon farmers to abandon potato production. This experience reinforces the importance of taking a systems-wide view and working across multiple partners, including potential private sector providers.

People and partnerships

Capacity development will always be an important part of ACIAR's research programs. This should be an ongoing process, able to evolve and respond to areas of identified need and comparative advantage in both Australia and the partner country. To some extent, the stronger local capacity developed through initial programs should reduce the need for subsequent external expertise. However, with the passage of time, new cohorts of researchers, technical advisers, farmers and others will continue to benefit from capacity development. Experience in the Philippines has demonstrated the value of a mix of project-specific training and formal academic scholarships and awards, such as John Allwright Fellowships and John Dillon Fellowships.

Leadership and project management skills need attention in their own right. Strong technical knowledge and skills do not necessarily make a researcher effective as a project (or program) manager, and tricky individual or institutional relationships can disrupt progress. ACIAR recognised this during the later stages of HORT/2007/066 and began adding leadership training modules to program events.

A genuine partnership needs to be actively cultivated and managed. ACIAR's relationship with PCAARRD was not well enough established at the beginning and there was insufficient clarity on some aspects of roles and responsibilities. Despite PCAARRD having research capability of its own in horticulture, they had little direct involvement but 'needed and wanted to know what was going on'.³⁸ Frictions emerged,

especially around monitoring and evaluation, with PCAARRD wanting to add its own processes to those already required by ACIAR. However, these early difficulties proved to be the catalyst for a much more deliberate brokering of the ACIAR-PCAARRD partnership, which was transformed within a few years and is now described as 'exemplary'. The experience provided important lessons on both sides. ACIAR came to appreciate PCAARRD's value-add in 'opening doors', increasing the program's status and influence, and communicating with policymakers. It also demonstrated that aligning with partner country interests and priorities is necessary, but not sufficient to ensuring smooth counterpart relationships. A lesson for PCAARRD was that the best way to support effective implementation is through a facilitator role rather than as a micro-manager (see KEQ 6.2 for greater detail).

Cross-country research relationships also take time and effort. ACIAR was relatively new to the southern Philippines and many untested collaborators were brought in to HORT/2007/066. Through the program, ACIAR provided opportunities and resources and built institutional linkages, particularly with VSU, UPMIn and UPLB. Over time, some strong working relationships were developed across the Australian and Filipino research teams, enhanced by study visits in both directions. The relationships that worked best were built on mutual respect and learning from each other (i.e. not a one-way flow of skills and capacity), reinforcing that soft skills and cultural awareness are an essential complement to technical expertise. Follow-on projects were able to build on program memory and knowledge across established institutional networks, and relationships with dedicated and productive researchers in-country.

Sustainability and longevity

Close engagement with third parties is critical to spreading program impacts and strengthening post-program sustainability. For HORT/2007/066, key local partners included LGUs, DA, producer groups, private-sector operators and providers of other similar or complementary programs. LGUs proved especially valuable for supporting dissemination and adoption of research findings beyond the program's immediate beneficiaries, as they managed extension services and had budgets that could support agriculture either directly, or indirectly through local infrastructure. The DA's ATI is an important conduit for practical research recommendations to reach extension workers and then be disseminated more widely to farmers. East-West Seed was well positioned to incorporate relevant results from ACIAR research into well-regarded training programs for farmers. Value-chain work requires identifying and facilitating collaborative relationships

38 ACIAR informant.

with key private-sector operators and industry groups that support farmers' linkages with a variety of markets. C4's work to establish marketing clusters highlighted the need for exit strategies to build self-reliance and sustainability, and enable limited program resources to have maximum impact.

Knowledge management is critical if research findings are to have maximum impact. HORT/2007/066 established a Web2 sharing site, but unfortunately this is no longer accessible. As programs and projects wrap up, ACIAR should ensure that key materials (beyond the standard reports and reviews) are transferred to the ACIAR server or similar central repository, to ensure they are accessible beyond the life of a program. Public communications material such as technical guidelines and training manuals should also be provided to the in-country partner agency (in this case, PCAARRD).

Policy settings will always be an important enabler or hindrance to impact. ACIAR programs respond to partner government priorities but can also provide a valuable evidence base and advocacy to inform policymaking. Despite mixed views among program participants on the usefulness of C5's policy-focused research, some activities such as SEARCA's transport study appear to have been widely used and valued.

Successive governments' prioritisation of organic agriculture has provided both opportunities and challenges for ACIAR's work on ICM and good agricultural practices (GAP). At local level, LGUs are critical partners but their priorities vary over place and time depending on local politics and budgets, so relationships and advocacy need ongoing effort.

Long-term engagement in a sector and region brings many benefits. ACIAR's ability to build on successive interventions in a long-standing program of support has been a key strength of its work in the southern Philippines vegetable sector. Gaps and shortcomings that emerged during the initial 2007 program – such as inadequate links between production and marketing activities and the need for more focus on pests, diseases and water management – have been taken into account in designing subsequent projects. What started 'on a wing and a prayer' has evolved over the years into strong, productive and enduring research partnerships. ACIAR now has a solid reputation as a reliable, respected and very valuable partner, both among the research institutions involved and at national government level. This has increased the opportunities for policy and programmatic influence.

Stakeholder perceptions of ACIAR and PCAARRD

KEQ 6.2: How did HORT/2007/066 affect stakeholder perceptions of ACIAR and PCAARRD?

There was a strong sense from a range of stakeholders interviewed that perceptions of both ACIAR and PCAARRD improved as a result of experiences during HORT/2007/066 (and beyond).

PCAARRD

The relationship between ACIAR and PCAARRD was not ideal in the preparatory and early implementation stages of HORT/2007/066, and this affected perceptions among program managers and researchers. PCAARRD's role and mandate within the Philippines government may not have been well understood by the ACIAR teams undertaking scoping and design. PCAARRD was quite centralised in Luzon but was expecting to be directly involved in program scoping. This was apparently not recognised by ACIAR, and PCAARRD was taken aback on finding scoping was underway without them. The question of how the program might support PCAARRD in achieving its own mandate was not addressed during program preparation. There were very few mentions of

PCAARRD in the program proposals (none at all for C1, C4 or C5), and no roles or responsibilities were assigned in program documentation in relation to program delivery and oversight.³⁹

In accordance with established in-country practice, in the early period of program implementation ACIAR transferred program funds to PCAARRD for disbursement to partners. PCAARRD applied a 15% management fee and sought to apply its standard governance, management and reporting arrangements on the program and do its own monitoring and evaluation. These processes added complexity and administrative burden for the implementing teams and were regarded (particularly by the Australians) as unhelpful top-down micro-management. Delays in fund

³⁹ This was partly corrected later in implementation.

disbursement further compounded implementation challenges. In response, ACIAR decided to instead disburse in-country allocations directly to trust funds for the lead universities – a move reportedly resented by PCAARRD.

These early difficulties led to dedicated partnership-building efforts between ACIAR and PCAARRD. As arrangements matured, a more supportive facilitatory relationship ensued, with strong mutual respect and collaboration. The Australian researchers involved in the program came to accept that PCAARRD was ‘the’ important partner and had much to offer. A former RPM explained:

The advantage was that PCAARRD knew everyone. They could open doors, had good leverage, had good status in the private sector and among NGOs... They also had the technology – a huge plus.

Local researchers were already well attuned to PCAARRD’s important role as the local counterpart:

PCAARRD would ask how you’re being treated, and are you being acknowledged. They were protecting the country’s intellectual property. And PCAARRD was standing up for us too.

As PCAARRD’s own resourcing increased, it gradually took on a greater share of co-funding – a strong demonstration of commitment.

PCAARRD’s own capabilities have developed greatly over the period, contributing to its status in both government and agricultural research circles. PCAARRD attributes ACIAR’s 2007 program as being a stepping stone for it to begin undertaking its own impact assessments in 2008. PCAARRD has drawn on guidelines provided by ACIAR to develop its impact evaluation practices.

ACIAR

The significant size of HORT/2007/066 and ongoing engagement of ACIAR in the southern Philippines vegetable sector have contributed to ACIAR’s current reputation as a reliable, respected and very valuable partner, both among the research institutions involved and at national government level.

PCAARRD staff described their collaboration with ACIAR as one of their biggest, not just on R&D but also in relation to capacity building. Importantly, whereas some other development partners support DOST centrally, ‘ACIAR is direct to PCAARRD’.

A widely held view among key stakeholders, well-expressed by one Australian lead, was that ‘the ACIAR relationship with PCAARRD and the Philippines was enormously strengthened’ as a result of HORT/2007/066. Dedicated attention to the ACIAR–PCAARRD partnership contributed to strong advocacy from PCAARRD leadership, with

PCAARRD’s director becoming ‘a great patron of ACIAR’. PCAARRD’s linkages to politicians and policymakers provided valuable opportunities for the program and contributed to a very positive profile for ACIAR with the Philippines Government.

In-country partners were universally favourable about their experience with ACIAR, which in many cases has been ongoing for several years through successive programs and projects. This long engagement has built strong familiarity with ACIAR among the academic and government agricultural research community. The partnerships with VSU, UPMIn and UPLB ensured a strong profile among staff and students in those institutions. The projects provided opportunities for staff and students, enabling many young researchers to begin their careers in funded positions. Similarly, an informant from a DA regional office said that ‘ACIAR made a lot of difference’.

While awareness at farmer level was sometimes attuned more to the local partner organisation or individual researchers rather than the source of funding, the ACIAR ‘brand’ was also quite well known. A UPMIn researcher commented that ‘the farmers we worked with are definitely aware of ACIAR’ – or, at least, of key individuals. This was confirmed by a market cluster leader involved in C4 and a follow-on project, who described the experience as ‘fun’ and had fond memories of several of the individual researchers from UPMIn and Australia. ‘They dealt with us very well,’ he said. One of the Leyte farmer-collaborators said that he was ‘very proud to be part of ACIAR at that time’.



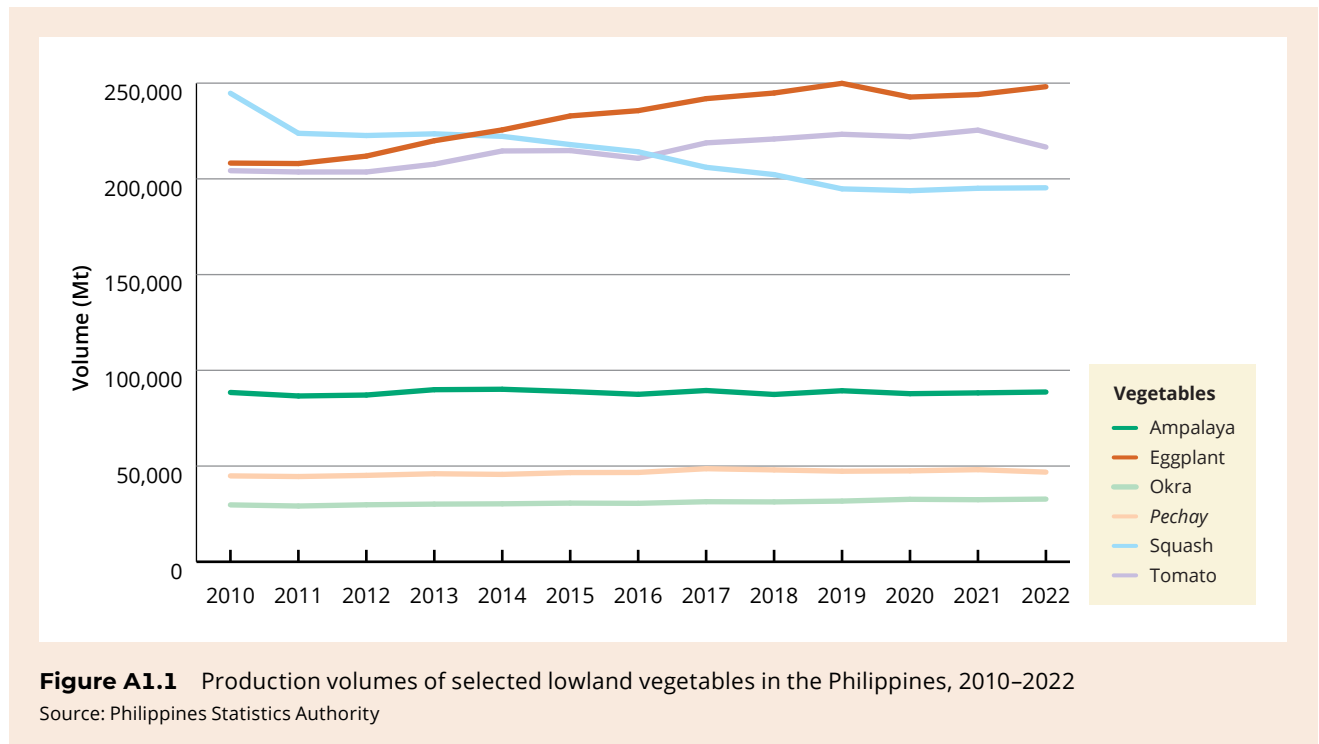
Follow-on projects from the initial research looked at opportunities and benefits for growers to form marketing clusters

Appendices

Appendix 1: Vegetable production statistics

The Philippines ranked second in South-East Asia, after Vietnam, in terms of land area planted to vegetables in 2019 (Bureau of Agricultural Research 2022). However, it is one the lowest in terms of yield. Since 2010, some of the common lowland vegetables, such as okra, eggplant, *pechay* and tomato, showed increased production volumes.⁴⁰ Except for tomato, the production volumes for these vegetables came with generally modest expansion in area planted (see Figures A1.1 and A1.2).

Some of the major upland vegetables that have increased in production volume are bell pepper, broccoli, cucumber and lettuce. Among these, production volume of bell pepper increased by about 34% despite a 5% decline in area planted (see Figures A1.3 and A1.4).



40 Unfortunately, the data available from the Philippines Statistics Authority only go back to 2010.

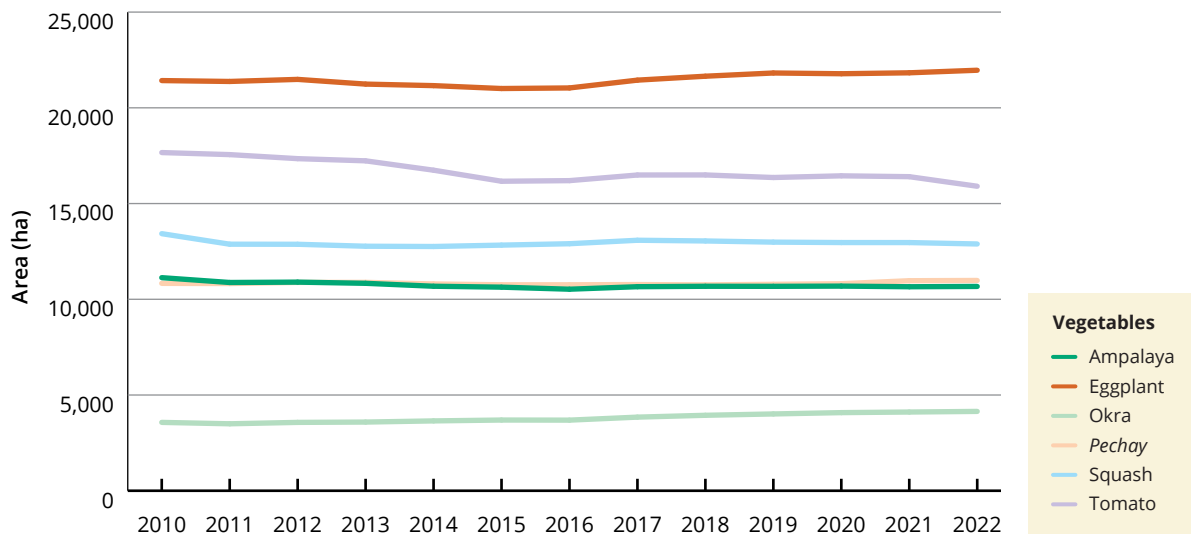


Figure A1.2 Area planted/harvested to selected lowland vegetables, Philippines, 2010–2023
Source: Philippines Statistics Authority

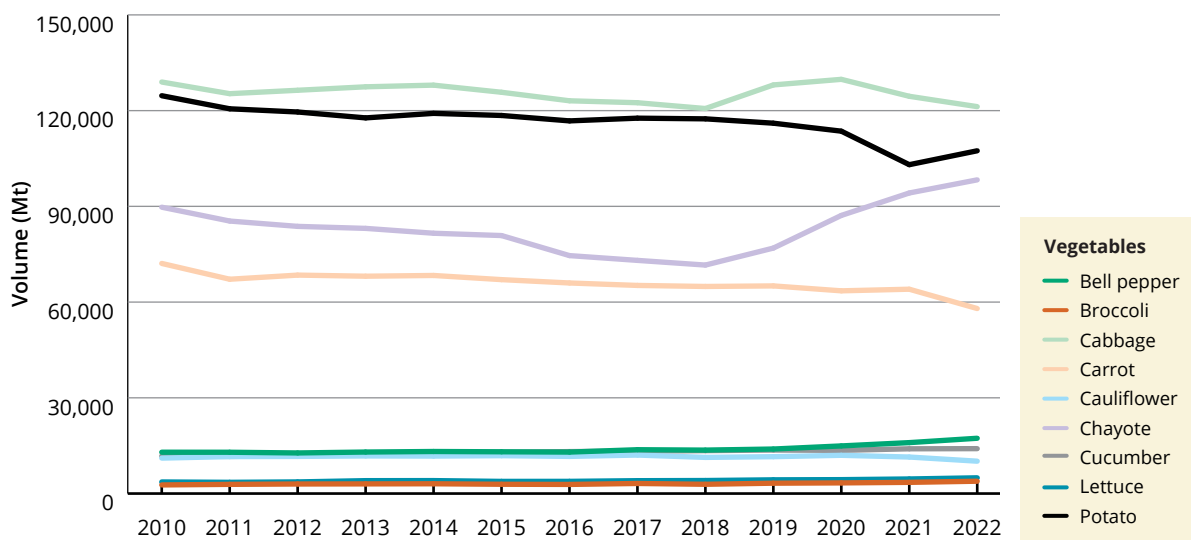


Figure A1.3 Production of selected upland vegetables, Philippines, 2010–2022
Source: Philippines Statistics Authority

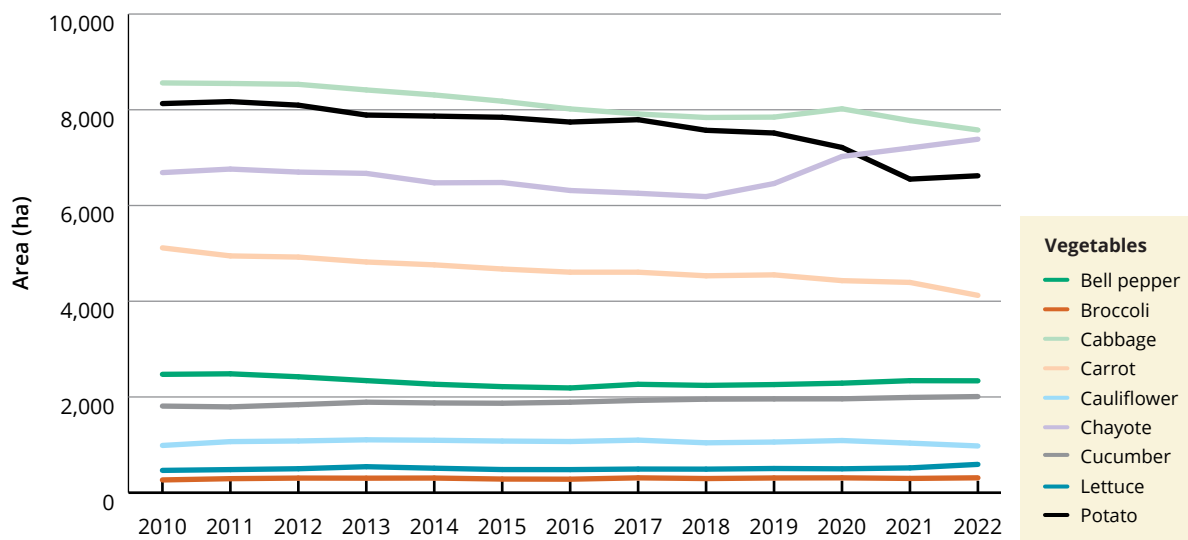


Figure A1.4 Area planted/harvested to selected upland vegetables, Philippines, 2010–2023
 Source: Philippines Statistics Authority

Appendix 2: Gathering evidence

Scoping

A joint ACIAR/Alinea scoping mission to the Philippines took place in March 2023.⁴¹ The team travelled to Leyte and Mindanao islands and the city of Los Baños (near Manila) to meet with researchers who had significant roles in HORT/2007/066 and related projects. At VSU in Leyte, UPMIn and UPLB, the team had courtesy calls with chancellor, presidents or their representatives, and roundtables with the in-country leads and/or other senior researchers for each of the 5 main components. There was also a visit to the VSU research farm where many of the Leyte research trials for C1 (soil and nutrient management) and C2 (protected cropping) had been undertaken. The team also met with the executive director and other staff of PCAARRD in Los Baños, which was involved in C6 (program management and integration).

The scoping meetings provided valuable background on ACIAR's horticulture initiatives in the southern Philippines and helped set the parameters for the evaluation. There was support for the proposed mixed-methods approach, tempered by some concerns that the length of time since the 2007–2012 program could make it difficult to tease out impacts and account for other contextual changes, such as new technologies or government policies and programs. It also became evident that clear boundaries needed to be set around the scope of the evaluation, particularly in relation to which aspects of subsequent projects should be included. Protected cropping and collaborative marketing groups (clusters) were highlighted as project activities that generated follow-on work and were of particular interest for in-depth assessment.

These insights guided development of the approach and KEQs for this study.

Document review

The evaluation itself began in June 2023 with detailed review of project documents. ACIAR provided access to proposals, annual reports, final reports and reviews from HORT/2007/066 and other relevant precursors and follow-on projects, and reports from some other related activities were sourced online. Former ACIAR and program staff also shared material from their own collections.

An early activity involved desk-based collation and assessment of publications from HORT/2007/066, based on project reporting. These lists were checked and updated during subsequent online and in-country

consultations. There is no single comprehensive database for publication citations, so multiple sources were used, including ResearchGate, Scopus and Google Scholar. Discrepancies between the databases are noted in the resulting summary tables. Information was also gathered on the h-index of the lead authors of project publications. The h-index measures both the productivity (number of cited papers) and the impact (number of citations) of individual researchers. Scopus was the primary data source for the h-index, supplemented by Google Scholar where necessary.

Online consultations

A total of 17 key informant interviews were carried out virtually with people now based in Australia. Nine were with former or current ACIAR staff or direct contractors responsible for Philippines vegetable projects (or program components) and the remaining 8 were with program staff and research leads and collaborators from Australian partner organisations. Most were involved with HORT/2007/066 and, in some cases, continued on into subsequent projects. Two informants were involved only in the follow-on value-chain (AGB/2012/109) and GAP (HORT/2016/188) projects. A full list is provided at the end of this appendix.

Question topics for the online key informant interviews mapped to the KEQs and were tailored appropriately to each interviewee.

In-country fieldwork (qualitative: Alinea–UPLB)

The Alinea team carried out a 3-week fieldwork visit to the Philippines in July–August 2023 and were supported and joined in-country by a research team from the Center for Strategic Planning and Policy Studies of the College of Public Affairs and Development of UPLB. The visit began and ended in Los Baños for whole-team discussions and meetings with PCAARRD. For the intensive consultations in Mindanao and Leyte, an experienced researcher from a local university (UPMin, Central Mindanao University and VSU respectively) organised and facilitated the program in each location.

Key in-country informants for the program-wide assessments (KEQ 1–4 and KEQ 6) included component leads and other researchers involved in HORT/2007/066, the farmer-collaborators engaged in on-farm activities under the various components, and selected others, such as local authorities and agricultural extension workers. For the more detailed

41 Scoping team members were Bethany Davies and Matt Armstrong (ACIAR Canberra), Hazel Aniceto and Mara Faylon (ACIAR Manila) and Julie Delforce (Alinea International, Canberra).



case studies, additional researchers who worked on follow-up projects were interviewed, along with direct farmer or farmer group (cluster) collaborators and members of their families and communities. Supplementary information was obtained from others who are active in the vegetable sector, such as industry groups and vegetable traders.

Site visits in Mindanao began in the Greater Davao City area (including with UPMIn and cluster marketing groups), followed by road travel to vegetable-growing centres in the north (Bukidnon Province) and the market centre of Cagayan de Oro City (Figure A2.1). Marketing clusters were a significant focus of investigations in Mindanao, noting that C4 of HORT/2007/066 (value chains) and part of its follow-on project AGB/2012/109 were carried out there.

The primary objective of the fieldwork was to gather qualitative information relevant to the KEQs, thereby gaining in-depth understanding of the local context and the interests and perspectives of various stakeholder groups. Key informant interviews were conducted individually with expert informants to elicit specialised insights. Focus group discussions were administered among selected farmer groups to gather broader insights, such as changes in their lives and agricultural activities over the past 10 to 15 years. Where warranted, the team conducted follow-up interviews with selected participants from the focus group discussion groups. The team also conducted on-site visits to wet markets, supermarkets and farms.

In Leyte (Figure A2.2), consultations took place at VSU and around Baybay, Bato and Ormoc cities. The team also visited a farmer-collaborator in Sogod, Southern Leyte. An important aspect of the research in Leyte was examination of protected cropping, noting that C2 of HORT/2007/066 (protected cropping) and the subsequent ICM project (HORT/2012/020) had a major focus in that region. The team was able to visit several farms to observe the development and utilisation of protected cropping structures.

A total of 101 stakeholders were interviewed individually during the qualitative phase of fieldwork (Table A2.1). These are listed in full in Table A2.2 at the end of this appendix, along with those who participated in focus group discussions.

Table A2.1 Summary of stakeholders consulted through key informant interviews in Mindanao and Leyte

Location	Categories	Number		Relevance to ACIAR project(s)
		M	F	
Mindanao				
Davao City	<ul style="list-style-type: none"> • Project researchers • LGU and other government representatives • Extension workers/agriculture technicians • Farmers' associations • Market actors 	7	8	<ul style="list-style-type: none"> • HORT/2007/066 C3-5 • AGB/2012/109
Marilog	<ul style="list-style-type: none"> • Farmers (farmer group members and non-farmer group members) 	6	11	<ul style="list-style-type: none"> • HORT/2007/066 C4 • AGB/2012/109
Impasugong	<ul style="list-style-type: none"> • NMACLRC (DA) • Former project staff • LGU representatives • Extension workers/agriculture technicians • Farmers' associations • Market actors 	6	4	<ul style="list-style-type: none"> • HORT/2007/066 • Follow-on projects
Lantapan	<ul style="list-style-type: none"> • Government representatives • Extension workers/agriculture technicians • Farmers • Market actors 	5	5	<ul style="list-style-type: none"> • HORT/2007/066 • Follow-on projects
Cagayan de Oro	<ul style="list-style-type: none"> • Government representatives • Farmers' association • Market actors 	2	3	<ul style="list-style-type: none"> • HORT/2007/066 C4
Total Mindanao		26	31	
Visayas (Leyte and Southern Leyte)				
Baybay, Bato and Sogod	<ul style="list-style-type: none"> • Project researchers • LGU representatives • Farmers* 	14	7	<ul style="list-style-type: none"> • HORT/2007/066 C2-5 • AGB/2012/109 • HORT/2012/020 • HORT/2016-188
Ormoc and Cabintan	<ul style="list-style-type: none"> • Farmers (farmer-collaborators and non-collaborators) • LGU representatives • Private sector representatives 	10	13	<ul style="list-style-type: none"> • HORT/2007/066 C2-5 • HORT/2016/188
Total Visayas		24	20	
Total KII consultations for 1=qualitative assessment		50	51	

LGU – local government unit

* VSU research leads for C1 and C2 were unavailable during the visit but were followed up separately afterwards.

Interview and discussion guides

Given the diversity of intended in-country consultations, several variants of key informant interviews and focus group discussion guides were prepared in advance of in-country travel. These included interviewing guides for project researchers, government staff (including local government officers and extension workers ('agricultural technicians'), other market actors such as private traders, 'farmer-collaborators', and other farmers not directly engaged in the ACIAR programs.

Similarly, slightly different focus group discussion guides were prepared for groups directly involved (such as marketing clusters) and others who may have benefited indirectly but were not a direct part of the project.

In addition, some of the guides were further modified to maximise their relevance for each of the 2 case studies. A selection of these qualitative instruments was provided to ACIAR in a fieldwork completion report (August 2023). The explicit intention was for these to *guide* consultations and provide a checklist of topics that could usefully be probed depending on the individual's or group's specific experiences, rather than being used as formal survey-style questionnaires.

Quantitative surveys (UPLB with UPMIn and VSU)

UPLB evaluation team members led follow-up quantitative data collection in conjunction with field teams based at VSU and UPMIn.⁴² Surveys were conducted for beneficiaries and non-beneficiaries of HORT/2007/066 in Leyte (Visayas) and Davao City (Mindanao).

Interviews with vegetable farmers in Leyte were mostly in Baybay City, with a few from Ormoc City. Baybay is VSU's base and it is where many vegetable farmers have benefited from support of both VSU and the LGU for agronomic innovations like protected cropping. The neighbouring locality of Ormoc City was also identified as a site for the survey as it was a location for project activities and some original C2 collaborators are operating there. Three sets of respondent groups were targeted for sampling:

- direct beneficiaries or former collaborators of the project
- indirect beneficiaries or farmers who have been exposed to the protected cropping technology through follow-on activities led by the local government
- non-beneficiaries or those who were not exposed to the protected cropping technology.

With a low number of project collaborators in the first place, and movements of the farmers through the years, only 2 direct beneficiaries were found in Ormoc, significantly lowering the sample size from the initial plan. Later, the direct beneficiaries were merged with indirect beneficiaries for meaningful comparison of outcomes at the farmer level. The survey consisted of 35 beneficiaries (including 2 former C2 collaborators) and 29 non-beneficiary vegetable farmers.

In Davao City, farmer interviews were conducted in District 3 around Marilog, where C4 was active. Respondents were divided into 2 groups:

- 27 former collaborators (beneficiaries) in cluster=marketing
- 30 non-collaborator vegetable growers (non-beneficiaries).

Sites in the province of Bukidnon were not included in the surveys for C4 as the earlier field visit confirmed that movement of former collaborators over the years would make it difficult to track them for interviews.

Ethical considerations

The evaluation was planned and conducted in accordance with the *DFAT Monitoring and Evaluation Standards* (2017) and (as relevant) Alinea International's Child Protection Policies. This included giving appropriate consideration to:

- **Informed consent:** All participants in consultations were provided with a written and/or oral overview of why they were being consulted, how the information would be used and the voluntary nature of their participation. Consultations were only undertaken once written and/or oral consent had been obtained.
- **Privacy and confidentiality:** The identity of program stakeholders and beneficiaries involved in the evaluation has been protected. Key informants in professional roles are 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.

⁴² The VSU and UPMIn lead researchers had also supported the qualitative fieldwork.

Consultation lists

Table A2.2 Consultation lists

Name	Type	M/F	Organisation/role	Role in ACIAR project
ACIAR				
Les Baxter	KII	M	RPM HORT	C2, C3 and C6, and C5 jointly with Caroline Lemerle
Peter Horne	KII	M	RPM/lead	Oversight
Caroline Lemerle	KII	F	RPM ASEM	C4, and C5 jointly with Les Baxter
Gamini Keerthisinghe	KII	M	RPM SMCN	C1
Rodd Dyer	KII	M	RPM AGB	AGB/2012/109
Irene Kernot	KII	F	QDAFF and fruit program manager (C6) for HORT/2007/067 2010–2012, now ACIAR RPM HORT	Led QDAFF involvement in ACIAR horticulture projects, currently oversees HORT/2016/188,
Mara Faylon	Informal (scoping)	F	Assistant manager, Philippines (Manila office)	Manila oversight, assisted Philippines Horticulture Manager
John Oakeshott	KII	M	Philippine Horticulture Manager	In-country manager (based in Davao) 2008–2017
David Hall	KII	M	NSW DPI, now contracted by ACIAR from 2010	C6 lead, also oversaw C5 in later stages
Australia-based researchers				
Gordon Rogers	KII	M	AHR	C2 lead, HORT/2012/020 lead, current HORT/2016/188 lead
Anthony Young	KII	KII	QDAFF	C3 lead 2008–2010
Nandita Pathania	KII	F	QDAFF	C3 later lead, then HORT/2012/020
Michael Hughes	KII	M	QDAFF	C3 researcher
Peter Batt	KII	M	CUT	C4 lead
Randall Jones	KII	M	NSW DPI	C5 lead (part)
Oleg Nicetic	KII	M	UQ	AGB/2012/109 lead
Gomathy Pataniappan	KII	F	UQ	AGB/2012/109 lead

Name	Type	M/F	Organisation/role	Role in ACIAR project
Luzon: DOST-PCAARRD, Los Baños				
Reynaldo Eborá	Roundtable	M	Executive director	
Leilani Pelegrina	Roundtable	F	Director, CRD	
Ma Cecilia Alaban	Roundtable	F	Science research specialist, CRD	
Ernesto Brown	Roundtable	M	Director, SERD	
Princess Ani	Roundtable	F	Supervising science research specialist, SERD	
Genny Bandoles	Roundtable	F	Senior science research specialist, SERD	
Polianna Tiamson	Roundtable	F	Senior science research specialist, SERD	
Janine Curibot	Roundtable	F	SERD	
Joel Norman Panganiban	Roundtable		Manager, CRD	
Ian Ines	Roundtable	M	Research and development unit	
Alex Tami	Roundtable	M	Policy	
Visayas (Leyte/Southern Leyte) consultations				
Research leads and research staff				
Maria Juliet Ceniza	Scoping – courtesy call	F	VSU	OIC, Office of the President
Zenaida Gonzaga	KII	F	VSU	In-country project lead (C2) and ICM, HORT/2016/188 in-country lead
Anabella Tulin	FGD	F	VSU	In-country project lead (C1)
Ma. Salome Bulayog	KII	F	College of Management and Economics, VSU	C5 researcher
Antonio P Abamo	KII	M	College of Management and Economics, VSU	AGB/2012/109 project lead for Leyte
Lucia Borines	Scoping and email	f	VSU	C2 researcher
Dhenber C Lusanta	KII	M	VSU	Project researcher (AGB and GAP)
Hadasha Bongat	FGD	F	VSU	Project researcher (AGB and GAP)
Lemuel B Preciados	KII	M	College of Management and Economics, VSU	Project researcher (C5)
Local government				
Mora C Abarquez	KII	F	CAO, Baybay	LGU personnel/extension worker/govt
Ma. Elena Mendoza	KII	F	CAO, Ormoc City	LGU personnel (C2)
Other market actors				
Danillo Vitualla	KII	M	EDC, now with PMPC	Market actor

Name	Type	M/F	Organisation/role	Role in ACIAR project
Farmers				
Albert Rosillo	KII and farm visit	M	Farmer, instructor	Farmer-collaborator (C2)
Lucio 'Boie' R Gerona	KII and farm visit	M	Farmer, instructor	Farmer-collaborator (C2)
Noel Morales	KII	M	Farmer	Farmer-collaborator (C2)
Renilda Kuizon	KII	F	Farmer, business owner	Farmer-collaborator (C2)
Alvin Morales	FGD	M	CALCOA	C2 support
Badil M Morales	FGD	M	CALCOA	C2 support
Danilo A Omapas	FGD	M	CALCOA	C2 support
Jessie Catipay	FGD	F	CALCOA	C2 support
Liza Loreto	FGD	F	CALCOA	C2 support
Marjon B Abenoja	FGD	M	CALCOA	C2 support
Perlito D Argomeda	FGD	M	CALCOA	C2 support
Rodel Morales	FGD	M	CALCOA	C2 support
Loterio Pachito (Tata)	Farm visit	M	CALCOA	C2 support
Jovan Nayre	FGD, KII and farm visit	M	Baybay GAP Farmers	Labourer, VSU res farm; indirect beneficiary via LGU
Acedera Melvin	FGD	F	Baybay GAP Farmers	Indirect beneficiary via LGU
Bobby John Enero	FGD	M	Baybay GAP Farmers	Indirect beneficiary via LGU
Cecilia Cantero	FGD	F	Baybay GAP Farmers	Indirect beneficiary via LGU
Dinah G Salapi	FGD	F	Baybay GAP Farmers	Indirect beneficiary via LGU
Diosito S Diaz	FGD	M	Baybay GAP Farmers	Indirect beneficiary via LGU
Helen Rebecca	FGD	F	Baybay GAP Farmers	Indirect beneficiary via LGU
Jessie P Abenoja	FGD	M	Baybay GAP Farmers	Indirect beneficiary via LGU
Loreto P Godoy	FGD	M	Baybay GAP Farmers	Indirect beneficiary via LGU
Marlon Uy	FGD	M	Baybay GAP Farmers	Indirect beneficiary via LGU
Rodelina Buccal	FGD	F	Baybay GAP Farmers	Indirect beneficiary via LGU
Romeo Mazo	FGD	M	Baybay GAP Farmers	Indirect beneficiary via LGU
William A Albero	FGD	M	Baybay GAP Farmers	Indirect beneficiary via LGU
Sabina Cantoy	FGD	F	Cabintan farmer	Not involved
Helen Nazario	FGD	F	Cabintan farmer	Not involved
Julia Avila	FGD	F	Cabintan farmer	Not involved
Lea Sanico	FGD	F	Cabintan farmer	Not involved
Eud Velet	FGD	M	Cabintan farmer	Not involved
Jordan Constantino	FGD	M	Cabintan farmer	Not involved
Junalyn Nazario	FGD	F	Cabintan farmer	Not involved
Lorna Constantino	FGD	F	Cabintan farmer	Not involved
Ramil Nazario	FGD	M	Cabintan farmer	Not involved
Virgie Gervacio	FGD	F	Cabintan farmer	Not involved

Name	Type	M/F	Organisation/role	Role in ACIAR project
Mindanao				
Research leads and research staff				
Luz Gomez	Scoping: courtesy call	F	OIC, Office of the Chancellor and Dean, School of Management, UPMin	
Sylvia B Conception	KII	F	UPMin	C4 in-country lead, now AGB/2018/196 in-country lead
Larry Digal	KII (scoping)	M	UPMin	C5 in-country lead
Roxanne Aguinaldo	KII	F	UPMin	Researcher (C5) then UPMin coordinator for AGB-2012-109
Marilou Montiflor	KII	F	UPMin	Researcher (C4 and AGB)
Luce Gomez	Roundtable	F	School of Management, UPMin	Minor involvement
Jon-Marx Sarmiento	KII	M	UPMin	Project researcher (C5) (now PhD student, CUT)
Valeriana Justo	KII	F	UPLB, now retired in Mindanao	Project lead (C3) for UPLB, then involved in ICM
Carmelito R Lapoot	KII	M	NMACLRRC (formerly NOMIARC)	NOMIARC researcher (C3, now NMACLRRC Director)
Dante Apra	KII	M	Agroenterprise coordinator, Impasug-ong and Lantapan	Agroenterprise coordinator (C4 staff)
Recarte Bacus	KII	M	UPMin	Agroenterprise coordinator (C4 staff), now MASS-SPECC co-op
Government: national and local				
Marilou Infante	KII	F	Plant Pathologist, Crop Protection, DA Region XI	Involved in C3, C4
Larry Paraluman	KII	M	Chief, Agribusiness and Marketing Assistance Service, DA, Cagayan de Oro	Not involved
Marissa Abella Salvador	KII	F	Committee on Agriculture, Davao City	Not involved
Samal Resma	KII	M	Councillor Abella's office	Not involved
Estilita Pilar M Valdez	KII	F	Extension worker, Davao CAO	Not involved
James Arly A Danac	KII	M	Extension worker, Davao CAO	Not involved
Dianne Jane B Gante	KII and FGD	F	Senior agriculturalist, Impasug-ong MAO	Not involved
Roan Fernandez	KII and FGD	M	Municipal agriculturist, Impasug-ong MAO	Not involved
April Ann N Baltazar	FGD	F	Agricultural technician, Impasug-ong MAO	Not involved
Catherine M Curimao	KII and FGD	F	Agricultural technician, Impasug-ong MAO	Not involved
Neptalie Ambos	KII	M	Municipal agriculturist, Lantapan MAO	Not involved
Zaldy K Dangilan, Jr	KII	M	Agricultural technician, Lantapan MAO	Not involved

Name	Type	M/F	Organisation/role	Role in ACIAR project
Market actors				
Roger Gualberto	KII	M	VICSMIn (producer association)	Involved in C4
Bong Cajés	KII	M	VICSMIn (producer association)	Involved in C4
Marcelino E Remotigue	KII	M	NorMinVeggies (producer association)	Involved in C4
Efren Tan	KII	M	Century House (trader/institutional buyer)	Not involved
Jennylyn Tan	KII	F	Century House (trader/institutional buyer)	Not involved
Mary Joy D Vallera	KII	F	Greenland (trader)	Not involved
Maria Nonna Savallero	KII	F	Trader	Not involved
Mary Ann Astillo	KII	F	Trader	Not involved
Shela Camarinta	KII	F	Farmer, business owner (Heal Thyself)	Not involved
Farmers and farmer groups				
Adimar Estrera	KII and FGD	M	President, Pamuhatan Farmers Association, Marilog	C4 farmer cluster
Merlene V Hamito	KII and FGD	F	Pamuhatan Farmers Association, Marilog	C4 farmer cluster
Modesto C Suarez	FGD	M	United Bisaya and IP Alliance, Marilog	C4 farmer cluster
Alimar Barili	FGD	M	Farmer, Marilog	C4 farmer cluster
Florendo L Iyas	FGD	M	Farmer, Marilog	C4 farmer cluster
Pulbio B Cabiladas	KII	M	Cafe Bukid (business owner), farmer, Lantapan	Farmer-collaborator (C3)
Jeizel R Simbaan	FGD	F	Farmer, Marilog	Not involved
Meriam Pailalan	FGD	F	Farmer, Marilog	Not involved
Analen R Hamoy	FGD	F	Farmer, Marilog	Not involved
Jessa B Maanib	FGD	F	Farmer, Marilog	Not involved
Gerlyn M Batanan	FGD	F	Farmer, Marilog	Not involved
Gina M Batanan	FGD	F	Farmer, Marilog	Not involved
Janet A Dayana	FGD	F	Farmer, Marilog	Not involved
Baby Jane A Dayam	FGD	F	Farmer, Marilog	Not involved
Mary Joy Calamagan	FGD	F	Farmer, Marilog	Not involved
Emma F Lawsar	FGD	F	Farmer, Marilog	Not involved
Florencio Cardonee	FGD	M	Farmer, Marilog	Not involved
Mark Anthony Oximer	FGD	M	President, KHVCA, Impasug-ong	Not involved
Percival L Lumibang	FGD	M	Capitan Juan Farmers Association, Impasug-ong	Not involved
Randel S Sagala	FGD	M	Capitan Juan Farmers Association, Impasug-ong	Not involved
Celistino Yabunan	FGD	M	INAGFA, Impasug-ong	Not involved
Osias A Cespeder	FGD	M	Farmer and group president, Impasug-ong	Not involved
Leonila V Javierto	FGD	F	Farmer, Impasug-ong	Not involved
Danilo Adrayan	FGD	M	Lantapan, Vegetable Farmers Marketing Cooperative	Not involved
Josephine T Bajuyo	FGD	F	Poblacion Lantapan Multipurpose Cooperative	Not involved
Rojessa Magbanua	FGD	F	Kibanghay Farmers Association, Lantapan	Not involved
Adelfa F Palmes	FGD	M	Bugkaon Kulasihan Manupali Association, Lantapan	Not involved
Hilda A Dayupay	FGD	F	Sa Positivong Mag-uuma Cooperative, Lantapan	Not involved

These lists do not include respondents to the UPLB quantitative surveys.

Notes:

- AGB – ACIAR Agribusiness Program
- AHR – Applied Horticultural Research
- ASEM – ACIAR Agricultural Systems Management Program
- CALCOA – Cabintan Livelihood Community Association
- CAO – City Agriculture Office
- CRD – Crops Research Division
- CUT – Curtin University of Technology
- DA – Department of Agriculture
- EDC – Energy Development Corporation
- FGD – focus group discussion
- GAP – Good Agricultural Practices
- HORT – ACIAR Horticulture Program
- ICM – integrated crop management
- INAGFA – Intavas Agri Farmers Association (Impasugong, Bukidnon, Mindanao)
- KHVCF – Kebenton High Value Crops Farmers association (Impasugong, Bukidnon, Mindanao)
- KII – key informant interview
- LGU – local government unit
- MAO – municipal agriculture office
- NMACLRC (formerly NOMIARC)
- NOMIARC – Northern Mindanao Integrated Agricultural Research Center
- NorMinVeggies – Northern Mindanao Vegetable Producers' Association
- NSW DPI – New South Wales Department of Primary Industries
- OIC – Officer in Charge
- PMPC – Partners' Multi-Purpose Cooperative, Leyte
- QDAFF – Queensland Department of Agriculture, Fisheries and Forestry
- RPM – research program manager
- SERD – Socioeconomic Research Division
- SMCN – ACIAR Soil Management and Crop Nutrition Program
- UPLB – University of the Philippines Los Baños
- UPMin – University of the Philippines Mindanao
- UQ – University of Queensland
- VICSMIn – Vegetable Industry Council of Southern Mindanao
- VSU – Visayas State University

Appendix 3: Philippines–ACIAR priorities for collaboration in horticulture, 2006–2010

Focus: Increasing the market competitiveness of Philippines agricultural products

Systems and policies for meeting market specifications (fruits and vegetables)

- Identification of farmer incentives for adoption of **horticultural post-harvest systems improvements**
- Development of new **quality management and food safety standards** and systems for horticultural products, including organic products
- Economic analysis of **marketing chains** and channels for perishables, including determination of consumer preferences
- **Building supply chains:** improving alliances between fruit and vegetable suppliers, processors, institutional buyers and marketers
- **Nutrient and pesticide management** to save costs and reduce residues

Higher returns from vegetable production

- **Protected-cropping** technologies and reduction of inputs (for production of crucifers, salad vegetables and strawberry)
- **Disease management:** management of bacterial wilt and other soil-borne diseases in solanaceous and crucifer crops, efficient production systems for disease-free seed potato
- **Pest management:** systems for diamondback moth management in brassicas
- **Germplasm** collection and evaluation and development of **cultural packages** and native vegetables
- **Post-harvest handling:** shelf-life extension, product development, packaging, quality, and sanitary and phyto-sanitary standards (SPSS) for markets for salad and semi-temperate vegetables and strawberry

Tropical fruit for export and premium domestic markets

- Selection and clonal propagation of new quality mango strains
- Control of major pests and diseases of mango
- Cultural practices, shelf-life extension, product development, packaging, quality and SPSS for markets for jackfruit, mango and new tropical fruit crops
- Application of control methods for phytophthora in durian

Addressing regulatory, policy and technical constraints to the adoption of research outputs

- Identifying and addressing local and national policy constraints to adoption of research, including:
 - land use, land tenure, taxation and transportation policies
 - sanitary and phytosanitary standards
 - intellectual property rights

Source: Attachment to letter from ACIAR CEO (John Skerritt) to David Hall, NSW DPI, 8 October 2007 (supplied by D Hall)

Appendix 4: Program management structure, leads and budgets

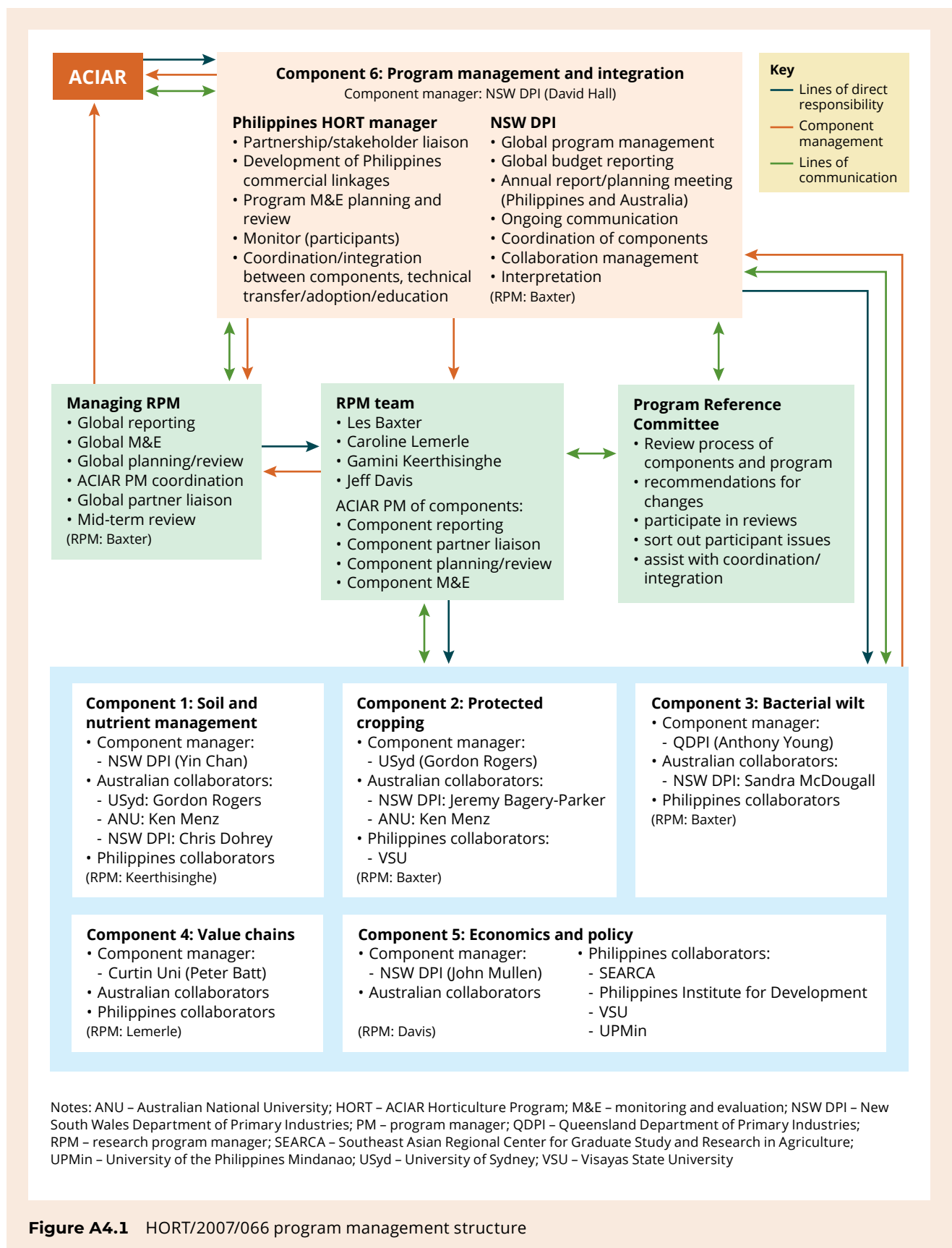


Figure A4.1 HORT/2007/066 program management structure

Table A4.1 Research program managers, leads and organisations by component

Component	Research program manager	Component lead investigator	Australian organisation	Philippine lead
C1	Dr Gamini Keerthisinghe, RPM SMCN	Dr Yin Chan, then Simon Eldridge with Dr Chris Dorahy, AbleBlue	NSW DPI	Dr Annabelle Tulin, VSU
C2	Dr Les Baxter, RPM HORT	Dr Gordon Rogers, AHR	AHR	Dr Othello Capuno, VSU, then Dr Zenaida Gonzaga, VSU
C3	Dr Les Baxter, RPM HORT	Dr Anthony Young, then Dr Nandita Pathania	QDAFF	Vale Justo, UPLB
C4	Dr Caroline Lemerle, RPM ASEM	Dr Peter Batt	CUT	Dr Sylvia Concepcion, UPMin
C5	Dr Caroline Lemerle with Dr Les Baxter	Dr John Mullen, then Dr Randall Jones, then Dr Kirrily Pollock then administered by Dr Hall	NSW DPI	Dr Larry Digal, UPMin
C6	Dr Les Baxter, RPM HORT	Dr David Hall, then Dr Jenny Ekman, then Dr Shane Hetherington. David Hall became a contractor after Oct 2010	NSW DPI	Dr Joy Eusebio, PCAARRD with John Oakeshott

Notes: AHR – Applied Horticultural Research; ASEM – ACIAR Agricultural Systems Management Program; CUT – Curtin University of Technology; HORT – ACIAR Horticulture Program; NSW DPI – New South Wales Department of Primary Industries; PCAARRD – Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development; QDAFF – Queensland Department of Agriculture, Fisheries and Forestry; RPM – research program manager; SMCN – ACIAR Soil Management and Crop Nutrition Program; UPLB – University of the Philippines Los Baños; UPMin – University of the Philippines Mindanao; VSU – Visayas State University

Table A4.2 Program budget at design stage, by component and source (AUD)

Source and payee location	C1	C2	C3	C4	C5	C6	Total
ACIAR funds							
Australia	563,706	544,353	788,538	330,806	311,487	323,692	2,862,581
Philippines	306,791	299,268	180,705	469,070	175,000	-	1,430,834
Total	870,497	843,620	969,243	799,876	486,487	323,692	4,293,415
Non-ACIAR funds							
Australia	311,612	256,716	532,601	192,359	274,133	95,288	1,662,709
Philippines	145,400	109,000	175,600	170,536	112,000	-	712,536
Total	457,012	365,716	708,201	362,895	386,133	95,288	2,375,245
All funds							
Australia	875,318	801,069	1,321,139	523,165	585,620	418,980	4,525,290
Philippines	452,191	408,268	356,305	639,606	287,000	-	2,143,370
Total	1,327,509	1,209,336	1,677,444	1,162,771	872,620	418,980	6,668,660

Appendix 5: Component-level changes to program

Table A5.1 Summary of key program changes by component and area

Component	Area
Personnel, partners, other engagements	
C1	2008–09: NorMinVeggies considering their role; likely not to be a formal partner but would participate in project activities where appropriate July 2010: Change in Australian lead (Dr Yin Chan retired, replaced by Dr Simon Eldridge)
C2	Linkages formed with EDC Informal working group set up between EDC, VSU, East-West Seed and city councils Others getting involved: commitment from Baybay to build 50 structures; Southern Leyte agriculturalist sought technical assistance for construction in 5 municipalities
C3	Australian lead (Dr Anthony Young) moved within QDAFF; replaced by Dr Nandita Pathania (2009–2012)
C4	CRS withdrew mid-2009 (but CRS staff absorbed into C4) UPSTREAM became the new research partner.
C5	Australian co-leads (Dr Mullen and Dr Jones) both left C5 in 2009; C6 coordinator (Hall) covered while seeking replacement lead; Dr Kirrily Pollock began May 2011 but resigned March 2012, not replaced; other Aust project officers also resigned during 2010–11 2010: Temporary unavailability of Philippine policy research lead (Dr Briones) Dr Larry Digal named as C5 in-country coordinator Partnership with BAS (and associated position) reviewed (2009–10); removed from project (2010–11)
C6	C6 lead, David Hall, retired from NSW DPI in October 2010; then contracted to continue management role Dr Ekman formally became NSW DPI Vegetable Project Manager; other (limited) senior NSW DPI involvement from Dr Trevor Gibson, Dr Shane Hetherington and Dr Sandra McDougall
Focus, activities, events	
C1	No significant changes noted
C2	2008–2010: Shift in focus away from detailed research at VSU sites towards farmer-based sites; intent to put greater emphasis on low-cost options Affected by C1 not providing timely soil and plant analyses Storms damaged structures; repairs made and further strengthening undertaken 2010–11: Moved away from detailed research on cooperators' farms to avoid over-burdening them with data collection (just VSU and Cabintan sites to be detailed) New (Deutsche Gesellschaft für Technische Zusammenarbeit or German Corporation for Technical Cooperation) project funding VSU and 8 LGUs to build 48 bamboo structures (some concerns about potential 'distraction') 2011–12: Irrigation identified as a significant cause of poor crop performance Involvement of expert agronomist Mike Titley
C3	2009–10: Disruptions to NOMIARC power supply affected potato seed production; resolved by providing a generator Opportunity identified to engage agribusiness and develop commercial seed production 2011: Difficulties producing disease-free seed in field conditions led to scoping of aeroponic production
C4	2008–09: Change in geographic focus within Davao region (Maragusan and Marilog instead of Kapatagan) 2009–10: Mining in parts of Maragusan affected interest in vegetable farming
C5	Policy research suspended while Dr Briones unavailable during 2010 2008–09 and ongoing: Difficulties obtaining information needed to develop gross margin analysis and assess technology impacts – affected ability to complete planned ex-ante analyses; some cut short (e.g. on C1 and C2); others required final data so extension sought to end-2012
C6	Identification of post-harvest quality and losses as major issues for further work, plus need for expertise in pathology and entomology

Component	Area
Administration and budgets	
C1	Additional funds to improve soil-testing capability at VSU (equipment and training) NorMinVeggies allocation reallocated within the program
C2	AUD10,000 savings from C5 allocated to analyse factors affecting yield and price including pests and diseases (2011–12)
C3	Additional budget from ACIAR for aeroponic scoping, supplemented by savings from C5 (AUD70,000)
C4	Extra AUD30,000 budget from ACIAR for additional in-country visit by Australian team
C5	Savings from BAS allocation Additional funds to UPMIn for policy reference group (2011, 2012) Savings from C5's Australian personnel and travel budget redistributed to C2, C3 and C6, and to VSU for research assistance and to UPMIn for additional fruit and vegetable research and coordination support
C6	2008–09: Admin issues with payments via PCAARRD to Philippine collaborators – resolved through alternative arrangements Program extended initially to June 2012 then Dec 2012; no additional funding except C4 Reallocations between components as above Final-year funding to assess research gaps on post-harvest issues and pest and disease control

Notes: BAS – Bureau of Agricultural Statistics; CRS – Catholic Relief Services; EDC – Energy Development Corporation; LGU – local government unit; NOMIARC – Northern Mindanao Integrated Agricultural Research Center; NorMinVeggies – Northern Mindanao Vegetable Producers' Association; NSW DPI – New South Wales Department of Primary Industries; PCAARRD – Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development; QDAFF – Queensland Department of Agriculture, Fisheries and Forestry; UPMIn – University of the Philippines Mindanao; UPSTREAM – University of the Philippines Strategic Research and Management Foundation; VSU – Visayas State University
Source: Bureau of Agricultural Statistics

Appendix 6: Follow-on vegetable projects

Table A6.1 ACIAR vegetable projects in the Philippines, 2012–present

Project code	Project title	Time period	Budget (AUD)	Australian partners	Filipino partners/ collaborators
HORT/2012/020	Integrated crop management (ICM) to enhance vegetable profitability and food security in the southern Philippines and Australia	2013–17	ACIAR: 2,363,867 Non-ACIAR: 2,616,337 Total: 4,980,204	• NSW DPI • QDAF • AHR	• VSU • UPLB • EWS • LFPI • BISU • NWSSU • USTP • PCAARRD
HORT/2012/098	Improved postharvest management of fruit and vegetables in the southern Philippines and Australia	2013–19	ACIAR: 1,096,012 Non-ACIAR: 711,002 Total: 1,807,014	• QDAF • AHR	• UPMin • VSU • Southern Philippines Fresh Fruit Corporation
AGB/2012/109	Developing vegetable and fruit value chains and integrating them with community development in the southern Philippines	2014–18	ACIAR: 1,842,214* Non-ACIAR: n/a Total: n/a	• UQ	• UPMin • VSU • LFPI • UPLB
SMCN/2012/029	Soil and nutrient management strategies for improving tropical vegetable production in southern Philippines and Australia	2014–19	ACIAR: 959,460* Non-ACIAR: n/a Total: n/a	• QDAF • UQ	• VSU • Bureau of Soils and Water Management (BSWM) • USTP • UPLB • LFPI
HORT/2016/188	Developing vegetable value chains to meet evolving market expectations in the Philippines	2019–24	ACIAR: 3,100,000 Non-ACIAR: 771,541 Total: 3,871,541	• AHR • NSW DPI	• VSU • EWS • LFPI
AGB/2017/039	Learning alliance approaches to scaling out vegetable value chains in the southern Philippines	2018–22	ACIAR: 257,000* Non-ACIAR: n/a Total: n/a	• UQ	• VSU
AGB/2019/100	A theory of change for inclusive value chains in the Philippines	2019–20	n/a	• UQ • CSIRO	• UPMin • VSU • FAC
AGB/2019/101	Agribusiness master class: Philippines	2019–20	n/a	• CSIRO • UQ	• FAC
AGB/2018/196	Agribusiness-led inclusive value chain development for smallholder farming systems in the Philippines	2021–25	ACIAR: 2,550,000* Non-ACIAR: n/a Total: n/a	• CSIRO • ANU • UQ	• FAC • UPLB • UPMin • VSU

* Full budget spreadsheets not available to evaluation team. Figures here are from project proposals or (for AGB/2018/196) overview flyer.

Notes: ACIAR – Australian Centre for International Agricultural Research; AHR – Applied Horticultural Research; ANU – Australian National University; BISU – Bohol Island State University; CSIRO – Commonwealth Scientific and Industrial Research Organisation; EWS – East-West Seed; FAC – Foodlink Advocacy Cooperative; LFPI – Landcare Foundation Philippines Inc.; NSW DPI – New South Wales Department of Primary Industries; NWSSU – Northwest Samar State University; PCAARRD – Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development; QDAF – Queensland Department of Agriculture and Fisheries; UPLB – University of the Philippines Los Baños; UPMin – University of the Philippines Mindanao; UQ – University of Queensland; USTP – University of Science and Technology of Southern Philippines; VSU – Visayas State University

Appendix 7: HORT/2007/066 publications

The lists below have been compiled from project documents and online searches, supplemented by additional inputs provided by former project personnel. For refereed publications, citations and the lead author's h-index are included.

Component 1: Soil and nutrient management

Peer-reviewed scientific journals (published)

Paper	Lead author			Number of citations
	Gender	Nationality	h-index (Scopus)	
Chan K, Orr L, Fahey D and Dorahy C (2011) 'Agronomic and economic benefits of garden organics compost in vegetable production', <i>Compost Science and Utilisation</i> , 19(2):97-104.	Male	Australian	30	16 – Google Scholar 8 – ResearchGate
Chan K, Van Zwieten L, Meszaros I, Downie A and Joseph S (2008) 'Agronomic values of greenwaste biochar as a soil amendment', <i>Australian Journal of Soil Research</i> , 45(8):629-634.	Male	Australian	30	2,627 – Google Scholar 1,356 (Scopus)
Chan K, Wells T, Fahey D, Eldridge SM and Dorahy C (2010) 'Assessing P fertiliser use in vegetable production: agronomic and environmental implications', <i>Australian Journal of Soil Research</i> , 48(8):674-681.	Male	Australian	30	15 – Google Scholar 12 – ResearchGate
Pizon F and Tulin A (2020) 'Intensive vegetable production degrades volcanic ash soil in Cabintan, Ormoc City, Philippines', <i>Science and Humanities Journal</i> , 14:36-53.	Female	Filipina	Not found	0 – Google Scholar 0 – ResearchGate
Tulin A, Mercado A and Dorahy C (2015) 'Profitable tomato and tomato-maize nutrient management systems in an acid soil', <i>Journal of South Pacific Agriculture</i> , 18(2):53-62.	Female	Filipina	6 – Google Scholar	0 – Google Scholar 0 – ResearchGate
Tulin A, Rallos R, Ranises M and Dorahy C (2013) 'Increasing cabbage production through NPK application in Cabintan, Ormoc City, Leyte, Philippines', <i>Annals of Tropical Research</i> , 35(1):96-108.	Female	Filipina	3	3 – Google Scholar 2 – ResearchGate
Tulin A, Ranises M, Galambao M, Umar M and Dorahy C (2015) 'Nutrient supply capacity determination for acid soils planted with vegetables using the double pot technique', <i>GSTF Journal of Agricultural Engineering</i> , 2(1):13-18.	Female	Filipina	3	0 – Google Scholar 0 – ResearchGate
Vallejera C, Tulin A, Asio V and Dorahy C (2014) 'Nutrient analysis, decomposition and nitrogen mineralization of various organic amendments used for pechay production', <i>Annals of Tropical Research</i> , 36(1):87-100.	Female	Filipina	2 – ResearchGate	1 – Google Scholar 3 – ResearchGate

Conference proceedings and papers (published)

Paper	Lead author			Number of citations
	Gender	Nationality	h-index (Scopus)	
Donovan N, Saleh F, Chan K, Eldridge S, Fahey D, Muirhead L, Meszaros I and Barchia I (2013) 'Use of garden organic compost in a long-term vegetable field trial: biological soil health', <i>Acta Horticulturae</i> , 1018:47–55.	Female	Australian	8	5 – Google Scholar 7 – ResearchGate
Dorahy C, Mercado A, Quinones C, Bicamon R, Salvani J, Lapoot C, Justo V, Oakeshott J, Atienza J and Tulin A (1–6 Aug 2010) 'A framework for prioritizing nutrient management research for vegetable production in the southern Philippines', in Gilkes RG and Prakongkep N (eds) 'Symposium 3.3.1 – Integrated nutrient management', <i>Proceedings of the 19th World Congress of Soil Science: Soil solutions for a changing world</i> , vol. 1, International Union of Soil Sciences, Brisbane, Australia, electronic proceedings.	Male	Australian	Not found	Not found
Eldridge S, Chan K, Donovan N, Saleh F, Fahey D, Meszaros I, Muirhead L and Barchia I (2013) 'Changes in soil quality over 5 consecutive vegetable crops following the application of garden organics compost', <i>Acta Horticulturae</i> , 1018:57–71.	Male	Australian	10 – Google Scholar	7 -Google Scholar 5 – ResearchGate
Gilkes RG and Prakongkep N (eds) (1–6 Aug 2010) 'Symposium 3.3.1 – Integrated nutrient management', <i>Proceedings of the 19th World Congress of Soil Science: Soil solutions for a changing world</i> , vol. 1, International Union of Soil Sciences, Brisbane, Australia, electronic proceedings.	Male	Australian	Not found	Not found
Gonzaga Z, Capuno O, Loreto M, Gerons R, Borines L, Tulin A, Mangman J, Lusanta D, Dimabuyu H and Rogers G (3 July 2012) 'Low-cost protected cultivation: enhancing year-round production of high-value vegetables in the Philippines', in Oakeshott J and Hall D (eds) <i>Smallholder HOPES – horticulture, people and soil: Proceedings of the ACIAR-PCAARRD Southern Philippines Fruits and Vegetables Program meeting, Cebu, Philippines</i> , ACIAR Proceedings 139, Australian Centre for International Agricultural Research, Canberra, Australia.	Female	Filipina	6 – Google Scholar	9 – Google Scholar 8 – ResearchGate
Lapoot C, Salvani J, Duna L, Dumayaca C, Bicamon R, Tulin A and Dorahy C (25–27 May 2011) 'Enhancing farmer's knowledge on soil and crop nutrient management for vegetable production in Bukidnon', <i>Proceedings of the 14th PSSST Annual Meeting and Scientific Conference</i> , Visayas State University, Baybay City, Leyte, Philippines.	Female	Filipina	3	4 – Google Scholar
Mercado A, Tulin A and Dorahy C (1–6 Aug 2010) 'Soil management and crop nutrition for tomato in acid soil of Claveria, Philippines', in Gilkes RG and Prakongkep N (eds) 'Symposium 3.3.1 – Integrated nutrient management', <i>Proceedings of the 19th World Congress of Soil Science: Soil solutions for a changing world</i> , vol. 1, International Union of Soil Sciences, Brisbane, Australia, electronic proceedings.	Male	Filipino	5	9 – Google Scholar

Paper	Lead author			Number of citations
	Gender	Nationality	h-index (Scopus)	
Mercado A, Tulin A, Gonzaga N and Dorahy C (16–18 May 2012) 'Material substrates for vermiculture', <i>Proceedings of the 15th PSSST Annual Meeting and Scientific Conference</i> , Silliman University, Dumaguete City, Philippines.	Male	Filipino	15 – Google Scholar	0
Tulin A, Galambao M, Mercado A, Gonzaga N, Lapoot C, Salavani L, Duna V Gusto and C Dorahy (2014) 'Integrated site-specific nutrient management for productive, profitable and sustainable vegetable production in marginal uplands in the southern Philippines: the case of cabbage production in Cabintan, Leyte, Philippines', <i>Acta Horticulturae</i> , 1128:207–214.	Female	Filipina	6 – Google Scholar	
Tulin A, Quinones C, Rallos R, Mercado A, Salvani J, Lapoot C, Justo V and Dorahy C (1–6 Aug 2010) 'Evidence-based nutrient management strategy in identifying fertility status and soil constraints for vegetable production in Southern Philippines', in Gilkes RG and Prakongkep N (eds) 'Symposium 3.3.1 – Integrated nutrient management', <i>Proceedings of the 19th World Congress of Soil Science: Soil solutions for a changing world</i> , vol. 1, International Union of Soil Sciences, Brisbane, Australia, electronic proceedings.	Female	Filipina	6 – Google Scholar	4 – Google Scholar 2 – ResearchGate
Tulin A, Rallos R and Dorahy C (1–6 Aug 2010) 'Integrated nutrient management for increased cabbage production in volcanic soil in Cabintan, Leyte, Philippines', in Gilkes RG and Prakongkep N (eds) 'Symposium 3.3.1 – Integrated nutrient management', <i>Proceedings of the 19th World Congress of Soil Science: Soil solutions for a changing world</i> , vol. 1, International Union of Soil Sciences, Brisbane, Australia, electronic proceedings.	Female	Filipina	6 – Google Scholar	1 – Google Scholar 1 – ResearchGate

Conference proceedings and papers (unpublished)

Paper	Lead author	
	Gender	Nationality
Dorahy C (21 May 2009) 'Managing soil fertility in horticultural production – lessons from Australia, Indonesia and the Philippines', Plenary Address to the 12th Annual Meeting and Scientific Conference of the Philippine Society of Soil Science and Technology, Inc. Eden Nature Park and Resort, Toril, Davao City, Philippines.	Male	Australian
Gabitano B and Tulin A (2010) 'Nitrogen dynamics of soil planted to sweet pepper (<i>Capsicum annum</i> L.) under protective structure', Proceedings of the 13th PSSST Annual Meeting and Scientific Conference, Legend Hotel, Puerto Princesa City, May 27–28, 2010, 67–68.	Unknown	Unknown
Lapoot C, Salvani J, Duna L, Dumayaca C, Bicomon R, Tulin A and Dorahy C (2011) 'Nutrient elimination addition test (NEAT) on hybrid tomato in Aduyon clay soils', Proceedings of the 14th PSSST Annual Meeting and Scientific Conference, Visayas State University, Baybay City, Leyte, May 25–27, 2011, 127–128.	Female	Filipina
Mercado A, Monera R, Bicomon R, Tulin A and Dorahy C (May 27–28, 2010) 'Soil and crop nutrient management for tomato in acid soil of Claveria, Philippines', Proceedings of the 13th PSSST Annual Meeting and Scientific Conference, Puerto Princesa, Philippines, May 27–28, 2010, 122–123.	Male	Filipino
Mercado A, Tulin A, Gonzaga N and Dorahy C (2012) 'Material substrates for vermiculture', Proceedings of the 15th PSSST Annual Meeting and Scientific Conference held at Silliman University, Dumaguete City, Negros Oriental, May 16–18, 2012, 97–98.	Male	Filipino
Tulin A, Canoy R, Ranises M and Abendan R (2011) 'Enhancement of root growth and plant development of <i>Euphorbia milii</i> with the application of Siam Early Grow', Proceedings of the 14th PSSST Annual Meeting and Scientific Conference, Visayas State University, Baybay City, Leyte, May 25–27, 2011, 135–136.	Female	Filipina
Tulin A, Rallos R, Ranises M and Dorahy C (2010) 'Farmer-scientist participatory assessment of integrated nutrient management for increased cabbage production in Cabintan, Ormoc City, Philippines', Proceedings of the 13th PSSST Annual Meeting and Scientific Conference, Legend Hotel, Puerto Princesa City, May 27–28, 2010, pp. 55–56.	Female	Filipina
Tulin A, Ranises M and Dorahy C (2011) 'Assessing the productivity of marginal lands through establishment of critical nutrient levels using low-cost nutrient omission trial technique', Proceedings of the 14th PSSST Annual Meeting and Scientific Conference, Visayas State University, Baybay City, Leyte, May 25–27, 2011, 135–136.	Female	Filipina
Tulin A, Ranises M, Galambao M and Dorahy C (2012) 'Nutrient balance studies for sustainable P production in P deficient soils', Proceedings of the 15th PSSST Annual Meeting and Scientific Conference held at Silliman University, Dumaguete City, Negros Oriental, May 16–18, 2012, 39–40.	Female	Filipina
Tulin A, Ranises M, Galambao M and Dorahy C (2013) 'Establishment of the nutrient supply capacity of acid soils planted with vegetables in the southern Philippines using the Double Pot Technique', Proceedings of the 11th International conference of the East and Southeast Asia Federation of Soil Science Societies, IP International Convention Center, Bogor, Indonesia, October 21–24, 90–91.	Female	Filipina
Sabijon J and Tulin A (2010) 'Evidence-based nutrient management strategy in identifying fertility status (<i>Lycopersicon esculentum</i> Mill)', Proceedings of the 13th PSSST Annual Meeting and Scientific Conference, Puerto Princesa, Philippines, May 27–28, 2010, 69–70.	Female	Filipina
Vallejera, C and Tulin A (2011) 'Characterization and nutrient content analysis of various organic amendments used for vegetable production', Proceedings of the 14th PSSST Annual Meeting and Scientific Conference held at Visayas State University, Baybay City, Leyte, May 25–27, 2011, 66–67.	Female	Filipina

Associated publications

	Lead author	
	Gender	Nationality
Report		
Collins D (2011) 'Proposed design of N-P-K trials in the Philippines', unpublished report, NSW DPI.	Unknown	Unknown
Gabitano B, Tulin A, Ranises M and Dorahy C (2010) 'Yield of sweet pepper (<i>Capsicum annuum</i> L.) and nutrient dynamics of soil under protective structure and open field applied with varying levels and sources of nitrogen', field trial report.	Unknown	Unknown
Mercado A, Monera R and Paday N (2008) <i>Participatory appraisal report: Claveria, Misamis Oriental, Sept to Dec 2008</i> , World Agroforestry Centre, ICRAF-Philippines.	Male	Filipino
Tulin A et. al. (2012) <i>Enhancing profitability of selected vegetable value chains in the southern Philippines and Australia – Component 1 – Integrated soil and crop nutrient management in vegetable crops in the southern Philippines</i> , Visayas State University.	Female	Filipina
Guideline		
Tulin et al. (in preparation) 'A question of balance: Managing nutrient inputs and outputs for sustainable nutrient management for vegetable production in the southern Philippines', Guidelines for achieving sustainable nutrient management for vegetable production.	Female	Filipina
Academic thesis		
Ejoc A (2010) 'Assessment of the NPK requirements of sweet pepper grown under different soils used in vegetable production in the southern Philippines using the double pot technique', thesis submitted in partial fulfilment of the requirements of Bachelor of Science (Soil Science) at Visayas State University, VISCA, Baybay, Philippines.	Unknown	Unknown
Gabitano B (2010) 'Nutrient dynamics of soils planted to sweet pepper under protective structure and in an open field', thesis submitted in partial fulfilment of the requirements of Bachelor of Science (Soil Science) at the Visayas State University, VISCA, Baybay, Philippines.	Unknown	Unknown
Rabe K, Celaya A and Tulin A (2010) 'Improvement of the growth, yield and anthocyanin activity of tomato grown under protective structure and open field conditions through potassium biofortification', fourth year high school student project, VSU Secondary College, Baybay, Leyte.	Unknown	Unknown
Sabijon J (2010) 'Effects of organic amendments on soil characteristic and growth and yield of tomato (<i>Lycopersicon esculentum</i> Mill.)', a thesis submitted in partial fulfilment of the requirements of Bachelor of Science (Soil Science) at Visayas State University, VISCA, Baybay, Philippines.	Unknown	Unknown
Vallejera C (2011) 'Characterization and nutrient content analysis of various organic amendments used for vegetable production', thesis submitted in partial fulfilment of the requirements of Master of Science (Soil Science) at Visayas State University, VISCA, Baybay, Philippines.	Unknown	Unknown

Component 2 – Protected cropping

Peer-reviewed conference proceedings and papers (published)

Paper	Lead author			Number of citations
	Gender	Nationality	h-index (Scopus)	
Armenia P, Menz K, Rogers G, Gonzaga Z, Gerona R and Tausa E (3 July 2012) 'Economics of vegetable production under protected cropping structures in the Eastern Visayas, Philippines', in Oakeshott J and Hall D (eds) <i>Smallholder HOPES – horticulture, people and soil: Proceedings of the ACIAR-PCAARRD Southern Philippines Fruits and Vegetables Program meeting, Cebu, Philippines</i> , ACIAR Proceedings 139, Australian Centre for International Agricultural Research, Canberra, Australia.	Male	Filipino	2 – ResearchGate	12 – Google Scholar 6 – ResearchGate
Borines L, Gonzaga Z, Capuno O, Gerona R, Lusanta D, Dimabuyu and Rogers G (2016) 'Diseases commonly affecting vegetables in Eastern Visayas, Philippines and their incidence under protective structure and in the open field', <i>Acta Horticulturae</i> , 1128:117–123.	Female	Filipina	3	0 – Google Scholar 3 – ResearchGate
Capuno O, Gonzaga Z, Loreto M, Gerona R, Borines L, Tulin A, Lusanta D, Dimabuyu H, Vega M, Mangmang J and Rogers G (2015) 'Development of a cost-effective protected vegetable cropping system in the Philippines', <i>Acta Horticulturae</i> , 1107:221–228.	Male	Filipino	2	6 – Google Scholar 9 – ResearchGate
Dimabuyu H, Gonzaga Z, Lusanta D, Mangmang J, Capuno O and Rogers G (2014) 'Reducing disease incidence and increasing productivity of ampalaya (<i>Momordica charantia</i> L.) through pruning and protected cultivation', <i>Acta Horticulturae</i> , 1128:177–182.	Male	Filipino	2	2 – Google Scholar 3 – ResearchGate
Gerona R, Gonzaga Z, Capuno O, Armenia P, Loreto M, Nuñez L and Menz K (2016) 'Sustainable vegetable production through the use of low-cost protective structures: a farmer's experience in Bontoc, southern Leyte, Philippines', <i>Acta Horticulturae</i> , 1128:171–176.	Female	Filipina	1	0 – Google Scholar 2 – ResearchGate
Gonzaga Z, Capuno O, Loreto M, Gerona R, Borines L, Tulin A and Rogers G (3 July 2012) 'Low-cost protected cultivation: enhancing year-round production of high-value vegetables in the Philippines', in Oakeshott J and Hall D (eds) <i>Smallholder HOPES – horticulture, people and soil: Proceedings of the ACIAR-PCAARRD Southern Philippines Fruits and Vegetables Program meeting, Cebu, Philippines</i> , ACIAR Proceedings 139, Australian Centre for International Agricultural Research, Canberra, Australia.	Female	Filipina	2	9 – Google Scholar 8 – ResearchGate
Gonzaga Z, Dimabuyu H, Lusanta D and Rom J (2014) 'Re-circulating aggregate hydroponic system: A strategy for off-season tomato (<i>Lycopersicon esculentum</i> Mill.) production in Leyte, the Philippines', <i>Acta Horticulturae</i> , 1128:333–338.	Female	Filipina	2	3 – Google Scholar 0 – ResearchGate
Gonzaga Z, Robido J, Rom J, Capuno O and Rogers G (2016) 'Growth and yield of lettuce (<i>Lactuca sativa</i> L.) as influenced by methods of raising seedlings under 2 types of cultivation system', <i>Acta Horticulturae</i> , 1205:843–850.	Female	Filipina	2	1 – Google Scholar 1 – ResearchGate

Associated publications (unpublished)	Lead author	
	Gender	Nationality
Academic thesis		
Dimabuyu H (2011) 'Growth and yield of pruned ampalaya (<i>Momordica charantia</i> L.) grown under protective structure and in the open field', fourth-year honours thesis.	Female	Filipina
Limbag C (2011) 'Horticultural and physiological responses of lettuce (<i>Lactuca sativa</i> L.) with phycocolloid as foliar supplementation grown under protected and conventional cultivation systems', PhD thesis.	Unknown	Unknown
Working paper		
Akhter S and Menz K (2009) 'Soil management for vegetable growing in the Philippine uplands: a bio economic analysis', Working Paper No. 3.	Unknown	Unknown
Armenia P, Kenneth M, Menz K, Gordon S, Rogers G, Gonzaga Z, Reny G, Gerona R, Elsie R and Tausa E (2012) 'Economics of vegetable production under protected cropping structures in the Eastern Visayas, Philippines', Working Paper No. 18.	Male	Filipino
Armenia P, Nuñez L and Tausa E (2009) 'Farmers' practices, initial feedback and constraints to adoption of vegetable production under protected structures', Working Paper No. 4.	Male	Filipino
Armenia P, Nuñez L, Tausa E, Loreto M, Jarvis J, Capuno O, Gonzaga Z, Briones E, Mandras B, Tulin A, Mangmang J, Menz K and Rogers G (2009) 'Design and costings for some protected cropping structures for vegetable production, Leyte', Working Paper No. 6.	Male	Filipino
Capuno O, Gonzaga Z, Armenia P, Loreto M, Gerona R, Nuñez L, Tulin A, Borines L, Mangmang J, Lusanta D, Tausa E, Vega L, Menz K and Rogers G (2011) 'Yield and gross margins of vegetable crops in the second year grown under protective structures and in open field', Working Paper No. 15.	Male	Filipino
Capuno O, Gonzaga Z, Loreto M, Briones E, Tulin A, Gerona R, Mangmang J and Rogers G (2011) 'The potential for growing lettuce (<i>Lactuca sativa</i>) under protective structures in VSU, Baybay, Leyte, Philippines', Working Paper No. 11.	Male	Filipino
Capuno O, Gonzaga Z, Loreto M, Briones E, Tulin A, Gerona R, Mangmang J and Rogers G (2011) 'Production of ampalaya (<i>Momordica charantia</i> Linn.) under protective structures in VSU, Baybay, Leyte, Philippines', Working Paper No. 12.	Male	Filipino
Capuno O, Gonzaga Z, Loreto M, Briones E, Tulin A, Gerona R, Mangmang J and Rogers G (2011) 'Cultivation of tomato (<i>Lycopersicon esculentum</i> Mill.) under a rain shelter and in the open field in Cabintan, Ormoc City, Leyte, Philippines', Working Paper No. 13.	Male	Filipino
Capuno O, Gonzaga Z, Loreto M, Briones E, Tulin A, Gerona R, Mangmang J and Rogers G (2011) 'Performance of cauliflower (<i>Brassica oleracea</i> var. <i>botrytis</i> L.) and broccoli (<i>Brassica oleracea</i> var. <i>italica</i> L.) grown under rain shelter and in the open field in Cabintan, Ormoc City, Leyte, Philippines', Working Paper No. 10.	Male	Filipino
Gonzaga Z, Capuno O, Loreto M, Gerona R, Borines L, Tulin A, Mangmang J, Lusanta D, Dimabuyu H and Rogers G (2012) 'Low-cost protected cultivation: enhancing year-round production of high-value vegetables in the Philippines', Working Paper No. 19.	Female	Filipina
Menz K and Armenia P (2009) 'Seasonal vegetable price data for Leyte, Philippines', Working Paper No. 2.	Male	Australian
Menz K and Armenia P (2012) 'Updated seasonal vegetable price data for Leyte and Southern Leyte', Working Paper No. 17.	Male	Australian
Nuñez L, Armenia P and Maurillo L (2009) 'Focus group discussion with farmers on protected vegetable cropping', Working Paper No. 1.	Unknown	Unknown
Sarno S and Teves J (2009) 'A case study on vegetable production and marketing assistance project, Maasin, Leyte', Working Paper No. 5.	Unknown	Unknown
Tausa E, Armenia P, Gonzaga Z, Capuno O and Menz K (2010) 'Profitability of vegetable crops in the first full year (3 cropping periods) grown under protective structures and in open field', Working Paper No. 9.	Female	Filipina

Associated publications (unpublished)	Lead author	
	Gender	Nationality
Tesoriero L, Hall D and Rogers G (2011) 'Assessment of disease issues in protected cropping and recommendations for future activities', Working Paper No. 16.	Male	Australian
Tulin, A, Gonzaga Z, Mangmang J and Rogers G (2010) 'Physico-chemical characteristics and nutrient dynamics of soils used for protected cropping', Working Paper No. 8.	Female	Filipina
Vega L and Loreto M (2011) 'Workshop on improving the designs of innovative low-cost structures for protected vegetable cropping', Working Paper No. 14.	Unknown	Unknown

Component 3 – Bacterial wilt

Peer-reviewed conference proceedings and papers (published)

Paper	Lead author			
	Gender	Nationality	h-index (Scopus)	Number of citations
Abragan F, Ronquillo M, Toraja W, Salvani J, Tatoy B, Lapoot C and Justo V (3 July 2012) 'Commercial potato varieties and lines tolerant to bacterial wilt, <i>Ralstonia solanacearum</i> ', in Oakeshott J and Hall D (eds) <i>Smallholder HOPES – horticulture, people and soil: Proceedings of the ACIAR-PCAARRD Southern Philippines Fruits and Vegetables Program meeting, Cebu, Philippines</i> , ACIAR Proceedings 139, Australian Centre for International Agricultural Research, Canberra, Australia.	Female	Filipina		
Dela Cueva F, Balendres M, Concepcion D, Binahon P, Waje A, Tiongco R, Vergara M, Justo V, Pathania N and Trevorrow P (3 July 2012) 'Phenotypic and genotypic relationships of <i>Ralstonia solanacearum</i> isolates from the northern and southern Philippines', in Oakeshott J and Hall D (eds) <i>Smallholder HOPES – horticulture, people and soil: Proceedings of the ACIAR-PCAARRD Southern Philippines Fruits and Vegetables Program meeting, Cebu, Philippines</i> , ACIAR Proceedings 139, Australian Centre for International Agricultural Research, Canberra, Australia.	Female	Filipina	74	5 – Google Scholar 3 – ResearchGate
Justo V, Abragan F, Tatoy B, Ronquillo M and Toraja W (3 July 2012) 'Soil amendments for bacterial wilt management in solanaceous vegetables', in Oakeshott J and Hall D (eds) <i>Smallholder HOPES – horticulture, people and soil: Proceedings of the ACIAR-PCAARRD Southern Philippines Fruits and Vegetables Program meeting, Cebu, Philippines</i> , ACIAR Proceedings 139, Australian Centre for International Agricultural Research, Canberra, Australia.	Female	Filipina	2	1 – Google Scholar
Pathania, N, Trevorrow P, Hughes M, Marton T, Justo V and Salvanin J (3 July 2012) 'Preliminary research to develop a low technology aeroponic system for producing clean seed potato in the Philippines', in Oakeshott J and Hall D (eds) <i>Smallholder HOPES – horticulture, people and soil: Proceedings of the ACIAR-PCAARRD Southern Philippines Fruits and Vegetables Program meeting, Cebu, Philippines</i> , ACIAR Proceedings 139, Australian Centre for International Agricultural Research, Canberra, Australia.	Female	Australian	2	4 – Google Scholar

Conference and proceeding paper (unpublished)	Lead author	
	Gender	Nationality
Balendres M, Dela Cueva M, Vergara M, Concepcion D, Tiongco R, Valeriana J, Pathania N and Trevorrow P (20–22 July 2011) 'Molecular detection, phylotyping and genetic diversity analysis of <i>Ralstonia solanacearum</i> isolated from white potato in the Philippines', 4th ACIAR-PCARRD Meeting, Bohol, Philippines.	Male	Filipino
Concepcion D, Dela Cueva F, Ardales E, Vergara M, Balendres M, Rizalina L, Tiongco R, Valeriana J and Pathania N (20–22 July 2011) 'Variation in phylotypes of <i>Ralstonia solanacearum</i> (EF Smith) Yabuuchi et al. isolated from white potato tubers', 4th ACIAR-PCARRD Meeting, Bohol, Philippines.	Female	Filipina
Dela Cueva F, Justo V, Vergara M and Concepcion D (27–29 April 2011) 'Genetic diversity and pathogenic variability among isolates of <i>Ralstonia solanacearum</i> from white potato growing areas in Northern Mindanao', Asian/Australasian Conference in Plant Pathology, Darwin, Australia.	Female	Filipina
Forsyth L and Tesoriero L (19–22 July 2009) 'Bacterial canker of tomato in Australia', Australian Hydroponic Greenhouse Association Conference, Sydney, Australia.	Female	Australian
Pathania N, Trevorrow P, Young A, Wright C and Marton T (9–12 March 2010) 'Evaluation of biofumigant crops on suppression of <i>Ralstonia solanacearum</i> population', Annual Scientific Conference, Davao, Philippines.	Female	Australian
Tesoriero L, Terras M and Forsyth L (19–22 July 2009) 'New and emerging disease threats to the Australian greenhouse and ornamental industry', Australian Hydroponic Greenhouse Association Conference, Sydney, Australia.	Male	Australian

Associated publications and reports	Lead author	
	Gender	Nationality
Conference paper		
Balendres M, Justo V, Pathania N, Trevorrow P and Dela Cueva F (8–11 May 2012) 'Characterization of <i>Ralstonia solanacearum</i> phylotype I and reduction of its population in biofumigated soil', paper presented at 43rd Pest Management Council of the Philippines Scientific Conference, Cagayan de Oro, Philippines.	Male	Filipino
Binahon P, Ardales E, Dela Cueva F and Justo V (8–11 May 2012) DNA fingerprinting of <i>R. solanacearum</i> (EF Smith) Yabuuchi et al. isolates from soil collected from potato (<i>Solanum tuberosum</i>) growing areas in Bukidnon, Philippines', paper presented at 43rd Pest Management Council of the Philippines Scientific Conference, Cagayan de Oro, Philippines.	Unknown	Unknown
Concepcion D, Ardales Y, Justo V, Pathania N, Dela Cueva F (8–11 May 2012) 'Phylotype and pathogenic analysis of <i>Ralstonia solanacearum</i> isolated from white potato in the Philippines', paper presented at 43rd Pest Management Council of the Philippines Scientific Conference, Cagayan de Oro, Philippines.	Female	Filipina
Concepcion D, Dela Cueva F, Vergara M, Tiongco R, Justo V and Pathania N (4–7 May 2011) 'Comparative analysis of <i>Ralstonia solanacearum</i> from Mindanao and Northern Luzon. 2011', paper presented at 42nd Annual Conference of the Pest Management Council of the Philippines, Bacolod City, Philippines.	Female	Filipina
Justo V, Kirkegaard J, Akiew S, Bayot R, Zorilla R, Lando L, Abragan F and Dangan J (21–25 July 2008) 'Farmer's experiences on biofumigation for bacterial wilt management in solanaceous crops in southern Philippines', paper presented at 3rd International Biofumigation Symposium, Canberra, Australia.	Female	Filipina
Vergara M, Concepcion D, Tiongco R, Dela Cueva F, Justo V and Pathania N (3–6 May 2011) 'Comparative nucleic acid- based analysis of isolates of <i>Ralstonia solanacearum</i> collected from Mindanao and Northern Luzon', paper presented at 42nd PMCP Annual Convention and Scientific Conference, Bacolod City, Philippines.	Unknown	Unknown

Associated publications and reports	Lead author	
	Gender	Nationality
Vergara M, Rizalina L, Dela Cueva F and Justo V (6–9 Mar 2010) 'PCR detection, biochemical characterization and aggressiveness of <i>Ralstonia solanacearum</i> collected from Northern Mindanao', paper and poster presented at PMCP Annual Convention and Scientific Conference, Davao City, Philippines.	Unknown	Unknown
Waje A, Ardales E, Dela Cueva F and Justo V (8–11 May 2012) 'Genetic variability of <i>R. solanacearum</i> (EF Smith) Yabuuchi et al. isolated from soil planted to different solanaceous crops in the Philippines', paper presented at 43rd Pest Management Council of the Philippines Scientific Conference, Cagayan de Oro, Philippines.	Female	Filipina
ACIAR report		
Hughes M and Trevorrow P (2011) 'A scoping study on clean seed production and integrated crop management options for potato production in bacterial wilt prone areas of Southern Philippines'.	Male	Australian
Justo V (2010) 'Annual report: Integrated strategies for the management of bacterial wilt and other wilting diseases in solanaceous crops in Southern Philippines and Australia', ACIAR project HORT/2007/0663.	Female	Filipina
Nandita P (14–22 November 2009) 'Integrated strategies for the management of bacterial wilt and other wilting diseases in solanaceous crops in the southern Philippines and Australia', ACIAR project HORT/2007/0663, trip report.	Female	Australian
Nandita P and Justo V (October 2010) 'Quarterly report: Integrated strategies for the management of bacterial wilt and other wilting diseases in solanaceous crops in the southern Philippines and Australia'.	Female	Australian
Nandita P and Trevorrow P (20–28 March 2010) 'Integrated strategies for the management of bacterial wilt and other wilting diseases in solanaceous crops in the southern Philippines and Australia', ACIAR project HORT/2007/0663, trip report.	Female	Australian
Nandita P and Trevorrow P (September 2009) 'Report on comparative tolerance of commercial potato varieties of North Queensland to <i>Ralstonia solanacearum</i> prepared for local potato seed distributor'.	Female	Australian
Nandita P, Justo V, Trevorrow P, Young A, Tesoriero L and Forsyth L (2010) 'Annual report: Integrated strategies for the management of bacterial wilt and other wilting diseases in solanaceous crop in the southern Philippines and Australia'.	Female	Australian
Nandita P, Justo V, Trevorrow P, Young A, Tesoriero L and Forsyth L (2010) 'Annual report: Integrated strategies for the management of bacterial wilt and other wilting diseases in solanaceous crop in the southern Philippines and Australia'.	Female	Australian
Nandita P, Justo V, Trevorrow P, Young A, Tesoriero L and Forsyth L (2011) 'Annual report: Integrated strategies for the management of bacterial wilt and other wilting diseases in solanaceous crops in the southern Philippines and Australia'.	Female	Australian
Young A, Justo V, Nandita P, Trevorrow P, Tesoriero L and Forsyth L (2009) 'Annual report: Integrated strategies for the management of bacterial wilt and other wilting disease in solanaceous crops in the southern Philippines and Australia'.	Male	Australian
Poster presentation		
Balendres M, Dela Cueva F and Justo V (20–23 September 2011) 'Bacterial wilt: What you should know about it', poster presented at 18th NOMIARC Field Days and Technology Forum, Malaybalay City, Philippines.	Male	Filipino
Vergara M, Tiongco L, Cueva Dela F and Justo V (12 March 2010) 'PCR detection, biochemical characterization and aggressiveness of <i>R. solanacearum</i> collected from North Mindanao', poster presented at 41st Anniversary and Scientific Conference of the Pest Management Council of the Philippines, Davao City, Philippines.	Unknown	Unknown

Component 4 – Value chains

Peer-reviewed conference proceedings/papers (published)	Lead author			
	Gender	Nationality	h-index (Scopus)	Number of citations
Axalan J, Israel F, Concepcion S, Batt P, Murray-Prior R and Loma L (2011) 'Socioeconomic impact of cluster marketing: the case of Ned Landcare Association Sweet Pepper Cluster', <i>Acta Horticulturae</i> , 895:7–44.	Male	Filipino	Unknown	11 – Google Scholar 3 – ResearchGate
Axalan J, Murray-Prior R, Concepcion S, Lamban R, Real R, Montiflor M, Batt P, Rola-Rubzen M, Bacus R, Israel F and Apará D (7–10 February 2012) 'Relationships with market intermediaries: the case of vegetable cluster marketing in Southern Philippines', paper presented at 56th AARES Annual Conference, Fremantle, Australia.	Male	Filipino	Unknown	2 – Google Scholar 1 – ResearchGate
Axalan J, Concepcion S, Montiflor M, Lamban R, Real R, Batt P, Murray-Prior R, Rola-Rubzen M, Israel F, Apará D and Bacus R (2013) 'Social capital and trust in collaborative marketing groups: the case of vegetable cluster marketing in the Southern Philippines', <i>Acta Horticulturae</i> , 1006:79–84.	Male	Filipino	Unknown	1 – Google Scholar 1 – ResearchGate
Bacus R, Real R, Concepcion S, Montiflor M and Aguinaldo R (2015) 'Linking smallholder vegetable producers to high-value markets: challenges, experiences and lessons from marketing clusters in the Southern Philippines', <i>Acta Horticulturae</i> , 1103:49–54.	Male	Filipino	4 – ResearchGate	2 – Google Scholar 2 – ResearchGate
Batt P, Concepcion S, Lopez M, Axalan J, Hualda L and Montiflor M (2011) 'Exploring the institutional market for fresh vegetables in the Southern Philippines', <i>Acta Horticulturae</i> , 895:59–68.	Male	Australian	13	11 – Google Scholar 4 – ResearchGate
Batt P, Concepcion S, Murray-Prior R, Axalan J, Lamban R, Montiflor M, Real R, Israel F, Apará D and Bacus R (3 July 2012) 'Addressing quality impediments in fresh vegetable supply chains in Mindanao', presented at ACIAR–PCAARRD Southern Philippines Fruits and Vegetables Program Meeting, Cebu, Philippines.	Male	Australian	13	8 – Google Scholar 3 – ResearchGate
Batt P, Concepcion S, Murray-Prior S and Israel F (2011) 'Experiences in linking smallholder vegetable farmers to the emerging institutional market in the Philippines', <i>Acta Horticulturae</i> , 921:57–63.	Male	Australian	13	13 – Google Scholar 5 – ResearchGate
Concepcion S, Montiflor M, Axalan J, Lamban R, Real R, Batt P, Murray-Prior R, Israel F, Bacus R and Apará DI (2011) 'Clusters and networks as enablers of product and process innovation' paper presented at 12th International Conference of the Society for Global Business and Economic Development.	Female	Filipina	5	1 – Google Scholar Not found – ResearchGate
Ebarle E (July 2012) 'A comparative analysis of marketing margins of fruit and vegetables in Mindanao, the Philippines', <i>Acta Horticulturae</i> , 1006:143–147.	Unknown	Filipino	1 – ResearchGate	2 – Google Scholar 2 – ResearchGate

Peer-reviewed conference proceedings/papers (published)	Lead author			Number of citations
	Gender	Nationality	h-index (Scopus)	
Lamban R, dela Cerna A, Montiflor M, Bacus R, Ramirez L, Concepcion S, Batt P and Murray-Prior R (2011) 'Factors affecting farmers' adoption of natural farming technologies in New Albay, Maragusan, Compostela Valley, Philippines', <i>Acta Horticulturae</i> , 895:153-158.	Unknown	Filipino	Unknown	9 – Google Scholar 10 – ResearchGate
Lamban R, Montiflor M, Rodel R, Axalan J, Concepcion S, Bacus R, Apará D, Israel F, Batt P, Murray-Prior R and Rola-Rubzen M (2013) 'Benefits derived from clustering: the case of vegetable clusters in the Southern Philippines', <i>Acta Horticulturae</i> , 1006:203-208.	Unknown	Filipino	Unknown	3 – Google Scholar 6 – ResearchGate
Montiflor M, Axalan J, Lamban R, Real R, Concepcion S, Batt P, Murray-Prior R and Rola-Rubzen M (2013) 'Leadership perceptions in collaborative marketing groups: the case of Southern Philippines', <i>Acta Horticulturae</i> , 1006:245-252.	Female	Filipina	6	1 – Google Scholar 1 – ResearchGate
Montiflor M, dela Cerna A, Lamban R, Bacus R, Concepcion S, Batt P and Murray-Prior R (2011) 'Social connections and smallholder vegetable farmers' collaborative marketing strategy: the case of small farmers association of Quirogpang in Davao City, Philippines', <i>Acta Horticulturae</i> , 895:177-184.	Female	Filipina	6	8 – Google Scholar 7 – ResearchGate
Murray-Prior R, Batt P, Concepcion S, Montiflor M, Axalan J, Lamban R, Real R, Israel F, Bacus R and Apará D (21-23 July 2011) 'Towards a sustainable approach to clustering small-scale farmers to market their agricultural produce', in <i>Proceedings of the 12th International Conference of the Society for Global Business and Economic Development: Building Capabilities for Sustainable Global Business: Balancing corporate success and social good</i> , SGBED, Singapore.	Male	Australian	8	3 – Google Scholar
Murray-Prior R, Batt P, Rola-Rubzen M, Concepcion S, Montiflor M, Axalan J, Real R, Lamban R, Israel F, Apará D and Bacus R (2013) 'Theory and practice of participatory action research and learning with cluster marketing groups in Mindanao, Philippines', <i>Acta Horticulturae</i> , 1006:269-276.	Male	Australian	8	3 – Google Scholar 4 – ResearchGate
Murray-Prior R, Concepcion S, Batt P, Israel F, Apará D, Bacus RH, Rola-Rubzen M, Montiflor M, Lamban R, Axalan J and Real R (3 July 2012) 'Experiences with the Catholic Relief Services' clustering process for agroenterprise development and some suggestions for improvement', in Oakeshott J and Hall D (eds) <i>Smallholder HOPES – horticulture, people and soil: Proceedings of the ACIAR-PCAARRD Southern Philippines Fruits and Vegetables Program meeting, Cebu, Philippines</i> , ACIAR Proceedings 139, Australian Centre for International Agricultural Research, Canberra, Australia.	Male	Australian	8	7 – Google Scholar 0 – ResearchGate

Peer-reviewed conference proceedings/papers (published)	Lead author			Number of citations
	Gender	Nationality	h-index (Scopus)	
Real R, Concepcion S, Montiflor M, Axalan J, Lamban R, Apará D, Israel F, Bacus R, Batt P, Murray-Prior R and Rola-Rubzen M (2013) 'Impact of collaborative marketing on vegetable production systems: the case of clustering in the Southern Philippines', <i>Acta Horticulturae</i> , 1006:303–308.	Male	Unknown	Unknown	4 – Google Scholar 5 – ResearchGate
Real R, Hualda L, Apará D, Concepcion S, Batt P and Murray-Prior R (2011) 'Microfinance as the key factor affecting farmers' investment decision-making: cluster experiences in Impasugong, Bukidnon, Philippines', <i>Acta Horticulturae</i> , 895:239–244.	Male	Unknown	Unknown	8 – Google Scholar 3 – ResearchGate
Rola-Rubzen M, Murray-Prior R, Batt P, Concepcion S, Real, Lamban R, Axalan R, Montiflor M, Israel F, Apará D and Bacus R (3 July 2012) Impacts of clustering of vegetable farmers in the Philippines', in Oakeshott J and Hall D (eds) <i>Smallholder HOPES – horticulture, people and soil: Proceedings of the ACIAR-PCAARRD Southern Philippines Fruits and Vegetables Program meeting, Cebu, Philippines</i> , ACIAR Proceedings 139, Australian Centre for International Agricultural Research, Canberra, Australia.	Female	Filipina	12	10 – Google Scholar Not found – ResearchGate
Murray-Prior R, Israel F, Bacus R, Apará D, Concepcion S, Montiflor M, Axalan J, Lamban R, Real R, Batt P and Rola-Rubzen M (2011) 'Reducing poverty through participatory action learning and action research processes with smallholder vegetable farmers in Mindanao, Extension Farming Systems', <i>Extension Farming Systems</i> , 7(2):109–114.	Male	Australian	8	4 – Google Scholar 3 – ResearchGate

Associated publications	Lead author	
	Gender	Nationality
Conference paper		
Aban M, Concepcion S and Montiflor M (9 August 2010) 'Consumers' perceptions on food safety of vegetables in Davao City', paper presented at Second Agribusiness Economics Conference, Davao City, Philippines.	Unknown	Unknown
Apara D, Real R, Concepcion S, Batt P, Murray-Prior R and Rola-Rubzen M (13–14 July 2011) 'Bukidnon marketing experiences on varied chain designs', paper presented at 3rd Agribusiness Economics Conference, Davao City, Philippines.	Unknown	Unknown
Axalan J and Concepcion S (9 August 2010) 'Institutional market demand for fresh vegetables in Bacolod City and Iloilo City', paper presented at Second Agribusiness Economics Conference, Davao City, Philippines.	Male	Filipino
Axalan J, Concepcion S, Batt P, Hualda L, Montiflor M and Lopez M (9 September 2009) 'Institutional buyers criteria for choice of vegetable suppliers', paper presented at First Agribusiness and Economics Conference, Davao City, Philippines.	Male	Filipino
Axalan J, Concepcion S, Batt P, Murray-Prior R and Israel F (13–14 July 2011) 'Factors affecting the contraction of cluster marketing: the case of vegetable cluster marketing in Southern Mindanao', paper presented at 3rd Agribusiness Economics Conference, Davao City, Philippines.	Male	Filipino
Axalan J, Concepcion S, Batt P, Murray-Prior R, Rola-Rubzen M and Israel F (20–21 October 2011) 'Strategies and factors to strengthen smallholders collaborative marketing: the case of vegetable clusters in South Cotabato', paper presented at 48th Philippine Agricultural Economics and Development Association Biennial Convention, Batac City, Philippines.	Male	Filipino
Axalan J, Concepcion S, Lamban R, Montiflor M, Batt P, Murray-Prior R, Rola-Rubzen M, Bacus R and Israel F (7–10 February 2012) 'Relationships with market intermediaries: the case of vegetable cluster marketing in the Southern Philippines', paper presented at 56th Australian Agricultural and Resource Economics Society, Fremantle, Australia.	Male	Filipino
Axalan J, Concepcion S, Montiflor M, Lamban R, Real R, Batt P, Murray-Prior R, Rola-Rubzen M, Israel F, Apara D and Bacus R (10–11 July 2012) 'Factors affecting the level of trust of vegetable farmers in Southern Philippines', paper presented at 4th Agribusiness Economics Conference, Davao City, Philippines.	Male	Filipino
Axalan J, Israel F, Montiflor M, Lamban R, Concepcion S and Batt P (8–9 November 2010) 'Strategies to overcome transport impediments: the case of vegetable cluster farmers in Mindanao', paper presented at Mindanao Conference on Issues in Development, Davao City, Philippines.	Male	Filipino
Bacus R, Montiflor M, Lamban R, Concepcion S, Batt P, Murray-Prior R and Rola-Rubzen M (13–14 July 2011) 'Building capacities in marketing: the case of Davao City vegetable farmers', paper presented at 3rd Agribusiness Economics Conference, Davao City, Philippines.	Male	Filipino
Batt P (21–23 July 2011) 'Research needs and outcomes in agroenterprise development' [keynote address], 12th International Conference of the Society for Global Business and Economic Development, Singapore.	Male	Australian
Batt P (9 November 2011) 'State of organic farming in ASEAN countries' [keynote address], 8th National Organic Agriculture Conference, Tarlac, Philippines.	Male	Australian
Catre J (21–23 July 2011) 'The clustering approach to agroenterprise development for small farmers: the CRS-Philippines experience' [keynote address], 12th International Conference of the Society for Global Business and Economic Development, Singapore.	Unknown	Unknown
Concepcion SB (9 November 2011) 'Organic agriculture: some insights from Mindanao', paper presented at 8th National Organic Agriculture Conference, Tarlac, Philippines.	Female	Filipina
Concepcion S, Batt P, Murray-Prior R, Montiflor M, Axalan J, Lamban R, Real R, Israel F, Bacus R and Apara, D (21–23 July 2011) 'Clusters and networks as enablers of product and process innovation', paper presented at 12th International Conference of the Society for Global Business and Economic Development, Singapore.	Female	Filipina

Associated publications	Lead author	
	Gender	Nationality
Israel F (13–14 July 2011) 'Exploratory study of the potential benefits and challenges of vegetable bagsakan trading center of Kablon cluster', paper presented at 3rd Agribusiness Economics Conference, Davao City, Philippines.	Unknown	Unknown
Lamban R, Montiflor M, Axalan J, Real R, Concepcion S, Bacus R, Apará D, Israel F, Batt P, Murray-Prior R and Rola-Rubzen M (10–11 July 2012) 'Family labor cost and profitability: the case of vegetable farmers in Southern Philippines', paper presented at 4th Agribusiness Economics Conference, Davao City, Philippines.	Unknown	Filipino
Lamban R, Montiflor M, Bacus R, Concepcion S, Batt P and Murray-Prior R (9 August 2010) 'Impacts of clustering approach: the case of the Saloy Small Vegetable Farmers' Association', paper presented at Second Agribusiness Economics Conference, Davao City, Philippines.	Unknown	Filipino
Lamban R, Montiflor M, Concepcion S, Bacus R, Batt P and Murray-Prior R (13–14 July 2011) 'Institutional market versus traditional market: the case of Pamuhatan Farmers Association Cluster in the Philippines', paper presented at 3rd Agribusiness Economics Conference, Davao City, Philippines.	Unknown	Filipino
Lamban R, Montiflor M, Real R, Axalan J, Concepcion S, Bacus R, Apará D, Israel F, Batt P, Murray-Prior R and Rola-Rubzen M (8–9 November 2010) 'Benefits of collaborative marketing groups: the case of clustering in Mindanao', paper presented at Mindanao Conference on Issues in Development, Davao City, Philippines.	Unknown	Filipino
Lamban R, Montiflor M, Real R, Concepcion S, Bacus R and Apará D (20–21 October 2011) 'Traditional versus institutional market: the case of vegetable clusters in Southern Philippines', paper presented at 48th Philippine Agricultural Economics and Development Association Biennial Convention, Batac City, Philippines.	Unknown	Filipino
Montiflor M (24 November 2009) 'Overview of the vegetable market', paper presented at Second South Cotabato Vegetable Production and Marketing Forum.	Female	Filipina
Montiflor M, Axalan J and Concepcion S (9 August 2010) 'Mindanao vegetable institutional buyer preferences', paper presented at Second Agribusiness Economics Conference, Davao City, Philippines.	Female	Filipina
Montiflor M, Axalan J, Lamban R, Concepcion S, Bacus R, Batt P and Murray-Prior R (8–9 November 2010) 'Leadership concepts of vegetable cluster farmers in Southern and Central Mindanao', paper presented at Mindanao Conference on Issues in Development, Davao City, Philippines.	Female	Filipina
Montiflor M, Lamban R, Concepcion S, Bacus R, Batt P and Murray-Prior R (13–14 July 2011) 'Factors affecting collaborative marketing group expansion: the case of Saloy, Calinan District, Philippines', paper presented at 3rd Agribusiness Economics Conference, Davao City, Philippines.	Female	Filipina
Montiflor M, Lamban R, Concepcion S, Bacus R, Batt P, Murray-Prior R and Rola-Rubzen M (20–21 October 2011) 'Benefits of technical and capacity-building training in strengthening collaborative marketing groups: Case of Brgy. Marilog and Brgy. Calinan vegetable farmers', paper presented at 48th Philippine Agricultural Economics and Development Association Biennial Convention, Batac City, Philippines.	Female	Filipina
Montiflor M, Lamban R, Real R, Axalan J, Concepcion S, Batt P, Murray-Prior R and Rola-Rubzen M (10–11 July 2012) 'Perception of Mindanao smallholder vegetable farmers on clustering', paper presented at 4th Agribusiness Economics Conference, Davao City, Philippines.	Female	Filipina
Real R, Concepcion S, Hualda L, Lamban R, Axalan J, Montiflor M, Batt P, Murray-Prior R, Rola-Rubzen M, Apará D, Bacus R and Israel F (10–11 July 2012) 'Comparative analysis of production and profitability of cluster and non-cluster farmers in Southern Philippines', paper presented at 4th Agribusiness Economics Conference, Davao City, Philippines.	Male	Filipino
Real R, Hualda L, Apará D and Concepcion S (9 August 2010) 'Farmer's preference for a downstream buyer: clusters' experiences in Impasugong and Lantapan, Bukidnon, Southern Philippines', paper presented at Second Agribusiness Economics Conference, Davao City, Philippines.	Male	Filipino

Associated publications	Lead author	
	Gender	Nationality
Real R, Hualda L, Axalan J, Concepcion S, Batt P, Murray-Prior R, Apará D and Israel F (8–9 November 2010) 'Agricultural loan arrangements for smallholder farmers: issues, challenges and strategies', paper presented at Mindanao Conference on Issues in Development, Davao City, Philippines.	Male	Filipino
Real R, Montiflor M, Axalan J, Lamban R, Hualda L, Concepcion S, Apará D, Bacus R, Israel F, Batt P, Murray-Prior R and Rola- Rubzen M (20–21 October 2011) 'Agricultural loan arrangements and seed support for smallholder farmers in Southern Philippines: issues, strategies and lessons learned', paper presented at 48th Philippine Agricultural Economics and Development Association Biennial Convention, Batac City, Philippines.	Male	Filipino
Rola-Rubzen M, Batt P, Murray-Prior R, Concepcion S, Montiflor M, Real R, Lamban R and Axalan J (7–10 February 2012) 'Are cluster farmers more technically efficient than non-cluster farmers? The case of vegetable farmers in Mindanao, Philippines', paper presented at 56th Australian Agricultural and Resource Economics Society, Fremantle, Western Australia.	Female	Filipina
Report		
Concepcion S, Batt P, Lopez M, Axalan J, Hualda L and Montiflor M (n.d.) <i>A review of the institutional market for fresh vegetables in Metro Manila, the Visayas and Mindanao</i> , University of the Philippines Strategic Research and Management Foundation.	Female	Filipina
Concepcion S, Batt P, Lopez, M, Axalan J, Hualda L and Montiflor M (2012) <i>Institutional Market Study Report</i> , UPSTREAM.	Female	Filipina

Component 5 – Economics and policy

Conference proceeding paper (peer reviewed)	Lead author			Number of citations
	Gender	Nationality	h-index (Scopus)	
Aguinaldo R, Sarmiento J, Digal L, Balgos C and Castillo A (3 July 2012) 'Analysing the performance of farmers in the mango value chain in major production areas in Davao Region, Philippines', in Oakeshott J and Hall D (eds) <i>Smallholder HOPES – horticulture, people and soil: Proceedings of the ACIAR-PCAARRD Southern Philippines Fruits and Vegetables Program meeting, Cebu, Philippines</i> , ACIAR Proceedings 139, Australian Centre for International Agricultural Research, Canberra, Australia.	Female	Filipina	3 – Google Scholar	8 – Google Scholar 3 – ResearchGate
Armenia P, Menz K, Rogers G, Gonzaga Z, Gerona R and Tausa Elsie (3 July 2012) 'Economics of vegetable production under protected cropping structures in the Eastern Visayas, Philippines', in Oakeshott J and Hall D (eds) <i>Smallholder HOPES – horticulture, people and soil: Proceedings of the ACIAR-PCAARRD Southern Philippines Fruits and Vegetables Program meeting, Cebu, Philippines</i> , ACIAR Proceedings 139, Australian Centre for International Agricultural Research, Canberra, Australia.	Male	Filipino	2 – Google Scholar	12 – Google Scholar 6 – ResearchGate
Briones R and Galang I (3 July 2012) 'Assessment of prospective impact of fruits and vegetables research at the industry level in the Philippines: the case of the ACIAR-PCAARRD horticulture project', in Oakeshott J and Hall D (eds) <i>Smallholder HOPES – horticulture, people and soil: Proceedings of the ACIAR-PCAARRD Southern Philippines Fruits and Vegetables Program meeting, Cebu, Philippines</i> , ACIAR Proceedings 139, Australian Centre for International Agricultural Research, Canberra, Australia.	Male	Filipino	5	4 – Google Scholar
Llanto G, Sombilla M, Quilloy K and Quimba Francis (3 July 2012) 'Market structure analysis: the case of some high-value fruits and vegetables in Mindanao', in Oakeshott J and Hall D (eds) <i>Smallholder HOPES – horticulture, people and soil: Proceedings of the ACIAR-PCAARRD Southern Philippines Fruits and Vegetables Program meeting, Cebu, Philippines</i> , ACIAR Proceedings 139, Australian Centre for International Agricultural Research, Canberra, Australia.			Not found	1 – Google Scholar
Oakeshott J and Hall D (eds) (3 July 2012) <i>Smallholder HOPES – horticulture, people and soil: Proceedings of the ACIAR-PCAARRD Southern Philippines Fruits and Vegetables Program meeting, Cebu, Philippines</i> , ACIAR Proceedings 139, Australian Centre for International Agricultural Research, Canberra, Australia.	Male	Australian	58	
Preciados L, Bulayog S, Borines L and Guadalquever G (3 July 2012) 'Ex-ante impact assessment of <i>Phytophthora</i> disease control for jackfruit in Region VIII, southern Philippines', in Oakeshott J and Hall D (eds) <i>Smallholder HOPES – horticulture, people and soil: Proceedings of the ACIAR-PCAARRD Southern Philippines Fruits and Vegetables Program meeting, Cebu, Philippines</i> , ACIAR Proceedings 139, Australian Centre for International Agricultural Research, Canberra, Australia.	Male	Filipino	3 – Google Scholar	4 – Google Scholar 1 – ResearchGate

Conference proceeding paper (peer reviewed)	Lead author			Number of citations
	Gender	Nationality	h-index (Scopus)	
Preciados L, Bulayog MS and Notarte A (3 July 2012) 'Ex-ante impact assessment of the adoption of IPM strategies for mango in Region XI of the southern Philippines', in Oakeshott J and Hall D (eds) <i>Smallholder HOPES – horticulture, people and soil: Proceedings of the ACIAR-PCAARRD Southern Philippines Fruits and Vegetables Program meeting, Cebu, Philippines</i> , ACIAR Proceedings 139, Australian Centre for International Agricultural Research, Canberra, Australia.	Male	Filipino	4 – Google Scholar	6 – Google Scholar 2 – ResearchGate
Preciados L, Bulayog MS, Soguilon C and Montiel C (3 July 2012) 'Gross margin impact analysis on adoption of Phytophthora control strategies for durian in Region XI, southern Philippines', in Oakeshott J and Hall D (eds) <i>Smallholder HOPES – horticulture, people and soil: Proceedings of the ACIAR-PCAARRD Southern Philippines Fruits and Vegetables Program meeting, Cebu, Philippines</i> , ACIAR Proceedings 139, Australian Centre for International Agricultural Research, Canberra, Australia.	Male	Filipino	3 – Google Scholar	2 – Google Scholar 0 – ResearchGate
Rola-Rubzen M, Murray-Prio R, Batt P, Concepcion S, Real R, Lamban R, Axalan J, Montiflor M, Israel F, Apra D and Bacus R (3 July 2012) 'Impacts of clustering of vegetable farmers in the Philippines', in Oakeshott J and Hall D (eds) <i>Smallholder HOPES – horticulture, people and soil: Proceedings of the ACIAR-PCAARRD Southern Philippines Fruits and Vegetables Program meeting, Cebu, Philippines</i> , ACIAR Proceedings 139, Australian Centre for International Agricultural Research, Canberra, Australia.	Female	Australian	12	10 – Google Scholar
Sarmiento J, Aguinaldo R, Digal L, Castro M, Comido S, Balgos C and Hall D (3 July 2012) 'Analysing the performance of smallholder cabbage farmers in the southern Philippines', in Oakeshott J and Hall D (eds) <i>Smallholder HOPES – horticulture, people and soil: Proceedings of the ACIAR-PCAARRD Southern Philippines Fruits and Vegetables Program meeting, Cebu, Philippines</i> , ACIAR Proceedings 139, Australian Centre for International Agricultural Research, Canberra, Australia.	Male	Filipino	4 – ResearchGate	0 – Google Scholar 2 – ResearchGate
Bulayog M and Preciados L (2012) 'Farm-level impact assessment of ACIAR HORT fruit technologies: the case of phytophthora control in jackfruit and durian', Davao City, Philippines. Other details not available.	Female	Filipina		
Preciados L (2010) 'Ex- ante impact assessment on phytophthora disease control for jackfruit, Southern Philippines', Davao City, Philippines. Other details not available.	Male	Filipino	2	3 – Google Scholar 1 – ResearchGate

Associated publications (published)

Paper	Lead author			Number of citations
	Gender	Nationality	h-index (Scopus)	
Refereed report				
Briones R (2008) 'Agricultural diversification and the fruits and vegetables subsector: policy issues and development constraints in the Philippines', <i>Philippine Journal of Development No. 65</i> , 35(2).	Male	Filipino	5	20 – Google Scholar 11 – ResearchGate
Briones R and Galang IM (2012) 'Assessment of prospective impact of fruits and vegetables research at the industry level in the Philippines: the case of the ACIAR- PCAARRD horticulture project', final report.	Male	Filipino	5	4 -Google Scholar Not found -- ResearchGate
Llanto G, Sombilla M, Quilloy K and Quimba F (2013) <i>Strengthening markets of high-value fruits and vegetables in Mindanao: the case of transport and shipping service improvement</i> , Southeast Asian Regional Center for Graduate Study and Research in Agriculture, Los Baños, Philippines.	Male	Filipino	5	1 – Google Scholar

Associated publications

Paper	Lead author	
	Gender	Nationality
Discussion paper		
Briones R (2009) <i>Agricultural diversification and the fruits and vegetables subsector: policy issues and development constraints in the Philippines</i> , Discussion Paper No. 2009–02, Philippine Institute for Development Studies, Makati City.	Male	Filipino
Manual		
Briones R and Galang IM (2012) <i>Welfare impact simulator for evaluating research: a manual for users</i> .	Male	Filipino
Report		
Briones R and Galang IM (2012) Welfare impact simulator for evaluating research [spreadsheet].	Male	Filipino
Domingo et al. (2013) 'Vegetable production and farmers' profile in the Southern Philippines', draft report from PhD thesis, part-funded by project.	Male	Filipino
Domingo (2013) 'Gross margins for eleven vegetable crops in Mindanao' [unpublished spreadsheet], available on ACIAR archive website, Meridio.	Male	Filipino
Kelly G, Napier T and Watts S (2013) 'Farm enterprise budgets for NSW vegetables', NSW DPI.	Male	Filipino
McClintock A, Preciados L, Orr L and Bulayog MS (2012) 'Economic impacts of Component 2: protected cropping technology for vegetable production in the Southern Philippines', interim report prepared for ACIAR project HORT/2007/066/5, NSW DPI and Visayas State University.	Female	Australian
McDougall S and Orr L (2011) 'Benchmarking vegetable IPM adoption: business case for adoption of integrated pest management (IPM) in lettuce', part of report for national vegetable IPM coordination project (VG09191).	Female	Australian
Orr L (2009) 'Australian (NSW) vegetable gross margin budgets for selected 10 vegetables', internal NSW DPI report, available on ACIAR archive website, Meridio.	Female	Australian
Orr L (2010) 'Benefit cost analysis of a multitarget approach to fruitspotting bug management', internal report, Philippines Web2 site.	Female	Australian
Orr L (2010) 'Analysis of papaya research with and without technology', in C5 2010 annual report, available on ACIAR archive website, Meridio.	Female	Australian

Paper	Lead author	
	Gender	Nationality
Orr L, Bulayog M.S, McClintock A and Preciados L (2010) 'Economic impacts of new technologies and policy constraints in the production of fruit in the Philippines and Australia', presentation of component research, Canberra, Australia.	Female	Australian
Orr L and Al-Khawaldeh (2010) 'Assessing the benefits from improved environmental controls in greenhouse vegetable production in NSW', internal NSW DPI report, available on ACIAR archive website, Meridio.	Female	Australian
Orr L and McDougall S (2011) 'Benchmarking vegetable IPM adoption: cost-benefit analysis of IPM adoption by NSW lettuce growers', part of report for National Vegetable IPM Coordination project (VG09191), available on ACIAR archive website, Meridio.	Female	Australian
Orr L and McClintock A (2009) 'The fruit and vegetable industry Southern Philippines 2000–2009: key statistics', available on ACIAR archive website, Meridio.	Female	Australian
Orr L, Mullen J and Jones R (2009) 'An evaluation of the economic, environmental and social impacts of NSW DPI investments in IPM research in cold disinfestation of citrus for quarantine restricted markets', unpublished economic research report.	Female	Australian
Page J (2013) 'An economic assessment of the contribution of trellising to the economic resilience of Far North Queensland fruit tree crops', internal Queensland DAFF report.	Male	Australian
Page J (2013) 'An economic assessment of <i>Phytophthora</i> control in papaya through better fallow management', internal Queensland DAFF report.	Male	Australian
Page J (2013) 'Economic assessment of cocoa production in Far North Queensland', internal Queensland DAFF report.	Male	Australian
Parks S, Orr L and Al-Khawaldeh B (2011) 'Is upgrading from low to high-tech greenhouses profitable?', paper presented at Protected Cropping Australia Conference, Adelaide, Australia.	Female	Australian
Parks S, Orr L and Al-Khawaldeh B (18–20 July 2012) 'Is upgrading from low to high-tech greenhouses profitable?', paper presented at Hydroponic Farmers Federation Conference 2012, Ballarat, Australia.	Female	Australian
Web2 publication		
Aguinaldo R, Digal L, Sarmiento J, Balgos C, Romo G and Laorden N (n.d.) 'Economic analysis of the value chain in southern Philippines: price spread, price transmission and net margins analyses of fruits and vegetables' (lettuce, potato, tomato, cabbage, eggplant, mango, durian, jackfruit and papaya).	Female	Filipina
Aguinaldo R, Digal L, Sarmiento J, Balgos C, Romo G and Laorden L (n.d.) 'Price spread, net margins analyses and market integration for fruits and vegetables' [3 working papers], available from senior author.	Female	Filipina
Bulayog MS and Preciados L (2009) 'Gross margins, Leyte, Mindanao and Philippines vegetables enterprise budgets', available on ACIAR archive website, Meridio.	Female	Filipina
Bulayog MS and Preciados L (2009) 'Region VIII Cabintan, Leyte vegetables enterprise budgets', available at ACIAR archive website, Meridio.	Female	Filipina
Bulayog MS and Preciados L (2009) 'Upland rain-fed cabintan cropping systems and the different seasons' (Working Paper No. 1), available from senior author.	Female	Filipina
Bulayog MS, Preciados L, McClintock A and Orr L (2010) 'Cabintan vegetable farm model', available from senior author.	Female	Filipina
Laorden N, Digal L, Aguinaldo R, Sarmiento J, Balgos C and Romo G (n.d.) 'Analyzing small farmer performance and productivity in selected fruits and vegetable value chains in Mindanao' [3 working papers], available from senior author.	Male	Filipina
McClintock A, Orr L, Bulayog MS and Preciados L (2009) 'Baseline vegetable budgets for region VIII, Philippines', available from senior author.	Female	Australian
Orr L (n.d.) 'Philippine Agricultural Statistics for fruit and vegetables' [summary].	Female	Australian

Paper	Lead author	
	Gender	Nationality
Orr L, Preciados L, McClintock A, Bulayog MS (2010) 'Draft of scientist interview responses C2 fruit – <i>Phytophthora</i> disease for durian and jackfruit', available from senior author.	Female	Australian
Preciados L (2011) 'Farm-level impacts of fruit technologies: the case of mango ICM recommendations' [trip report], available from senior author.	Male	Filipino
Preciados L (2013) 'Papaya production baseline data and "without technology" gross margins' [unpublished report], available from senior author.	Male	Filipino
Working paper		
Aguinaldo R, Digal L, Romo G, Laorden N, Sarmiento J, McClintock A and Orr L (2011) 'Price spread analysis of selected fruits and vegetables in Southern Mindanao'.	Female	Filipina
Bulayog MS and Preciados L (2009) 'Enterprise budget (farmers practice) for region 8, Cabintan, Leyte', C5 Working Paper No. 2.	Female	Filipina
Bulayog MS and Preciados L (2009) 'Upland rain-fed Cabintan cropping systems and the different seasons', C5 Working Paper No. 1.	Female	Filipina
Laorden NL, Romo GDA, Digal LN, Aguinaldo RT, Sarmiento JMP, McClintock A and Orr L (2011) 'Net margin analysis of selected fruits and vegetables in Mindanao' [draft working paper].	Male	Filipino
Romo GDA, Digal LN, Aguinaldo RT, Laorden NL, Sarmiento JMP, McClintock A and Orr L (2011) 'Spatial integration of selected crops in the Philippines' [draft working paper].	Female	Filipina

Appendix 8: Marketing clusters: key stakeholders

Several key stakeholder groups participated in and/or supported marketing clusters and related value-chain activities under HORT/2007/066 (C4) and AGB/2012/109. Given the varying characteristics and processes of the markets in Mindanao and Visayas, a separate overview is provided for each region.

Mindanao

The stakeholders who participated in and/or supported the marketing-cluster activities in the institutional and wet markets of the Davao area are detailed below.

Industry associations: NorMinVeggies and VICSMIn

NorMinVeggies and VICSMIn are collaborative farmer associations mainly composed of independent farmers who are shipping better-quality products to institutional markets in Manila, Visayas and Mindanao. Both organisations play a pivotal role in the promotion and advancement of the vegetable industry in Mindanao. NorMinVeggies is currently dormant following the COVID-19 pandemic.

VICSMIn was established in 2001 and is still currently active. VICSMIn actively supports smallholder farmers by bridging the gap between producers and buyers, thereby reducing reliance on intermediaries. One of its initiatives was the proposal to establish Davao Food Terminal, a PHP70 million budget project that was established in 2017 to serve as a wholesale hub for Davao City.

VICSMIn established a for-profit entity named Davao Regional Agricultural Cooperative (DRACO) to manage the terminal. DRACO also aimed to serve the farmers and provided a significant amount of funding for farmers who supplied Davao Food Terminal. DRACO has implemented rules that ensure transparency and fairness in transactions. Each farmer must possess a registered card and financial transactions are conducted through banks, ensuring traceability and accountability in the flow of money. Importantly, taxes are paid directly, contributing to government revenue and fostering a culture of compliance.

Initially, VICSMIn and the Davao City Agriculturist Office envisaged that Davao Food Terminal would serve as:

- a way for farmers to showcase and sell their produce efficiently (farmers would be involved in determining agreements on the percentage of their products to be supplied)
- a hub to establish price reference for purchases

- a platform to provide advances for fertilisers and trucks for transportation for farmers.

Farmers, either as individuals or in clusters, would deliver their products, and the DRACO inspection team would examine them for quality. If the products passed the quality check, the farmers would get paid that day. This was in contrast to the existing practice at that time, where traders or consolidators paid the farmers one or more days later, and if the price was then lower, that was the price paid.

However, Davao Food Terminal faced challenges due to issues with traders in Bangkerohan, a prominent and large wet market in Davao City. It was challenging to get farmers to drop off their fruits and vegetables at the terminal due to the presence of the wet market in Bangkerohan.

At the time of the evaluation field visit, Davao Food Terminal had temporarily stopped operating (City Government of Davao City 2022). However, it resumed operations in October 2023, with the Davao City Agriculturist Office assuming a major role. However, the same issues prevail as farmers' and traders' activities are still concentrated at Bangkerohan.

VICSMIn also played the role of a connector between the government, market and farmers. It regularly conducted a national vegetable market summit, which brought together key stakeholders, including companies such as East-West Seed. This summit served as a platform for knowledge exchange, innovation showcase and collaboration to address challenges and explore opportunities in the vegetable sector across regions. Additionally, VICSMIn maintained good relationships with government agencies such as DA and CAO, which has a representative on the VICSMIn Council. VICSMIn also has a technical group, of which UPMIn and UPLB are members.

Institutional buyer: New City Commercial Corporation

NCCC is Mindanao's leading consumer goods retailer and wholesaler. During the implementation of C4, the Pamuhatan Farmers Association, one of the C4 marketing clusters located in Marilog, Davao, successfully established connections to supply NCCC with products such as tomato, bell pepper, calabash and chayote. However, in instances where their products fell short of NCCC's quality standards, they sold them to the wet market for approximately PHP10–15/kg less than NCCC would have paid.⁴³

43 Key informant interview and focus group discussion with members of the Pamuhatan Farmers Association.

The opportunity to extend sales to an institutional market was a result of a market survey conducted with the C4 agroenterprise coordinator. This initiative, coupled with improved knowledge of planting schedules to optimise production and a shared decision-making process among the cluster members regarding the percentage allocated to institutional buyers versus the wet market, was a direct outcome of learnings from the project. As an example, a farmer contributed 90% of their chayote yield to the cluster, while each cluster member supplied 5% of their tomato yield. Notably, 60–70% of the cluster’s overall volume was directed to NCCC and the remaining 30–40% was sold to the wet market.

Wet-market traders

During the field visit, the evaluation team had the opportunity to talk with a few traders in Bulua Market in Cagayan de Oro. Bulua is one of the biggest markets in Mindanao and features an extensive selection of fresh produce, locally sourced fruits, vegetables and a variety of meats. Approximately 500 vegetable traders operate there.⁴⁴ The traders acted as intermediaries between farmers and buyers. They source fresh products from farmers, both as individual and groups, usually in Bukidnon, and supply to various locations across the Philippines, including institutional buyers such as Gaisano supermarket.

The traders played a significant role in the value chain, including setting prices, which are determined based on factors like crop quality, size and condition. Prices are set informally, without contracts, and respond to supply and demand. When asked about the negative perception that traders set prices that disadvantage farmers, the traders responded that, contrary to prevailing assumptions, traders faced significant risks owing to the volatility of market prices. During periods of overproduction, traders often opted to purchase surplus goods from their trusted suppliers, with some choosing to donate excess produce to local institutions.

In some cases, traders also provided financing support, such as loans to farmers. However, they mentioned that these funds are often misdirected for purposes other than the intended agricultural use. This can lead to complications (including the inability of farmers to repay the loans) that hinder the effectiveness of farmer financing initiatives. When traders stopped the financing support, there was usually a decrease in supply to those traders.

Local government units and local Department of Agriculture offices

LGUs played a pivotal role in empowering farmers by offering a diverse array of training programs. For instance, the municipal agricultural office in Lantapan conducted various learning programs covering training on natural farming technology systems, farmer field schools and the School on the Air program. Farmers also received training on organic farming and good agricultural practices provided by LGUs and/or DA. Furthermore, LGUs assigned agricultural technicians to regularly visit and assess farmers (although coverage is somewhat dependent on budget priorities).

The DA office in Cagayan de Oro played a supportive role for NorMinVeggies’ marketing and commodity clusters through 3 key initiatives:

- marketing assistance to identify potential markets for farmers
- equipment support, such as rain protection for crops in NorMinVeggies’ areas
- third-party organic farming certifications.

The DA also provided crop insurance through the Philippine Crop Insurance Corporation. This insurance coverage was free of charge for the agriculture and livestock sectors, subject to individuals being registered members of the Registry System for the Basic Sector in Agriculture. Government assistance also included providing free fertiliser and seeds.

In general, farmers could access several avenues of support from the government. In fact, the potential to access this support was an incentive to formally organise into farmers’ groups or associations.

Visayas

While C4 concentrated its cluster-based approach in Mindanao, the follow-on AGB/2012/109 initiative took a broader perspective in both Mindanao and Visayas, analysing the vegetable value chain at the regional level, particularly in Visayas, encompassing areas such as Leyte and Cebu. This distinction between the 2 approaches suggested that C4 emphasised more localised and specific clusters within Mindanao, while AGB/2012/109 extended its scope to understand the dynamics and form a holistic view of the vegetable value chain across entire regions, fostering a more comprehensive understanding of the agricultural landscape in Mindanao and Visayas. Stakeholders who participated in and/or supported marketing aspects of the follow-on project in the Leyte area included wet-market traders and institutional buyers.

⁴⁴ Key informant interview with traders in Bulua Market, Cagayan de Oro City.

Wet-market traders

Before the initiation of the AGB project, the customary practice among smallholder farmers in the area involved selling their produce to a trader who also served as their financier, resulting in low selling prices. A significant contribution of AGB/2012/109 was the implementation of market price monitoring. The price information was provided to the farmer groups, revealing that prices in the marketplace were notably higher than those offered by the trader, potentially reaching triple the amount. However, farmers were wary of undermining their established working relationship with the trader. To address this concern, the project helped communicate with the trader, clarifying that the farmers would still sell a portion of their produce to him while diverting another portion direct to the market. Despite the establishment of a cluster, the farmers did not experience a substantial increase in their ability to influence prices. The role of traders remained crucial for risk-sharing purposes, as traders consolidated volumes from various buyers and assumed risks that the farmers, lacking the necessary resources, were unable to take on. The farmers maintained their connection with the trader because he played a pivotal role in financing their production activities.

Institutional buyers, including buyer chains from Cebu and supermarkets such as Gaisano

One of the key pillars of AGB/2012/109 was the advancement of marketing. This pillar had 4 steps:

- market assessment
- production planning
- test marketing and improvement
- value chain establishment.

One of the outcomes of the market assessment activities was a map of vegetable distribution networks (Figure A8.1). These assessments enabled farmer group members to identify crops to plant based on price and customers' preference as well as planting areas to meet target volume based on the demand.

Test marketing and improvement were conducted to determine the viability and effectiveness of various marketing strategies. During this phase, the farmers engaged in trial marketing initiatives, facilitated by the project team, to evaluate the market response to their produce. Feedback and data collected from these test marketing endeavours were analysed to identify areas of improvement in product presentation, pricing and overall market positioning. This iterative process allowed the farmers to refine their marketing approach, ensuring that it aligned with consumer preferences and demands.

One of the collaborators in the Visayas region, CALCOA, successfully forged marketing connections with value chain participants beyond their local area. This achievement directly resulted from the project, as CALCOA lacked such a network previously. Notably, CALCOA employed one of its members as a market specialist during implementation of AGB/2012/109.

At their inception, each of the clusters endeavoured to agree on how much members were willing to pay the marketing officer for facilitating the sales of the produce. The marketing officer had to not only liaise with the intended customer to identify the desired volumes and to agree on a price, but also coordinate delivery among the contributing farmers and, in some instances, arrange transport, accompany the produce to the buyer, collect the funds and then distribute the funds to the farmers on their return. On average, the marketing officer, who was also a member of the cluster, was paid 5% of the net proceeds of the sale. The price-setting arrangements were dependent upon the customers, the prevailing practices and the capacity of the cluster leaders to negotiate favourable terms of payment. For those clusters dealing with buyers in the traditional market, the terms of trade were primarily cash on delivery.

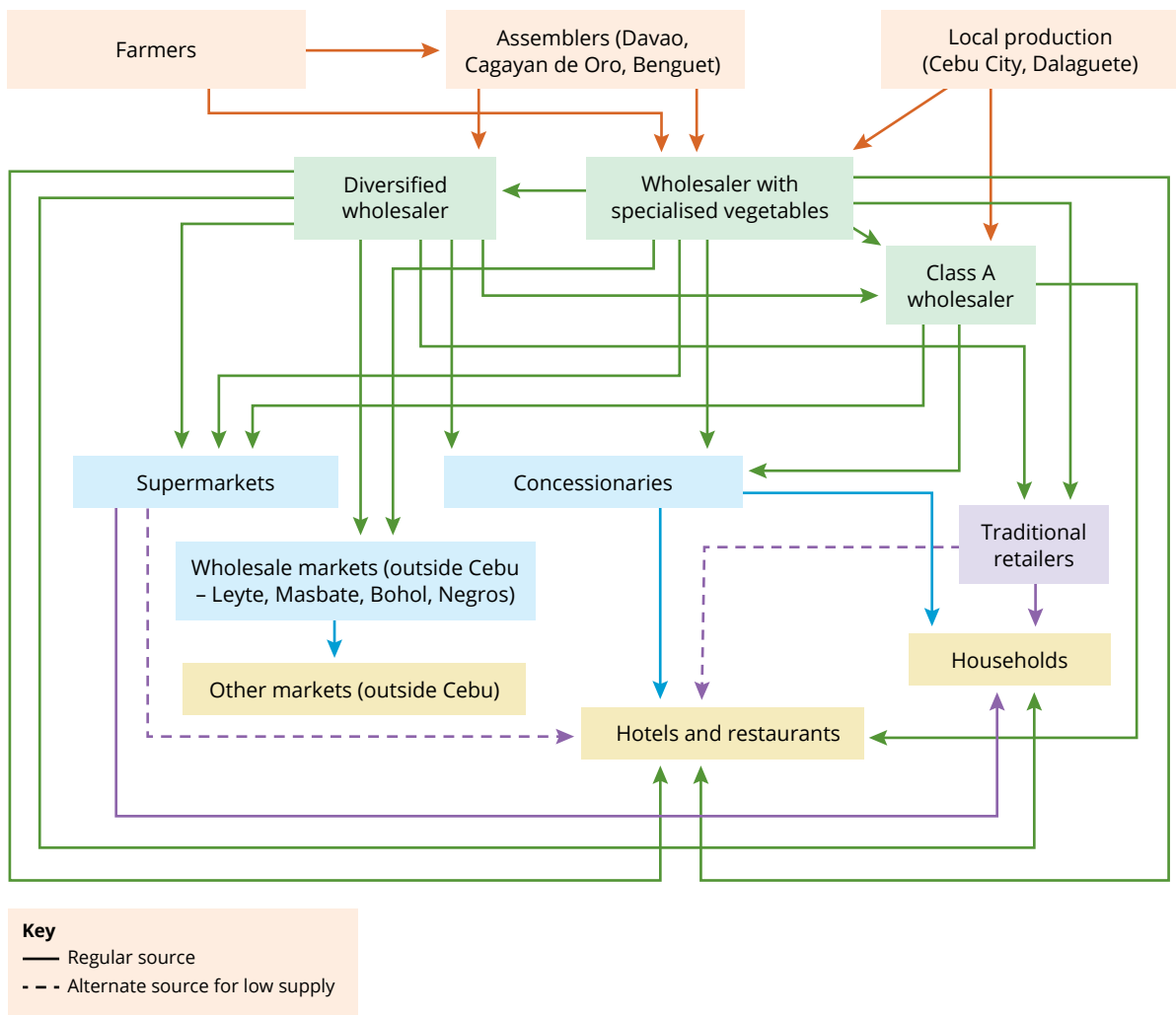


Figure A8.1 AGB/2012/109 map of vegetable distribution networks

Appendix 9: Quantitative survey data: Leyte farmers

The following tables are relevant quantitative assessments associated with the case study on protected cropping. Tables in the body of the report are not repeated here. Direct beneficiaries were farmer-collaborators during HORT/2007/066. Indirect beneficiaries received protective structures through their LGU. Non-beneficiaries have never used protective structures.

Respondents' ages (Table A9.1) reflect the current challenge in the Philippines of ageing farmers. Education levels of most respondents (and their spouses, not shown) were consistent with the generally high education levels in the Philippines. Thirty-four of the 61 interviewees were female, illustrating the strong participation of women in agriculture in Leyte.

Table A9.1 Sociodemographic profile of interviewees by beneficiary type, Leyte, 2022

	Direct beneficiary (N = 2)	Indirect beneficiary (N = 33)	Non-beneficiary (N = 29)
Sociodemographic characteristics			
Average age (years)	55	48	53
Male (%)	100	52	38
Female (%)	-	48	62
Married/de facto (%)	100	97	86
Widowed/separated/divorced (%)	-	3	14
Household size (no.)	5	5	5
Household members below 17 years of age (%)	40	20	20
Household members 60 years of age and above (%)	20	-	-
Household members with income (%)	20	40	40
Years in vegetable farming (no.)	34	9	11
Educational attainment of respondent (%)			
No formal schooling	-	3	-
Elementary (partial or full)	50	24	52
High school (partial or full)	50	36	24
College (partial or full)	-	33	17
Vocational graduate	-	-	7
Post-college graduate	-	3	-

All respondents grew a wide variety of vegetables (Table A9.2). None of the non-beneficiaries were growing lettuce but more were growing the lower-value local leafy vegetable, *pechay*.

Table A9.2 Crops planted by beneficiary type, Leyte, 2022

	Direct beneficiary (N = 2)		Indirect beneficiary (N = 33)		Non-beneficiary (N = 29)	
	No.	%	No.	%	No.	%
Tomato	1	50	15	45	14	48
Sweet pepper	-	-	22	67	12	41
Lettuce	1	50	2	6	-	-
<i>Pechay</i>	-	-	9	27	14	48
Cabbage	-	-	2	6	2	7
Others	2	100	26	79	20	69

Land areas planted differed considerably between the 3 respondent groups, as shown in Table A9.3.

Table A9.3 Vegetable farm characteristics by beneficiary type, Leyte, 2022

	Direct beneficiary (N = 2)	Indirect beneficiary (N = 33)	Non-beneficiary (N = 29)
Production characteristic			
Average vegetable area planted (ha)	10.15	1.26	0.64
Average no. of parcels planted	3	2	2
Land tenure status (%)			
Owned	40	45	44
Share tenant	-	28	30
Leased/rented	-	24	23
Certificate of land transfer	60	3	-
Mortgaged	-	-	2

Production

The most common factor affecting crop selection decisions by the Leyte respondents (Table A9.4) was seasonality, that is, the expected climatic conditions at planting time and their knowledge of what crops can be planted during either dry or wet seasons. Market demand and consequent income potential was another important consideration. The availability of seeds along with their quality also affected decisions. In particular, with the high commercial cost of inputs such as seeds and seedlings, many farmers rely on whatever is available free from their LGU and local DA office.

Table A9.4 Reasons for crop selection by beneficiary type, Leyte, 2022

	Direct beneficiary (N = 2)	Indirect beneficiary (N = 33)	Non-beneficiary (N = 29)
Seasonality	-	11	2
Market demand	-	7	4
Traditional	1	-	1
Seed quality and availability	1	8	10
Provided by the government	-	5	7
Available information	-	1	4
Site suitability	-	2	-
Pest and disease management	-	1	-
Resource availability	-	1	-
Ease in production	-	-	1

Note: Multiple responses were possible.

As noted in the case study discussion (KEQ 5), income levels differed significantly between the 3 groups. Further detail on returns for particular crops is provided in Table A9.5.

Table A9.5 Income by crop and beneficiary type, Leyte, 2022 (PHP/100 m²)

	Direct beneficiary (N = 2)	Indirect beneficiary (N = 33)	Non-beneficiary (N = 29)
Crop 1: Tomato	<i>n</i> = 0	<i>n</i> = 15	<i>n</i> = 14
Gross income	11,640	5,482	1,395
Costs	2,778	3,415	3,057
Net income	8,862	2,067	(1,662)
Crop 2: Sweet pepper	<i>n</i> = 0	<i>n</i> = 22	<i>n</i> = 12
Gross income	-	6,791	1,802
Costs	-	3,127	793
Net income	-	3,664	1,009
Crop 3: Lettuce	<i>n</i> = 1	<i>n</i> = 2	<i>n</i> = 0
Gross income	13,922	7,987	-
Costs	4,561	3,315	-
Net income	9,361	4,672	-
Crop 4: Pechay	<i>n</i> = 0	<i>n</i> = 9	<i>n</i> = 14
Gross income	-	7,987	14,976
Costs	-	3,315	12,869
Net income	-	4,672	2,107
Crop 5: Cabbage	<i>n</i> = 0	<i>n</i> = 2	<i>n</i> = 2
Gross income	-	5,262	3,067
Costs	-	1,127	1,031
Net income	-	4,135	2,036

Farmers in Baybay City⁴⁵ experience various challenges that negatively affect their production and income. Survey respondents reported their primary concerns were related to extreme weather and presence of pests and diseases (see Table A9.6). Extreme weather events include typhoons and flooding but drought is also common, resulting in some concerns about water supply.

45 In Baybay City, 69 *barangays* (districts) are classified as rural and 23 are classified as urban.

Table A9.6 Production challenges by beneficiary type, Leyte, 2022

	Direct beneficiary (N = 2)	Indirect beneficiary (N = 33)	Non-beneficiary (N = 29)
Extreme weather condition	1	15	7
Pests and diseases	1	14	16
Capital	-	1	
Water supply	-	-	1
None	-	5	5

Note: Multiple responses were possible.

Follow-up questions on how farmers address their challenges indicated that many, particularly in the non-beneficiary group, see limited options. In relation to extreme weather, all but 1 of the 7 non-beneficiaries, and 5 of the 15 indirect beneficiaries, had no management strategy. Three of the indirect beneficiaries answered that protective structures helped them deal with extreme weather (but note this is a very small sample size); another 3 would harvest early. The majority of interviewees addressed pest or disease threats through application of pesticides. This was expected as this has been among the conventional practices in the country and chemical pesticides are readily accessible to the local farmers.

Table A9.7 shows the importance of LGUs and the DA in providing information to farmers.

Table A9.7 Source of information by beneficiary type, Leyte, 2022

	Direct beneficiary (N = 2)		Indirect beneficiary (N = 33)		Non-beneficiary (N = 29)	
	No.	%	No.	%	No.	%
ACIAR	1	50	-	-	-	-
DA	2	100	10	30	3	10
LGU	-	-	22	67	13	45
VSU	1	50	1	3	2	7
Private sector	-	-	1	3	-	-
Co-farmers	-	-	1	3	6	21
Personal experience	-	-	1	3	-	-

Notes:

Multiple responses were possible.

ACIAR – Australian Centre for International Agricultural Research; DA – Department of Agriculture; LGU – local government unit;

VSU – Visayas State University

Appendix 10: Quantitative survey data: Davao farmers

The following tables are relevant quantitative assessments associated with the case study on marketing clusters in Davao, Mindanao. Tables in the body of the report are not repeated here. Beneficiaries were those who participated in C4 marketing clusters. Non-beneficiaries were not involved.

Table A10.1 Crops planted by beneficiary type, Davao City, 2022

	Direct beneficiary (N = 27)		Non-beneficiary (N = 30)	
	No.	%	No.	%
Tomato	15	56	19	63
Squash	12	44	2	7
Bitter gourd	9	33	3	10
Eggplant	3	11	9	30
Legumes	5	19	6	20
Other	12	44	25	83

Note: Other crops planted include cucumber, bell pepper, okra, *pechay*, cabbage, red pepper, ginger, sweetpotato, radish, carrots, Malabar spinach and onion

Table A10.2 Vegetable farm characteristics by beneficiary type, Davao City, 2022

	Direct beneficiary (N = 27)	Non-beneficiary (N = 30)
Production		
Average vegetable area planted (ha)	0.69	0.82
Average no. of parcels planted	2	1
Land tenure status (%)		
Owned	92	91
Share tenant	4	9
Leased/rented	4	-

As shown in Table A10.3, survey respondents from Davao City identified the presence of pests and diseases and occurrence of extreme weather conditions as significant challenges to their local agriculture sector. Financial challenges included the lack of capital for crop production, exacerbated by the increasing costs of inputs such as seeds, fertiliser and pesticides. This made smallholder farmers highly dependent on external support, especially from government instrumentalities. However, while DA and CAO provided vegetable seeds, farmers regarded these as low quality because there was stunted growth and low yield.

Table A10.3 Challenges encountered by beneficiary type, Davao City, 2022

	Direct beneficiary (N = 27)	Non-beneficiary (N = 30)
Extreme weather condition	4	10
Pests and diseases	19	12
Capital and cost of inputs	4	7
Poor soil condition	2	-
Quality of produce	-	2
None	1	-

Follow-up questions on how farmers address their challenges indicated that many, particularly in the beneficiary group, see limited options. In relation to extreme weather, all but 1 of the 12 beneficiaries who provided a response had no management strategy. 'Watering' was the most common strategy in the non-beneficiary group, reflecting that drought is a more frequent concern than torrential rain (as in Visayas). The majority of interviewees addressed pest or disease threats through application of pesticides. This was expected as this has been among the conventional practices in the country and chemical pesticides are readily accessible to the local farmers. However, input prices were also a concern, leading some to reduce their input use or look for cheaper alternatives such as cheaper brands or home-made compost.

Table A10.4 shows gross and net income received by Davao farmers from production of tomato, squash and bitter gourd during 2022 cropping cycles. As discussed under KEQ 5, farmers not involved in the C4 marketing clusters had significantly higher income per area than former C4 beneficiaries.

Table A10.4 Income by crop and beneficiary type, Davao City, 2022 (PHP/100 m²)

	Direct beneficiary (N = 27)	Non-beneficiary (N = 30)
Crop 1: Tomato	<i>n</i> = 15	<i>n</i> = 19
Gross income	3,851	5,299
Costs	1,824	2,208
Net income	2,027	3,091
Crop 2: Squash	<i>n</i> = 12	<i>n</i> = 2
Gross income	1,768	2,750
Costs	722	1,179
Net income	1,046	1,571
Crop 3: Bitter gourd	<i>n</i> = 9	<i>n</i> = 3
Gross income	5,024	7,639
Costs	2,512	3,321
Net income	2,512	4,318

Table A10.5 illustrates the continued heavy reliance of former C4 beneficiaries in Davao City on technical expertise from UPMin, whereas the non-beneficiaries rely more on their LGU. Both respondent groups also reported sourcing information from other farmers.

Table A10.5 Source of information by beneficiary type, Davao City, 2022

	Direct beneficiary (N = 27)		Non-beneficiary (N = 30)	
	No.	%	No.	%
UPMin	18	67	1	3
LGU	3	11	7	23
Co-farmers	10	37	11	37
DA	-	-	4	13
Internet	-	-	1	3
Market	-	-	1	3

Notes:

Multiple responses were possible.

DA - Department of Agriculture; LGU - local government unit;

UPMin - University of the Philippines Mindanao.

Table A10.6 shows respondents' recollections of training programs they attended both during the C4 period and subsequently. While the beneficiary group was able to access more training while participating in C4, this advantage has not been maintained through to the recent period.

Table A10.6 Training attended by beneficiary type, Davao City, 2018–2027

Period	Training topic	Direct beneficiary (N = 27)		Non-beneficiary (N = 30)	
		No.	%	No.	%
2008–2012	Agricultural production	6	20	2	7
	Pest and disease management	2	7	-	-
2013–2017	Agricultural production	5	19	3	10
	Good agricultural practices	-	-	1	3
2018–2022	Agricultural production	3	11	4	13
	Cluster marketing	1	4	-	-
	Good agricultural practices	1	4	1	3
	Pest and disease management	-	-	2	7
	Harvesting and post-harvesting	-	-	2	7
	Climate change	-	-	1	3

References

- ACIAR (2007) *ACIAR operating plan 2007–08*, Australian Centre for International Agricultural Research, Canberra.
- ACIAR (2012) *Protected vegetable cropping in the Visayas, Philippines* [YouTube video], Australian Centre for International Agricultural Research, Canberra. <https://www.youtube.com/watch?v=fKkNb0CN0xs>
- ACIAR (2006) 'Helping the Philippines along the path to prosperity', *Partners*, 2006 issue 1. Australian Centre for International Agricultural Research, Canberra. <https://www.aciar.gov.au/publication/partners-magazine/partners-magazine-2006-issue-1>
- ACIAR (2018) *ACIAR 10-Year Strategy 2018–2027: Research that works for developing countries and Australia*, Australian Centre for International Agricultural Research, Canberra.
- ACIAR (2022) *ACIAR 10-Year Strategy 2018–2027*, 2nd ed., Australian Centre for International Agricultural Research, Canberra. <https://www.aciar.gov.au/publication/corporate-publications/aciar-10-year-strategy-2018-2027>
- Aksnes DW, Langfeldt L and Wouters P (2019) 'Citations, citation indicators and research quality: An overview of basic concepts and theories', *SAGE Open*, 9(1). <https://doi.org/10.1177/2158244019829575>
- Aquino C (2003) *The Philippine vegetable industry almost comatose*, Focus on Poverty website. <https://www.focusonpoverty.org/the-philippine-vegetable-industry-almost-comatose/>
- BAFS (Bureau of Agriculture and Fisheries Product Standards) (2017) *Good Agricultural Practices (GAP) for fruits and vegetable farming – Code of Practice*, Department of Agriculture, Philippines Government.
- Batt P and Concepcion SB (2013) *Final report: Component 4: Analysis of selected value chains in southern Philippines (HORT/2007/066/4)*, Australian Centre for International Agricultural Research, Canberra.
- Batt P, Concepcion S and Catre J (2009) *Annual report: Project component 4: Analysis of selected vegetable value chains in the southern Philippines and Australia (HORT/2007/066/4)*, Australian Centre for International Agricultural Research, Canberra.
- Batt P, Concepcion S, Dagupen Benguet K and Murray-Prior R (2007) *ASEM-2005-062 final report*, Australian Centre for International Agricultural Research, Canberra. <https://www.aciar.gov.au/sites/default/files/2022-03/Final%20Report%20for%20ASEM-2005-062.pdf>
- BetterEvaluation (2022) *What is evaluation?* BetterEvaluation website. <https://www.betterevaluation.org/getting-started/what-evaluation>
- Bureau of Agricultural Research (2022) *The Philippine Vegetable Industry Roadmap (2021–2025)*, Department of Agriculture, Philippines Government.
- Chapman K, Batugal PA and Davies L (2011) *HORT/2007/066 final review*, Australian Centre for International Agricultural Research, Canberra.
- City Government of Davao City (2022) *New EO adopts IRR of Davao Food Terminal complex*, City Government of Davao City website. <https://www.davaocity.gov.ph/agriculture/new-eo-adopts-irr-of-davao-food-terminal-complex/>
- Concepción S, Digal LN and Uy JC (2008) *Innovative Practice Philippines: The case of NorMinVeggies in the Philippines*, International Institute for Environment and Development website. <https://www.ied.org/g03259>
- Catholic Relief Services (2007) *The clustering approach to agroenterprise development for small farmers – the CRS-Philippines experience: a guidebook for facilitators*, Catholic Relief Services, Davao City, Philippines.
- Craik W, Falvey L, Woods B, Tukuitonga C, Keating B, Grover S and Wyborn C (2022) *Mid-term review of the ACIAR 10-Year Strategy 2018–2027 and its impact on organisational performance and results: final report*, Australian Centre for International Agricultural Research, Canberra. <https://www.aciar.gov.au/corporate-governance/agency-reviews/strategy-review-2022>
- Davis J, Gordon J, Pearce D and Templeton D (2008) *Guidelines for assessing the impacts of ACIAR's research activities*, ACIAR Impact Assessment Series No. 58, Australian Centre for International Agricultural Research, Canberra.
- Davis P and Hanley C (2023) *A programmatic evaluation of the TADEP and ASLP programs*, ACIAR Outcome Evaluation No. 3, Australian Centre for International Agricultural Research, Canberra.
- Delforce J, Janssen G, Vesely K, Poulton D, Maksalmina and Kemala I (2023) *Aceh soils*, ACIAR Impact Assessment Series No. 106, Australian Centre for International Agricultural Research, Canberra.
- Dorahy C (2008) *Component proposal (HORT/2007/066 – Component 1)*, Australian Centre for International Agricultural Research, Canberra.
- Dorahy C, Tulin A and Eldridge S (2013) *Final report: Enhancing profitability of selected vegetable value chains in the southern Philippines and Australia, Component 1 – Integrated soil and crop nutrient management (HORT/2007/066/1)*, Australian Centre for International Agricultural Research, Canberra.
- Downer A (2000) *Australia's overseas aid program 2000–01*, Budget archives, Australian Government, Canberra. https://archive.budget.gov.au/2000-01/ministerial_statements/ausaid.pdf

- Ekman J (2019) *Improved postharvest management of fruit and vegetables in the southern Philippines and Australia – final report*, Australian Centre for International Agricultural Research, Canberra.
- Hall D (2008a) *Component proposal: Enhanced profitability of selected vegetable value chains in the southern Philippines and Australia – Component 6 – program management*, Australian Centre for International Agricultural Research, Canberra.
- Hall D (2008b) *Program proposal: Enhanced profitability of selected vegetable value chains in the southern Philippines and Australia – Program master document HORT-2007-066*, Australian Centre for International Agricultural Research, Canberra.
- Hall D (2013) *Final report: Enhancing profitability of selected vegetable value chains in the southern Philippines and Australia, Component 6 – program management and combined report (HORT/2007/066)*, Australian Centre for International Agricultural Research, Canberra.
- Hall D (2022) *Final report C5: Enhanced profitability of selected vegetable and fruit value chains in the Southern Philippines and Australia: Component 5 – Economic impacts of new technologies and policy constraints in the production of vegetables and fruit in the Southern Philippines and Australia (HORT/2007/066-5 and HORT/2007/067-5)*, Australian Centre for International Agricultural Research, Canberra.
- McDougall S (2019) *Final report: Integrated crop management (ICM) to enhance vegetable profitability and food security in the Southern Philippines and Australia (HORT 2012/020)*, Australian Centre for International Agricultural Research, Canberra.
- Murray-Prior RB, Rola-Rubzen MF, McGregor MJ, Batt PJ, Concepcion SB, Rasco E, Digal LN, Manalili NM, Moran A, Ellson A, Montiflor MO, Hualda L and Migalbin L (11–14 February 2003) 'A pluralistic methodology for analysing supply chains' [conference paper], *Australian Agriculture and Resources Economics Society Conference*, Perth, Australia. <https://doi.org/10.22004/ag.econ.57926>
- Murray-Prior R, Batt PJ, Concepcion SB, Montiflor MO, Axalan J, Lamban RJG, Real RR et al. (2011) 'Towards a sustainable approach to clustering small-scale farmers to market their agricultural produce', in *Proceedings of the 12th International Conference of the Society for Global Business and Economic Development, Jul 21–23, 2011*, Society for Global Business and Economic Development, Singapore.
- PSA (Philippine Statistics Authority) (2020) PSA website. <https://www.psa.gov.ph/>
- Rogers G (2007a) *Component proposal (Report No. HORT/2007/066/2)*, Australian Centre for International Agricultural Research, Canberra.
- Rogers G (2007b) *Potential for protected cropping research in Leyte and Mindanao. Visits to the Philippines 11–16 December 2006 and February 2007*, Australian Centre for International Agricultural Research, Canberra.
- Rogers G (2013) *Final report: Enhancing profitability of selected vegetable value chains in the southern Philippines and Australia, Component 2: Development of a cost-effective protected cropping system (HORT/2007/066–2)*, Australian Centre for International Agricultural Research, Canberra.
- Vock N and DEEDI (Department of Employment, Economic Development and Innovation – Queensland Government) (2013) *Final report: Sustaining landcare systems in the Philippines and Australia (Project No. ASEM/2002/051)*, Australian Centre for International Agricultural Research, Canberra.
- Vock N and DEEDI (Department of Employment, Economic Development and Innovation – Queensland Government) (2012) *Final report: Enhancing development outcomes for smallholder farmers through closer collaboration between ACIAR's landcare and other projects*, Australian Centre for International Agricultural Research, Canberra.
- Williams LJ, McMillan L, Van Wensveen M, Butler JRA, Camacho Jr JDV, Lapitan A, Datoon R, Gapas J, Pinca E, Macavinta-Gabunada F, Serino MNV, Nunez L, Recto AL, Ruales JH, Enerlan WC, Cagasan EG, Ani PAB and Aranas MB (2021) *An integrated approach to ex-post impact assessment*, ACIAR Impact Assessment Series Report No. 102, Australian Centre for International Agricultural Research, Canberra.
- Young A and Trevorrow P (2007) *Component proposal (proposal phase full proposal) program component, Component no. HORT/2007/066-3*, Australian Centre for International Agricultural Research, Canberra.

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59	Chupungco A, Dumayas E and Mullen J (2008)	Two-stage grain drying in the Philippines	PHT/1983/008, PHT/1986/008, PHT/1990/008
60	Centre for International Economics (2009)	ACIAR Database for Impact Assessments (ADIA): an outline of the database structure and a guide to its operation	
61	Fisher H and Pearce D (2009)	Salinity reduction in tannery effluents in India and Australia	AS1/2001/005
62	Francisco SR, Mangabat MC, Mataia AB, Acda MA, Kagaoan CV, Laguna JP, Ramos M, Garabiag KA, Paguaia FL and Mullen JD (2009)	Integrated management of insect pests of stored grain in the Philippines	PHT/1983/009, PHT/1983/011, PHT/1986/009, PHT/1990/009
63	Harding M, Tingsong Jiang and Pearce D (2009)	Analysis of ACIAR's returns on investment: appropriateness, efficiency and effectiveness	
64	Mullen JD (2010)	Reform of domestic grain markets in China: a reassessment of the contribution of ACIAR-funded economic policy research	ADP/1997/021, ANRE1/1992/028
65	Martin G (2010)	ACIAR investment in research on forages in Indonesia	AS2/2000/103, AS2/2000/124, AS2/2001/125, LPS/2004/005, SMAR/2006/061, SMAR/2006/096

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66	Harris DN (2010)	Extending low-cost fish farming in Thailand: an ACIAR– World Vision collaborative program	PLIA/2000/165
67	Fisher H (2010)	The biology, socioeconomics and management of the barramundi fishery in Papua New Guinea's Western Province	FIS/1998/024
68	McClintock A and Griffith G (2010)	Benefit–cost meta-analysis of investment in the International Agricultural Research Centres	
69	Pearce D (2010)	Lessons learned from past ACIAR impact assessments, adoption studies and experience	
70	Harris DN (2011)	Extending low-chill fruit in northern Thailand: an ACIAR–World Vision collaborative project	PLIA/2000/165
71	Lindner R (2011)	The economic impact in Indonesia and Australia from ACIAR's investment in plantation forestry research, 1987–2009	FST/1986/013, FST/1990/043, FST/1993/118, FST/1995/110, FST/1995/124, FST/1996/182, FST/1997/035, FST/1998/096, FST/2000/122, FST/2000/123, FST/2003/048, FST/2004/058
72	Lindner R (2011)	Frameworks for assessing policy research and ACIAR's investment in policy-oriented projects in Indonesia	ADP/1994/049, ADP/2000/100, ADP/2000/126, AGB/2000/072, AGB/2004/028, ANRE1/1990/038, ANRE1/1993/023, ANRE1/1993/705, EFS/1983/062, EFS/1988/022
73	Fisher H (2011)	Forestry in Papua New Guinea: a review of ACIAR's program	FST/1994/033, FST/1995/123, FST/1998/118, FST/2002/010, FST/2004/050, FST/2004/055, FST/2004/061, FST/2006/048, FST/2006/088, FST/2006/120, FST/2007/078, FST/2009/012
74	Brennan JP and Malabayabas A (2011)	International Rice Research Institute's contribution to rice varietal yield improvement in South-East Asia	
75	Harris DN (2011)	Extending rice crop yield improvements in Lao PDR: an ACIAR–World Vision collaborative project	CIM/1999/048, CS1/1995/100, PLIA/2000/165
76	Grewal B, Grunfeld H and Sheehan P (2011)	The contribution of agricultural growth to poverty reduction	
77	Saunders C, Davis L and Pearce D (2012)	Rice–wheat cropping systems in India and Australia, and development of the 'Happy Seeder'	LWR/2000/089, LWR/2006/132, CSE/2006/124
78	Carpenter D and McGillivray M (2012)	A methodology for assessing the poverty-reducing impacts of Australia's international agricultural research	
79	Dugdale A, Sadleir C, Tennant-Wood R and Turner M (2012)	Developing and testing a tool for measuring capacity building	
80	Fisher H, Sar L and Winzenried C (2012)	Oil palm pathways: an analysis of ACIAR's oil palm projects in Papua New Guinea	ASEM/1999/084, ASEM/2002/014, ASEM/2006/127, CP/1996/091, CP/2007/098, PC/2004/064, PC/2006/063
81	Pearce D and White L (2012)	Including natural resource management and environmental impacts within impact assessment studies: methodological issues	

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82	Fisher H and Hohnen L (2012)	ACIAR's activities in Africa: a review	AS1/1983/003, AS1/1995/040, AS1/1995/111, AS1/1996/096, AS1/1998/010, AS2/1990/047, AS2/1991/018, AS2/1993/724, AS2/1996/014, AS2/1999/063, AS2/1996/090, AS2/1996/149, AS2/1996/203, AS2/1997/098, CP/1994/126, CS2/1990/007, EFS/1983/026, FST/1983/020, FST/1983/031, FST/1983/057, FST/1988/008, FST/1988/009, FST/1991/026, FST/1995/107, FST/1996/124, FST/1996/206, FST/2003/002, IAP/1996/181, LPS/1999/036, LPS/2002/081, LPS/2004/022, LPS/2008/013, LWR/2011/015, LWR1/1994/046, LWR2/1987/035, LWR2/1996/049, LWR2/1996/163, LWRS/1996/215, LWR2/1997/038, SMCN/1999/003, SMCN/1999/004, SMCN/2000/173, SMCN/2001/028
83	Palis FG, Sumalde ZM, Torres CS, Contreras AP and Datar FA (2013)	Impact pathway analysis of ACIAR's investment in rodent control in Vietnam, Lao PDR and Cambodia	ADP/2000/007, ADP/2003/060, ADP/2004/016, AS1/1994/020, AS1/1996/079, AS1/1998/036, CARD2000/024, PLIA/2000/165
84	Mayne J and Stern E (2013)	Impact evaluation of natural resource management research programs: a broader view	
85	Jilani A, Pearce D and Bailo F (2013)	ACIAR wheat and maize projects in Afghanistan	SMCN/2002/028, CIM/2004/002, CIM/2007/065
86	Lindner B, McLeod P and Mullen J (2013)	Returns to ACIAR's investment in bilateral agricultural research	
87	Fisher H (2014)	Newcastle disease control in Africa	AS1/1995/040, AS1/1996/096
88	Clarke M (2015)	ACIAR-funded crop–livestock projects, Tibet Autonomous Region, People's Republic of China	LPS/2002/104, CIM/2002/093, LPS/2005/018, LPS/2005/129, LPS/2006/119, LPS/2008/048, LPS/2010/028, C2012/228, C2013/017
89	Pearce D (2016)	Sustaining cocoa production: impact evaluation of cocoa projects in Indonesia and Papua New Guinea	SMAR/2005/074, HORT/2010/011, ASEM/2003/015, ASEM/2006/127, PC/2006/114
90	Pearce D (2016)	Impact of private sector involvement in ACIAR projects: a framework and cocoa case studies	PC/2006/114, ASEM/2006/127, SMAR/2005/074, HORT/2010/011
91	Brown PR, Nidumolu UB, Kuehne G, Llewellyn R, Mungai O, Brown B and Ouzman J (2016)	Development of the public release version of Smallholder ADOPT for developing countries	
92	Davila F, Sloan T and van Kerkhoff L (2016)	Knowledge systems and RAPID framework for impact assessments	CP/1997/017
93	Mullen JD, de Meyer J, Gray D and Morris G (2016)	Recognising the contribution of capacity building in ACIAR bilateral projects: Case studies from three IAS reports	FST/1986/030, FST/1993/118, FST/1998/096, FIS/2005/114
94	Davila F, Sloan T, Milne M and van Kerkhoff L (2017)	Impact assessment of giant clam research in the Indo- Pacific region	FIS/1982/032, FIS/1987/033, EFS/1988/023, FIS/1995/042
95	Ackerman JL and Sayaka B (2018)	Impact assessment of ACIAR's Aceh aquaculture rehabilitation projects	FIS/2005/009, FIS/2006/002
96	Clarke M and Mikhailovich K (2018)	Impact assessment of investment in aquaculture- based livelihoods in the Pacific islands region and tropical Australia	FIS/2001/075, FIS/2006/138
97	Mullen JD, Malcolm B and Farquharson RJ (2019)	Impact assessment of ACIAR-supported research in lowland rice systems in Lao PDR	CSI/1995/100, CIM/1999/048, CSE/2006/041
98	Clarke M (2019)	Impact assessment of ACIAR investment in citrus rootstock, scion and production improvement in China, Vietnam, Bhutan and Australia	CSI/1987/002, CS1/1996/076, HORT/2005/142, HORT/2010/089

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99	Abell J, Chudleigh P and Hardaker T (2021)	An impact assessment of conservation tillage research in China and Australia	LWR2/1992/009, LWR2/1996/143
100 (1)	Centre for International Economics (2022)	The impact of ACIAR work in agricultural research for development 1982–2022: quantifying returns on investment	Selected projects since 1982
100 (2)	van der Heijden J (2022)	The impact of ACIAR work in agricultural research for development 1982–2022: a qualitative comparative analysis	Selected projects since 1982
101	Davila F, Vanzetti D and Sloan T (2021)	Mixed-methods impact assessment of sandalwood research in Vanuatu	FST/2002/097, FST/2008/010
102	Williams LJ, McMillan L, Van Wensveen M, Butler JRA, Camacho Jr JDV, Lapitan A, Datoon R, Gapas J, Pinca E, Macavinta-Gabunada F, Serino MNV, Nunez L, Recto AL, Ruales JH, Enerlan WC, Ani PAB and Aranas MB (2021)	An integrated approach to ex-post impact assessment	ASEM/1998/052, ASEM/2002/051, ASEM/2009/044
103	Petersen E and Hua Hong Hieu (2022)	Agricultural research on integrated rice–shrimp and mangrove–shrimp farming systems in the Mekong Delta of Vietnam	ANRE/1993/036, ASEM/1995/119, FIS/1994/012
104	Clarke M and Powell M (2022)	Strengthening the Fiji papaya industry through applied research and information dissemination	HORT/2008/033
105	Petersen E and Luis J (2023)	Integrated management of Fusarium wilt of bananas	HORT/2012/097
106	Delforce J, Janssen G, Vesely K, Poulton D, Maksalmina and Kemala CI (2023)	Aceh soils	SMCN/2005/004, SMCN/2005/118, SMCN/2005/075, SMCN/2007/040
107	Delforce J, Regar Q, Angus K, Lee-Palmer Z, Solomon E, Lapitan A, Anastasio N, Flores E, Lopez M and Bongat H (2024)	Impact of vegetable value chain research in the Philippines	HORT/2007/066



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