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International Agricultural Research

An evaluation of the ACIAR Agriculture Sector Linkages Program



1

ACIAR OUTCOME
EVALUATION SERIES

An evaluation of the ACIAR Agriculture Sector Linkages Program

Penny Davis
Alinea International



2022

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Foreword

This book is the first of a new series of reports that is based on outcome evaluations of research and programs supported by the Australian Centre for International Agricultural Research (ACIAR).

ACIAR establishes international research partnerships between scientists from Australia and partner countries in the Indo-Pacific region to improve the productivity and sustainability of agriculture, fisheries and forestry for smallholder farmers.

As a learning organisation, ACIAR is committed to understanding the diverse outcomes delivered by the research collaborations we develop, to demonstrate the value of investment of public funds, to continuously improve research design and to increase the likelihood that ACIAR-funded research improves the lives of farming communities in our partner countries. An important mechanism for achieving our aims is to work closely with the wider Australian development assistance program to develop promising research into improved agricultural practices and profitable enterprises at scale.

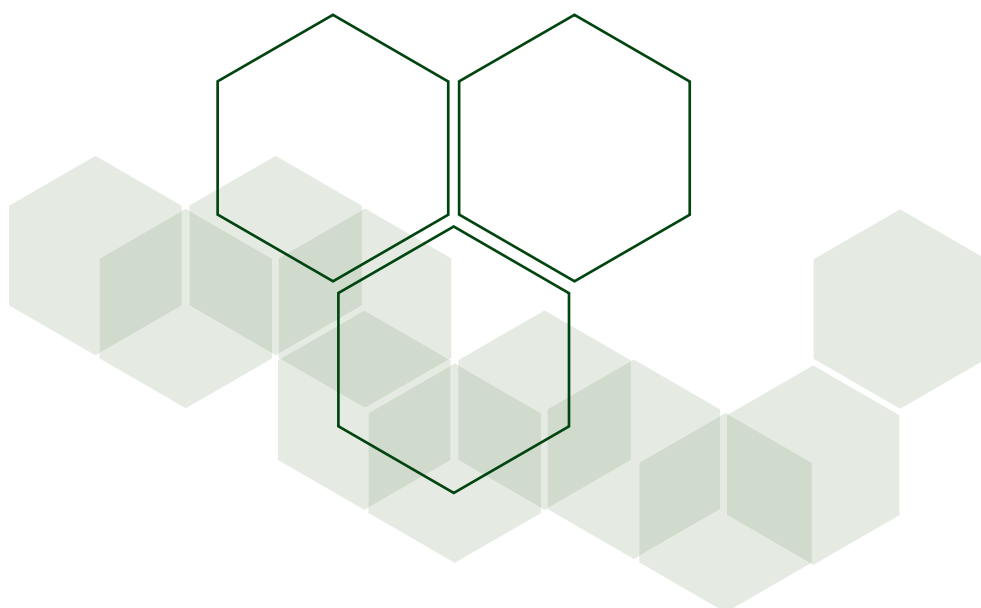
This report presents a suite of evaluations of the Agriculture Sector Linkages Program, conducted in Pakistan, and co-funded by the Department of Foreign Affairs and Trade (DFAT) and ACIAR from 2005 to 2015. The program was an opportunity for Australian agencies to partner with Pakistani researchers and ministries to advance the development of key agriculture sectors, seeking particularly to understand pathways to adoption for improved practices in Pakistan. The investment sought to strengthen learning and insights in these common areas by linking projects together into a programmatic structure.

The evaluations ultimately seek to understand the value that this programmatic structure delivered and identify lessons for future programmatic and/or place-based research-for-development investments. To inform these insights, a series of project-level outcome evaluations were conducted. These evaluations were designed to investigate the extent to which the funded projects contributed to short-term development outcomes.

Outcome evaluations adopt a largely qualitative, theory-based approach and seek to empirically test the project's articulated logic and investigate the assumptions underpinning this logic. In addition to documenting the contribution of ACIAR projects to intended outcomes, these outcome evaluations are intended to generate data for cross-case analysis that, over time, will support the elicitation of lessons regarding effective agriculture research-for-development practice.



Andrew Campbell
Chief Executive Officer, ACIAR



An evaluation of the ACIAR Agriculture Sector Linkages Program

Part 1: Programmatic approach

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Part 2: Citrus projects

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Part 1: Programmatic approach

An evaluation of the
ACIAR Agriculture Sector Linkages Program

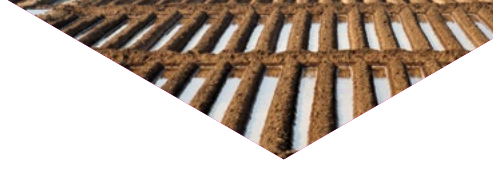
Abbreviations and acronyms

ACIAR	Australian Centre for International Agricultural Research
ASLP	Agriculture Sector Linkages Program
AUD	Australian Dollar
AusAID	Australian Agency for International Development
AVCCR	Agriculture Value Chain Collaborative Research Program
DFAT	Department of Foreign Affairs and Trade
M&E	Monitoring and evaluation
NARC	National Agriculture Research Centre (Pakistan)
ODA	Official development assistance
PKR	Pakistan Rupee
RPM	Research Program Manager (ACIAR)
TADEP	Transformative Agriculture and Development Enterprise Program

Acknowledgements

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The evaluation team would also like to express its appreciation to all program stakeholders who gave their time to be interviewed and to review the evaluation findings.



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Summary

From 2005 to 2015, the Australian Centre for International Agricultural Research (ACIAR) oversaw 2 phases of the Agriculture Sector Linkages Program (ASLP) in Pakistan, which was a research-for-development program in the Punjab and Sindh provinces of Pakistan focused on enhancing selected agricultural value chains for the benefit of the rural poor. The program had 2 phases: Phase 1 ran from 2005 to 2010, and Phase 2 was implemented from 2011 to 2015. The program was funded by the Department of Foreign Affairs and Trade (DFAT)¹ and was managed by ACIAR. Both phases included commodity-based projects focused on citrus, dairy and mango. Phase 2 also included:

- a social science research project which aimed to increase the pro-poor focus of, and collaboration between, other projects
- a policy enabling project which sought to understand and overcome policy constraints faced by smallholder farmers
- a range of activities focused on building agricultural capability in Pakistan.

This report, ACIAR Outcome Evaluation No. 1, summarises the outcomes of ASLP, and identifies lessons that can inform the design and implementation of future ACIAR programs.

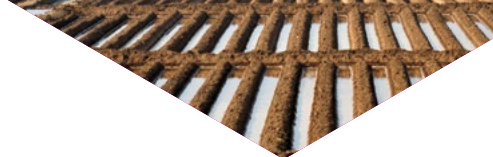
Part 1 reports on the whole ASLP program and lessons learned from the ASLP programmatic approach. Parts 2, 3 and 4 report on evaluations of the commodity-based projects within the program, focused on citrus, dairy and mango.

A similar evaluation was conducted on the Transformative Agriculture and Enterprise Development Program (TADEP), and is reported in Outcome Evaluation No. 2.

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



¹ ASLP was originally funded by the Australian Agency for International Development (AusAID), which merged with DFAT in 2013. For simplicity, the program funder is referred to as DFAT throughout this report.



Key findings



What was the process, timing and rationale for bringing projects together under this program?

ASLP was envisioned and designed as a program.

The initial program parameters were developed during a scoping visit to Pakistan in 2005. Following this, specific projects or activities that would be implemented under the program were developed.

The choice of a program appears to have been driven by several factors. For example, there was recognition that Pakistan was an increasingly sophisticated development partner. Program designers from ACIAR and DFAT believed that there were lessons to be learned across different projects, particularly on the pathways to adoption, and so there would be a mutual learning benefit. Finally, DFAT (as the program funder) drove a program approach and ACIAR responded to this.

The ASLP program structure was different in Phases 1 and 2. Phase 1 had 4 components, 2 of which – agriculture linkages (focused on commodity-based projects) and program review – were overseen by ACIAR.² In Phase 2, all program components were brought under ACIAR oversight to ensure they were more closely linked. The 3 components of Phase 2 were:

- **Pro-poor value chains:** Under this component, the mango, citrus and dairy projects that commenced in Phase 1 were continued and the social science project was added.
- **Agricultural capability:** This component aimed to build capability in Pakistan's agriculture sector through a variety of activities, including scholarships and short-term training.
- **Enabling policy:** This aimed to identify policy constraints and policy options which could benefit smallholder farmers (including women) in Pakistan. It was implemented through the project 'Enabling agricultural policies for benefiting smallholders in dairy, citrus and mango industries of Pakistan' (ADP/2010/091).

2 A trade linkages component was overseen by Austrade and a scholarships component was overseen by AusAID.

Key findings (cont.)

2

What is the program's theory of change? To what extent have program goals and outcomes been achieved?

In 2005 when ASLP was first designed, theory of change use was limited in Australia's aid program. Consequently, it is not surprising that the ASLP documentation does not include a theory of change.

The evaluation team suggested a theory of change, with a visual representation at Appendix 1.1. The essence of the theory of change is that participatory, high quality scientific research was expected to lead to best practice production and value chain approaches, and improved capacity of multiple actors, including growers, extension services, researchers and government. These actors were then expected to use their increased capacity to scale out the approaches identified by ASLP.

Considering the program's achievements against this theory of change, **it is clear that the program's outputs were achieved.** Project-level evaluation reports demonstrate the significant research and best practice outputs achieved by the commodity-based projects. The project 'Enabling agricultural policies for benefiting smallholders in dairy, citrus and mango industries of Pakistan' (ADP/2010/091) also identified key policy issues, albeit after the end of ASLP. There is strong evidence that ASLP was seen as credible and relevant by Pakistan partners.

At the outcome level, project-level evaluations also demonstrate that **many direct project beneficiaries adopted ASLP best practices, and experienced positive outcomes such as increased incomes as a result.** Evidence also demonstrates the **program had success in building the capacity of researchers and scientists involved in the commodity-based projects.** At the same time, there is insufficient data available to support conclusions on whether capacity of extension services and governments was built, and on whether actors used increased capacity to adopt ASLP policies and scale out ASLP best practices.

3

Benefits and challenges of the programmatic approach

This section covers the key evaluation questions:

- What are the main factors that influenced program performance?
- What benefits were realised by adopting a programmatic approach, compared to an individual project approach?
- What challenges arose from the programmatic approach?

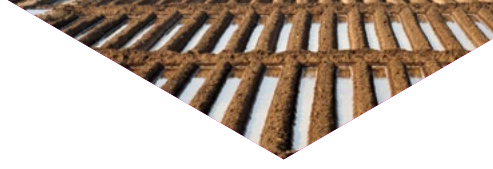
To address these questions, the evaluation team, drawing on available literature, identified the potential benefits of adopting a programmatic approach. We also developed a rubric to assess whether ACIAR programs aimed to achieve, and ultimately realised, these benefits. The potential benefits and rubric are summarised in Appendix 1.2.

Potential benefit 1: Increasing impact

Medium-High: Projects are closely connected but without a strong theory of change; projects operate independently with some collaboration

A key dimension of a programmatic approach is that it can increase impact beyond what would be achieved by individual projects. The extent to which ASLP realised this benefit is rated as **medium-high**.

The first way that ASLP sought to use a program to increase impact was by ensuring projects worked collaboratively towards shared outcomes, combining results for greater impact. In the first area, it is clear that the **ASLP projects were closely connected and aimed to work together to achieve more than the sum of their parts.** The project designs were complementary, and achieving scale out relied on outputs and outcomes being combined across multiple projects.



At the same time, a major program challenge was that the **theory of change – and particularly the final outcomes that ASLP would achieve – were not clear during the program’s life**. As noted, ASLP did not have an articulated theory of change. This made it more difficult for program staff to understand the program’s desired outcomes and to manage the expectations of in-country partners and funders.

The second area where ASLP sought to increase impact was to broaden the diversity of perspectives and strategies to provide a holistic response to development challenges in Pakistan. **ASLP particularly aimed to do this through the introduction of the social science project in Phase 2 of the program**. The social science project aimed to support other projects to better collaborate, and to increase their pro-poor and gender focus by providing greater insight into the needs of Pakistan communities.

The potential for the social and commodity-based projects to provide a holistic response did not reach its full potential, with the projects unable to add as much value to each other as desired. Reasons for this include:

- Context: The social science project was not added until Phase 2, making it challenging to find common ground with the established projects. The program did not dedicate sufficient time and resources to collaboration.
- Objectives and methods: There were different expectations of what success for the social science project might look like. Social and commodity-based scientists also had different research approaches and struggled to understand each other’s value-add.
- Program incentives: There were few tangible incentives – such as proposal set-up and reporting, and accountability mechanisms – to compel projects to collaborate and work in the interests of the program.

Potential benefit 2: Increasing knowledge and learning

High: Strong evidence of sharing and learning between projects with evidence of how this learning has strengthened project implementation

A second dimension of a programmatic approach is that it can increase knowledge and learning between its constituent parts. The extent to which this benefit was realised by ASLP is rated as **high**.

The issues with the social science project notwithstanding, ASLP achieved knowledge sharing and learning, which strengthened outcomes. There were several examples of how this took place.

While this evaluation looked specifically at learning between projects within ASLP, other forms of learning came up during the evaluation process, such as learning between different phases of the same program, and between different ACIAR programs. Interviewees presented very different views on the extent to which these types of learning took place, with some feeling that learning had featured strongly, and others reflecting that learning systems and culture were lacking in ACIAR.

Key findings (cont.)

Potential benefit 3: Increasing influence and adoption

Medium: Some examples or evidence of the program enhancing leverage or influence with stakeholders and communicating results

A further dimension of a programmatic approach is that it can assist with increasing influence and adoption. The extent to which ASLP realised this benefit is rated as **medium**.

One strategy ASLP used to increase influence was to enhance leverage and foster sustainability through working with the partner government. This was achieved through a multifaceted approach to building close relationships with government partners.

ASLP missed an opportunity to increase its influence and adoption through strengthened communication of research findings. The program's projects produced a significant number of research outputs, including practical materials such as best practice manuals, fact sheets and training modules. However, at the end of the program, there was no institutional home for many of these materials, nor a system to ensure their ongoing maintenance and availability.

Potential benefit 4: Streamlining management

Medium: Minimal benefits to streamlining reporting and donor relationships; governance and training adding value to the projects

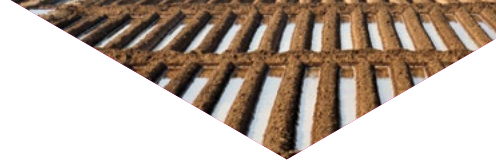
A final dimension of a programmatic approach is that it can streamline management. The extent to which ASLP realised this benefit is rated as **medium**.

ASLP aimed to streamline management primarily through program-level interactions with DFAT, and programmatic monitoring and evaluation (M&E) and reporting. ASLP had a program coordinator responsible for managing M&E and reporting to DFAT. This created efficiencies for projects, which were not required to report directly to the funder.

However, **there were significant tensions between DFAT and ACIAR, which took time and resources to manage**, meaning ASLP did not fully achieve the streamlining benefit. ASLP's theory of change was not clear and this issue flowed through into the program's M&E and reporting. DFAT expressed dissatisfaction with program M&E and reporting, while the ACIAR view was that DFAT expectations were unrealistic and their reporting needs were unclear. A number of factors outside ASLP control – including high staff turnover at DFAT and broader challenges with ACIAR–DFAT relationships – exacerbated these tensions. In considering these issues, it is important to note that not all ACIAR programs are or will be funded by DFAT, meaning lessons on the ACIAR–DFAT relationship will not be applicable to all ACIAR programs.

Another way that **ASLP aimed to streamline management was through shared governance and budget arrangements. The program was very successful in this regard.** The ASLP Steering Committee was an effective governance mechanism. On a practical level, it was more efficient to get partner government approval for a single program than for multiple projects. The program also used an international organisation to hold program funds, thereby ensuring the program funds were easily accessible and not subject to restrictive Pakistan government processes.

The **ASLP approach also came with transaction costs.** Additional staff time was needed to oversee the program, and busy ACIAR research program managers (RPMs) and project leaders needed to put more time and effort into collaboration and coordination. However, in the context of the benefits of the programmatic approach that were achieved, and the potential for even greater benefits, these transaction costs appear to have been a worthwhile investment.



Conclusion and lessons learned

ASLP was conceived as a program and brought together complementary projects to achieve an overall set of outcomes. It achieved a significant number of outputs, as well as some outcomes for direct project participants and researchers in Pakistan. Unfortunately, the lack of systematic data means it is not possible to draw conclusions on whether capacity was built for governments and the extension system, and if increased capacity was used to scale out the program's work.

The framework at Appendix 1.2 identifies a number of potential benefits of a programmatic approach. As the ASLP has highlighted, when ACIAR uses a programmatic approach, **it needs to intentionally design, implement and resource activities which will ensure these programmatic benefits are realised.**

Examples of how this was achieved in ASLP include:

- the complementary nature of ASLP projects set up the program to achieve more than the sum of its parts
- learning between projects, particularly the mango projects, strengthened outcomes
- the multifaceted approach to building relationships assisted ASLP to enhance leverage and foster sustainability
- streamlined approval processes with the Government of Pakistan, as well as streamlined budget processes, delivered management benefits to ACIAR.

There was potential for more benefits to be achieved through the programmatic approach, but this potential was not realised. There was a lack of clarity around the program's theory of change and what it could realistically achieve by its completion, restricting the program's ability to achieve impact. The potential for the social and commodity-based projects to provide a holistic response was not realised, while there was a missed opportunity to better communicate the program's outputs. There were also considerable challenges in the ACIAR–DFAT relationship, noting these challenges will not apply to all ACIAR programs.

The ASLP experience highlights lessons for ACIAR to consider. Learning from and applying these lessons will help ensure that the ASLP experience was worthwhile, not only for the practical outputs it achieved, but for the foundation it provided for future ACIAR programs.

Lessons learned

1. Programs, and the projects under them, need monitoring systems that systematically collect data on changes in capacity and scale out to support robust conclusions on higher-level program outcomes.
2. Programs should use a theory of change to be clear on what they can achieve and their limitations. A theory of change can assist ACIAR to better manage its program, and to manage the expectations of in-country partners and any future co-funders.
3. To capitalise on diverse perspectives and create holistic responses in programs, ACIAR should ensure project teams include traits such as openness to collaboration and willingness to work in an interdisciplinary way, and that incentives compel projects to work in the interests of the program.
4. Better communication strategies and central repositories for program outputs should be considered to maximise the opportunities for program influence.
5. ACIAR may wish to revisit its approach to organisational learning and consider whether improvements are needed.

Introduction

Purpose, scope and audience

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

From 2005 to 2015, ACIAR managed the Agriculture Sector Linkages Program (ASLP)³, a research-for-development program funded by DFAT⁴, in the Punjab and Sindh provinces of Pakistan. The program focused on enhancing selected agricultural value chains for the ultimate benefit of the rural poor. There were 2 phases of the program: Phase 1 from 2005 to 2010, and Phase 2 from 2011 to 2015. Both phases included commodity-based projects focused on citrus, dairy and mango. Phase 2 also included a social science research project.

ACIAR commissioned a program-level evaluation to identify lessons that will inform the design and implementation of future ACIAR investments and improve the quality of outcomes.

Purpose

The program-level evaluation has 5 key purposes:

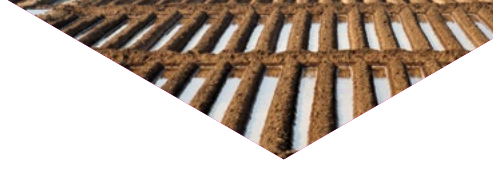
1. Compile performance information from each project under a program and investigate the contribution to specific project outcomes, with a particular focus on differential effects for women and men.
2. Generate project-level case studies for use in a qualitative cross-case analysis.
3. Summarise the contribution to outcomes of each program, with a particular focus on differential effects for women and men.
4. Establish how the different approaches to programmatic management adopted by each program influenced the achievement of outcomes.
5. Identify lessons related to programmatic management of agricultural research-for-development to inform future ACIAR investments.

Scope

This program-level evaluation focuses on the whole ASLP and its constituent projects. Individual evaluations have been conducted on the citrus, mango and dairy projects under ASLP. Drawing on these project evaluations, this program-level evaluation has been developed for ASLP. Note, a similar evaluation is being undertaken for the ACIAR Transformative Agriculture and Enterprise Development Program (TADEP) in Papua New Guinea (Outcome Evaluation 2), and the ASLP and TADEP evaluations will be synthesised into a final report to outline common lessons from ACIAR programs (Outcome Evaluation 3).

³ A third phase of the Pakistan program that began in 2015 is known as the Agriculture Value Chain Collaborative Research Program (AVCCR), or Aik Saath. However, the projects to be evaluated all started under the earlier phase, known as ASLP. For simplicity, this program is referred to as ASLP in the remainder of this document.

⁴ ASLP was originally funded by the Australian Agency for International Development (AusAID). AusAID was merged with DFAT in 2013.

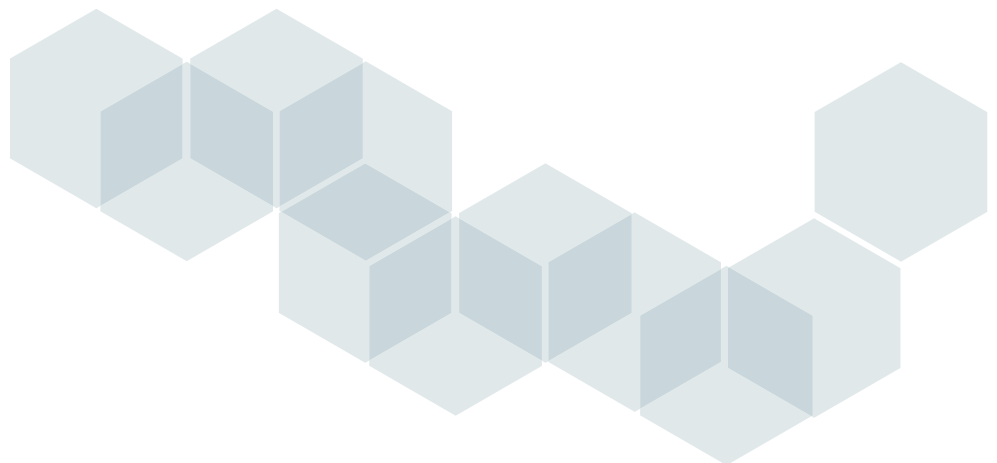


This ASLP program-level evaluation was guided by the following key evaluation questions:

1. What was the process, timing (vis-à-vis constituent projects) and rationale for bringing projects together under this program?
 - How is the program structured?
2. What is the program's theory of change? To what extent have the intended program goal and outcomes been achieved?
 - What was the contribution of each project?
3. What were the main factors that influenced program performance?
 - To what extent were the program's scope, scale, structure and management arrangements appropriate?
 - How did the program's particular structure and management arrangements influence program achievements?
 - What external factors arose, for example, budgetary, natural hazards, policy settings?
4. What benefits were realised by adopting a programmatic approach, compared to an individual project approach?
 - What evidence is there of learning or cross-collaboration between projects within a program?
 - To what extent were project-level outcomes mutually reinforcing within the program?
 - Did the programmatic approach result in improved implementation strategies and/or additional resourcing, for example, on gender equality?
5. What challenges arose from the programmatic approach?
 - To what extent did the benefits outweigh the challenges?

Audience

The primary audience for this program-level evaluation is ACIAR staff with direct responsibilities for programs and/or their constituent projects. This includes Canberra-based research program managers (RPMs), and any future field-based program managers and coordinators. The ACIAR Executive and senior managers, and DFAT fund managers, are also important audiences particularly for the program-level assessments and synthesis report.



Methodology

Data collection and analysis

The ASLP evaluation collected data by:

- Reviewing project-level evaluation reports and ASLP-specific documents (for example, design documents, independent reviews, program-level reporting).
- Interviewing 8 program stakeholders via Zoom. The interviewees were intentionally selected by the evaluation team and ACIAR.

Systematic analysis of data collected was undertaken using NVivo qualitative data analysis software to distil findings. To aid this process, the evaluation team developed a framework outlining the potential benefits of a programmatic approach (see Appendix 1.2). This framework was developed drawing on literature, particularly Buffardi and Hearn (2015), as well as the evaluation team's expertise. This framework:

- Outlines the potential benefits of a programmatic approach under 4 topic areas:
 - increasing impact
 - knowledge and learning
 - influence and adoption
 - streamlining management.
- Provides a rubric to assess the extent to which an ACIAR program achieved the potential benefits. The 3 possible rubric ratings are low, medium and high.

The data analysis phase specifically focused on understanding whether ASLP aimed to achieve a potential benefit, and the extent to which it did (or didn't) achieve this benefit. Note, the Transformative Agriculture and Enterprise Development Program (TADEP) evaluation also uses this framework. This will allow for the identification of common themes and program comparison in the final synthesis report.

Preliminary findings were shared and tested in a program validation workshop involving the stakeholders previously consulted. Stakeholders were also given the opportunity to provide written comments on a draft executive summary. These activities provided the opportunity to 'ground-truth' the assessments, identify any key issues not addressed, clarify any areas of uncertainty, and correct any misinterpretations. A draft evaluation report was then prepared for review by ACIAR and finalised in accordance with feedback received.

Limitations

The evaluation relied heavily on pre-existing documentation, provided by ACIAR, which was of varying quality.

Stakeholder consultations also faced limitations. Primary data collection was restricted to online interviews, limiting the ability of evaluators to build rapport with participants and interpret non-verbal communication. In addition, the second phase of ASLP was completed in 2015 and making it challenging for interviewees to provide accurate data. In particular, it was difficult to find DFAT representatives who were involved in the ASLP, and could provide good data on the early years.

This program-wide evaluation drew heavily on the project-level evaluations of the citrus, mango, and dairy projects, with all 4 evaluations conducted by the same team. It also discusses other ASLP projects, such as the social science project and policy enabling project, which were added during Phase 2. However, the evaluation team was only able to lightly review these additional projects by drawing on ACIAR documentation and a small number of interviews. Consequently, data and findings on these other projects is less rich and robust compared to findings related to the citrus, mango and dairy projects. A further project, 'Heat stress alleviation in summer vegetables' (HORT/2012/002), was added to Phase 2 at a later point in time, but not included in this evaluation.

Ethical considerations

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

- **Informed consent:** All participants in consultations were provided with a verbal overview of why they were being consulted, how the information would be used and that their participation was voluntary prior to the consultation. Consultations were only undertaken once verbal consent was obtained.
- **Privacy and confidentiality:** The identities of any project stakeholders involved in the evaluation have been protected. Key informants in professional roles may be referred to by their position title in the report where explicit consent has been obtained; otherwise they are referred to as a representative of the organisation they work with. Note, the DFAT representative who was interviewed for the evaluation asked that their name be kept confidential, given only one person from DFAT was interviewed and they felt confidentiality would enable them to provide frank data.



Overview of program

Context

In 2005, the Government of Pakistan requested Australia's assistance for its agriculture sector. An ACIAR delegation conducted a scoping mission, which included close consultations with government and industry organisations, including the Ministry for Food, Agriculture and Livestock, and the Pakistan Council for Agricultural Research. The scoping mission developed the Agriculture Sector Linkages Program (ASLP).

The program

ASLP was a research-for-development program in the Punjab and Sindh provinces of Pakistan focused on enhancing selected agricultural value chains for the ultimate benefit of the rural poor. The program had 2 phases:

- Phase 1 ran from 2005 to 2010
- Phase 2 was implemented from 2011 to 2015.

The program was funded by the Department of Foreign Affairs and Trade (DFAT)⁵ and was managed by ACIAR. Both phases included commodity-based projects focused on citrus, dairy and mango. Phase 2 also included a social science research project, a policy enabling project, and a variety of activities focused on building agricultural capability in Pakistan.

The goals of ASLP Phase 1 (2005–2010) were:

1. To transfer Australian knowledge and expertise to key sectors of Pakistan agribusiness to increase profitability and enhance export potential.
2. To contribute to poverty alleviation of smallholder farmers through collaborative research and development.
3. To enhance the capacity of the Pakistan research, development and extension system to deliver targeted and practical research outputs to agribusiness and farmers.

The goals for the second phase were adapted, but retained a core focus on building value chains to support smallholder farms, and building technical capacity in Pakistan. The Phase 2 (2011–2015) goals were:

1. Pro-poor value chains: To support 'keystone' interventions to sustainably enhance selected value chains, and increase understanding and delivery of benefits to the rural poor through productivity improvements and market and employment opportunities.
2. Agricultural capability: To enhance agriculture capability and sustainably improve agricultural value chains by providing short-term 'smart linkages', scoping studies and other initiatives, as well as longer-term formal training, that are demand driven and catalytic, and complement the initiatives supported under other components of the program.
3. Enabling policy: To support policy analysis and interventions which improve or enable better economic and natural resource management, particularly where they underpin or strengthen pro-poor value chains and more sustainable farming systems.

⁵ ASLP was originally funded by the Australian Agency for International Development (AusAID). AusAID was merged with DFAT in 2013. For ease, DFAT is referred to as the program funder throughout this report.

Findings

1. What was the process, timing and rationale for bringing projects together under this program?

ASLP was envisioned and designed as a program, under which specific activities or projects would be implemented. Following a request from the Government of Pakistan for Australian assistance in agricultural development, a scoping visit was conducted in 2005 and the initial program parameters were developed. Then specific projects to be implemented under the program were developed.

The choice of a program appears to have been driven by several factors. For example, there was recognition that Pakistan was an increasingly sophisticated development partner, interested in long-term and holistic development modalities, rather than smaller project-based approaches. Program stakeholders believed that there were lessons to be learned across different projects, particularly on the pathways to adoption, and so projects would mutually benefit from learnings. Finally, the Department of Foreign Affairs and Trade (DFAT) (as the program funder) drove a program approach and ACIAR responded to this.

ASLP Phase 1 had 4 components:

- **Market linkages:** Austrade led an agriculture market feasibility mission to Pakistan for a consortium of Australian companies.
- **Academic linkages:** AusAID managed this component, providing 7 agriculture research scholarships to Pakistani students under the Australian Development Scholarship Program.
- **Agriculture linkages:** This was led by ACIAR and became the core aspect of Phase 1. It focused on 4 research projects covering production and value chains for 3 commodities: citrus, dairy and mango.
- **Linkages program review:** ACIAR managed the fourth component, which focused on a joint independent review of ASLP Phase 1, which was commissioned in the third year of the program.

The 2008 review of ASLP Phase 1 (the fourth component) **found some significant flaws with the program structure.** In particular, the different components were managed by different government partners, and agriculture linkages for ACIAR were much larger than linkages in the other components. The other market linkages and academic linkages components were small parts of larger Austrade and AusAID initiatives.

As a result of this, the program review found there was 'minimal ASLP strategic coordination; limited integration of program components; and a lack of coordinated Program level M&E' (ASLP 1 Program Review 2008:7).

This lack of integration was addressed in ASLP Phase 2, which ran from 2010 to 2015. The design for Phase 2 outlined a much more integrated and interdependent program with overall program oversight and management by ACIAR. ASLP Phase 2 had 3 components:

- **Pro-poor value chains:** The research-for-development projects which commenced under ASLP Phase 1 continued under this component. A social science project was also added. The social science project aimed to increase the engagement of rural poor who might benefit from the commodity-based projects; increase collaboration between project teams; and foster effective collaborative development in rural Pakistan.
- **Agricultural capability:** This component aimed to build capability by providing short-term links such as scoping studies and short-term training, as well as John Allwright Fellowships (which provide scientists from partner countries with the opportunity to obtain a postgraduate qualification in Australia) and John Dillon Fellowships (which aim to develop the leadership and management skills of mid-career professionals working in agricultural research).
- **Enabling policy:** This component aimed to identify policy constraints and policy options which could benefit smallholder farmers (including women) in Pakistan. It was implemented through the project, 'Enabling agricultural policies for benefiting smallholders in dairy, citrus and mango industries of Pakistan' (ADP/2010/091).

Some program structure features were common across both ASLP phases. An ASLP Reference or Steering Committee was used in both phases (see Figure 1 and Figure 2). This committee included high-level representatives from the governments of Pakistan and Australia, and provided oversight and advice to the program.

Both program phases saw ACIAR appoint an ASLP program coordinator with overall responsibility for management, finances, monitoring and evaluation, and reporting. In addition, each individual research project was managed by an ACIAR research program manager (RPM) from the relevant sectoral area in ACIAR.

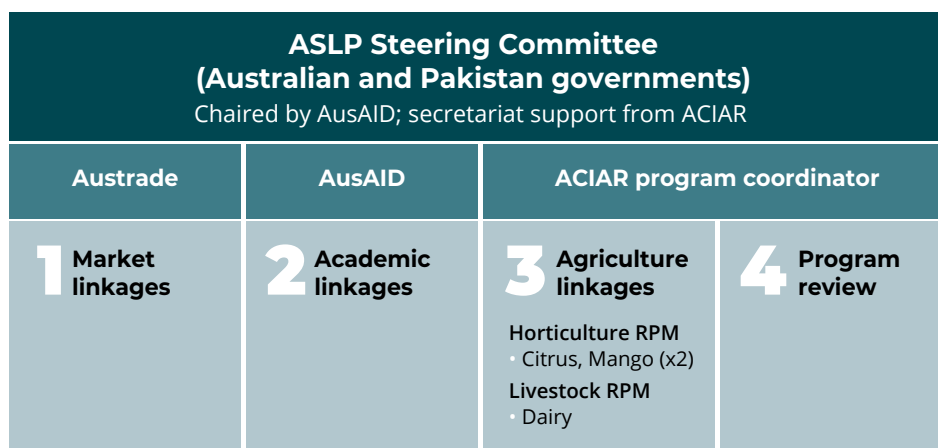


Figure 1 Program structure for ASLP Phase 1

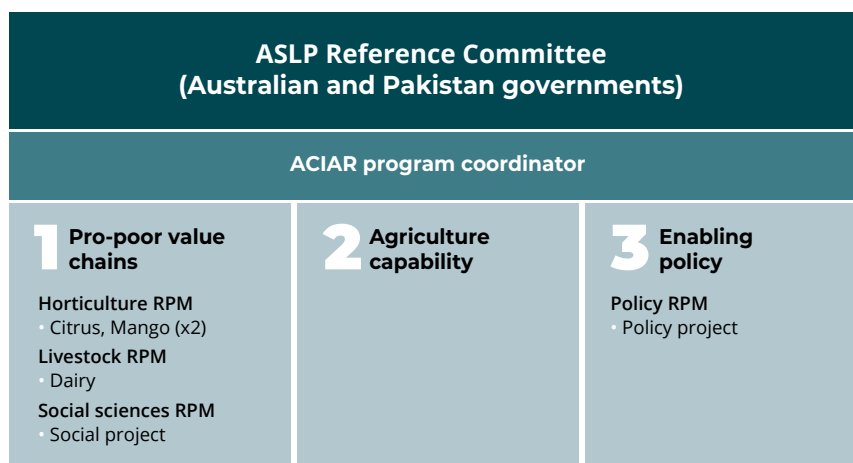


Figure 2 Program structure for ASLP Phase 2

2. What is the program's theory of change? To what extent have the intended program goal and outcomes been achieved?

In 2005 when ASLP was first designed, theory of change use was limited in Australia's aid program. Consequently, it is not surprising that the **ASLP documentation does not include a theory of change** to articulate how the program expected change to happen, or how activities would lead to outputs and outcomes.

Drawing on documents and discussion with stakeholders, **the evaluation team developed a suggested theory of change**. A visual representation of the theory of change is at Appendix 1.1. This theory of change is predominately for ASLP Phase 2, when ACIAR had oversight of the full program.

The ASLP theory of changes outlines that the program's activities and outputs need to link together to achieve a higher set of outcomes.

The theory of change is underpinned by the program's key activity: **participatory, high quality scientific research that responds to industry needs, builds partner capacity, and links Australian and Pakistan institutions**. It is expected that this activity is expected to identify practices or approaches that improve production and value chains in Pakistan. These practices are expected to be adopted by direct participants in the program (for example, trainees and demonstration site participants), with adoption expected to lead to outcomes such as increased incomes. Further, it is expected that participatory research will lead to the identification of policies which benefit smallholder farmers, including women.

The participatory research and outputs in practices and policies are also expected to combine to achieve a series of higher-level capacity and industry-wide outcomes. It is expected that the scientific, extension and government *capacity-building* activities implemented through participatory research will combine with other *capacity-building* activities, such as scholarships and study tours. This will lead to increased capacity of multiple actors in Pakistan, including growers, extension services, researchers and government.

Further, the increased capacity, when combined with ASLP being seen as a credible and relevant partner, is **expected to lead to actors using their increased capacity to scale out the approaches and policies identified by ASLP**. This, in turn, is expected to result in a range of high-level outcomes, such as improved production practices, improved value chains and improved policies – all of which should result in better livelihoods and reduced poverty for male and female smallholder farmers in Pakistan.



Program achievements – outputs

Looking at the extent to which the intended program goal and outcomes were achieved, we can map different achievements against the program's theory of change.

As outlined in the theory of change, one of the program's main outputs was **practices/approaches identified that improve production and value chains**. It is clear that all commodity-based projects and the social science project made strong contributions to this output. All the projects:

- researched and identified improved production and value chain approaches
- shared these approaches through multiple publications
- trained growers and orchard managers (including women) in these approaches
- supported capacity building and higher degrees for Pakistan students, researchers, and extension workers.

A summary of contributions is provided in Appendix 1.3 and more details are provided in the mango, dairy and citrus evaluations.

A second ASLP output was **policies identified which benefit smallholder farmers (including women)**.

This output was achieved by 'Enabling agricultural policies for benefiting smallholders in dairy, citrus and mango industries of Pakistan' (ADP/2010/091). This project identified policy constraints for smallholder farmers in Pakistan and corresponding enabling policies in areas such as provision of credit, improved market access structure, and the expansion of cooperatives.

However, it is important to note that the dates of this project differed significantly from other ASLP projects. It commenced in November 2013 and an ACIAR monograph of the key findings wasn't published on the ACIAR website until 2019.⁶ Interviewees reflected that they were using the project's results in their interactions with Government of Pakistan officials, as they were able to suggest policy areas where Pakistan could assist smallholder farmers. However, the late delivery of the project results makes it difficult to say that this project was instrumental in the achievement of ASLP's outputs and outcomes during the program's life.

The final major output was that **ASLP is seen as credible and relevant by Pakistan partners**. There is good evidence from ASLP reports that this output was achieved. Evidence suggests that the Pakistani government viewed the program as credible, effective, and relevant to their needs. For example:

- An independent review of ASLP Phase 1 noted that 'ASLP... has provided a very high profile engagement achieving a level of recognition well above what would have been expected for its modest scope and budget. Pakistani Government partners reflect that it is one of the few donor engagements where industry issues and concerns are addressed in a practical and targeted manner' (ASLP 1 Program Review 2008:35).
- The independent mid-term review of ASLP Phase 2 (ACIAR and AusAID 2013) also noted the high level of engagement from Pakistani officials and the value that Pakistani organisations saw in the program.

6 See <https://aciar.gov.au/publication/books-and-manuals/enabling-policies-developing-smallholder-agriculture-pakistan> accessed on 15 April 2021.

Program achievements – outcomes

The program's theory of change envisioned that direct participants in ASLP projects (for example, those involved in demonstration sites or value chains) would adopt the practices promoted by ASLP, and through this achieve outcomes such as increased incomes.

The available evidence suggests **that adoption and increased incomes for participants were largely achieved**. There is credible evidence from the dairy, mango and social science projects that direct participants adopted the improved practices and improved their incomes as a result. The contribution of specific projects is summarised in Appendix 1.3 and discussed in more detail in each of the individual commodity evaluations.

Evidence also suggests there has been **success in building the capacity of researchers and scientists**. For example:

- In the citrus projects, ongoing trials of new varieties and rootstocks beyond the projects' end suggest that the citrus projects have built ongoing scientific capacity in this area.
- In dairy, Pakistani and Australian student scientists, scientists and dairy experts who participated in the projects' *capacity-building* programs recorded a high adoption of dairy research knowledge and practices.
- In the mango projects, there is good evidence that capacity of the post-harvest research and teaching laboratory at the University of Agriculture Faisalabad was built during the projects, and has likely improved further after the projects.
- Projects were able to break down barriers between different institutions in Pakistan, enabling these institutions to better communicate and collaborate with each other. This is a significant achievement in the context of the siloed nature of institutions in Pakistan.

At the same time, **there is insufficient data available to support conclusions on whether capacity of extension services and governments was built through ASLP**. On the positive side, the dairy project impact study demonstrated increased capacity of extension workers to deliver inclusive extension services. However, for the citrus and mango projects, there is no systematic data available on changes in extension capacity. Similarly for government agencies, it has been difficult to access quality data on changes in capacity. This has been an ongoing challenge during ASLP. For example, the final independent review for the mango value chain project found that, although National Agricultural Research Council (NARC) understood the importance of value chain research and development, the independent team was unable to assess whether this translated into increased capacity to deliver value chain projects.

A further outcome in the theory of change is that actors **use their increased capacity to adopt policies and scale out practices/approaches**. Similar to the capacity outcome outlined above, **there is insufficient data available to support conclusions on whether this was achieved**.

On the positive side, the final ASLP report notes that ASLP Phases 1 and 2 'underpinned public sector investment in the form of complementary projects amounting to [PKR]17,750 million (AUD ~178 Million)' (Brettell et al. 2016:17). Interviewees also reflected that they continued to share program outputs; for example, ACIAR continues to share outputs from the policy component with senior Pakistan government officials.

At the same time, there is no systematic data available to the reviewer to support conclusions that scale out has taken place. The above quote on public sector investment, for example, wasn't verified in any of the program's independent reports. The project-level evaluations also paint a mixed picture. Some interviewees reflected that ASLP practices continued to be used and have spread in Pakistan, while others felt that, while there was a good knowledge basis in the country, project outputs were not easily available for stakeholders to access and there had not been significant widespread change. In addition, the final outputs for the policy project were delivered much later (in 2019) than the other ASLP projects, making it difficult to assign its successes to ASLP.

Given the lack of systematic data available, and the mixed evidence from interviews, this evaluation has not been able to reach defensible conclusions on the achievement (or otherwise) of higher-level outcomes on scale out of ASLP-supported practices and policies.

This points to an important lesson for ACIAR, and one which was also highlighted in project-level reports: that programs (and the projects under them) **need monitoring systems that systematically collect data on changes in capacity and scale out**. This will allow programs to understand if, during their lifetimes, they are making progress towards these higher-level outcomes. If progress is not being made, adjustments can be made as required. Systematic monitoring systems would also ensure more data is available to make a case for whether outcomes have been achieved in the long-term.



3. Benefits and challenges of the programmatic approach

This section of the report discusses the factors that influenced ASLP's performance and the benefits and challenges of ASLP's programmatic approach. It covers the key evaluation questions of:

- What are the main factors that influenced program performance?
- What benefits were realised by adopting a programmatic approach, compared to an individual project approach?
- What challenges arose from the programmatic approach?

As discussed in the methodology section of the report, to address these evaluation questions, the evaluation team developed a framework outlining the potential benefits of a programmatic approach (see Appendix 1.2). The framework identifies 4 potential ways in which a programmatic approach can add value beyond what individual projects can achieve:

- by increasing impact
- by increasing knowledge and learning
- by increasing influence and adoption
- by streamlining management.

The framework also outlines criteria to determine whether an ACIAR program realised these program benefits to a low, medium or high extent.

Potential benefit 1: Increasing impact

Medium-High: Projects are closely connected but without a strong theory of change; projects operate independently with some collaboration

A key potential benefit of a programmatic approach is that **it can increase impact beyond what would be achieved by individual projects**. Specific ways that increased impact can be achieved include:

- Projects work collaboratively towards a program theory of change, combining results for greater impact.
- A program extends the reach of interventions to multiple geographic areas.
- A program broadens the diversity of perspectives and strategies to provide a holistic response to a common problem.

ASLP sought to increase impact through the strategies described in dot points one and 3 above.

The extent to which ASLP actually realised these benefits is rated as medium-high. The ASLP projects were closely connected and worked towards shared outcomes. However, the theory of change and the end-of-program outcomes were not clear. ASLP also sought to broaden the diversity of perspectives through the introduction of the social science project in Phase 2. Unfortunately, the potential for the social and commodity-based projects to achieve a holistic response was not realised due to the context, differing project methods, and the lack of incentive alignment.

As we can see from the preceding sections on the theory of change and program achievements, it is clear that **ASLP projects were closely connected and aimed to work together to achieve more than the sum of their parts**. ASLP's components and projects were complementary, and achieving higher-level outcomes relied on outputs being combined across multiple projects and areas of action (including the ACIAR engagement with the Government of Pakistan).

At the same time, a major program challenge was that **the theory of change - and particularly the final outcomes that ASLP would achieve - was not clear during the program's life**. As previously noted, ASLP did not have an articulated theory of change. A theory of change can benefit a program by articulating the desired outcomes a program wishes to achieve, unpacking individual activities which can contribute to desired outcomes, and identifying a program's limitations.

The ASLP experience highlights some clear disadvantages of not having a theory of change. ASLP did not have a clear set of outcomes that it wished to achieve. The **ASLP Phase 2 design document presents ASLP as a development program** and does not clearly articulate the benefits and limitations of a research-for-development approach. The design document implied that ASLP would have broad development and poverty reduction outcomes beyond those achieved for beneficiaries directly involved in program activities. For example:

- One program outcome was 'collaborate strategically to improve livelihood systems for the rural poor in Pakistan' (ACIAR 2010:44).
- Program-level indicators included 'ASLP contributes to poverty alleviation in Pakistan' and 'strengthened gender equity and environmental sustainability' (ACIAR 2010:44).
- An indicator for the program's pro-poor component was that 'ASLP led to improvements in the dairy, mango and citrus industries measurable in terms of enhanced productivity, quality and market access, and employment opportunities for the poor and marginalised' (ACIAR 2010:44).

The Phase 2 mid-term review **steps back from this position of ASLP Phase 2 achieving broad development outcomes**. It highlights that:

ASLP is clearly an agricultural research initiative with potential to develop and pilot appropriate 'proof of concept' or 'fit for purpose' technologies or approaches. Thus, ASLP is an incubator of ideas and approaches rather than a mechanism to deliver broad scaling up (ACIAR and AusAID 2013:8).

At the same, the mid-term review **highlights that ASLP was more ambitious than a traditional research-for-development program**. This is because it sought to actively address constraints to adoption and policy barriers, and wanted to ensure approaches were embedded with long-term partners who could achieve scale out. This implies that ASLP occupied a middle ground between a development program and a more standard research-for-development program.

This lack of clarity on whether ASLP was a development program or a research-for-development program created challenges. Without a clear theory of change and realistic end-of-program outcomes, it is more difficult for program staff to understand what they are trying to achieve, maximise program impact, and manage the expectations of partner organisations and funders. In particular, the lack of clarity around program outcomes created significant tension with the program funder, DFAT.

A lesson for ACIAR is that **programs should be very clear on what research-for-development programs can achieve as well as their limitations**. A clear program theory of change, which demonstrates what a research-for-development program can and can't realistically achieve, can assist ACIAR to better manage its programs and manage the expectations of in-country partners and funders.

The second area where ASLP sought to increase impact was to **broaden the diversity of perspectives and strategies to provide a holistic response to development challenges in Pakistan**. ASLP particularly aimed to do this through the introduction of the social science project into Phase 2 of the program. The social science project aimed to support other projects to better collaborate, and to increase their pro-poor and gender focus by providing greater insight into the needs of Pakistan communities. Strong engagement between the social science project and the commodity-based projects was envisioned when the Phase 2 projects were designed.

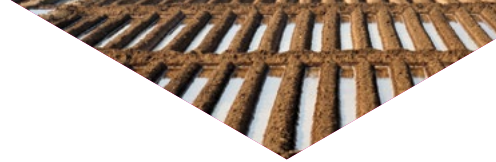
The potential for the social science and commodity-based projects to provide a holistic response to challenges in Pakistan was not realised, with the social science and commodity-based projects unable to add as much value to each other as desired. This was likely to the detriment of all projects and the program overall. Three main factors contributed to this situation:

- context
- project objectives and methods
- incentives.

In relation to **context**, the social science project did not commence until Phase 2 of ASLP. At this point the commodity-based projects, including their approaches and their geographic locations, were already well-established. This made it challenging for the different projects to adjust and identify common areas of interest where they could work together. At the same time, ASLP devoted insufficient time and effort to encouraging and facilitating collaboration between projects. Annual meetings between team leaders were held in Australia, however, interviews indicate that insufficient time was dedicated to enabling teams to deeply understand each other's approaches and perspectives to enable collaboration.

In the area of **project objectives and methods**, staff from the commodity-based projects felt the purpose of the social science project was unclear and that it was 'tacked on' to ASLP. There were also different views about what success for the social science project might look like. In addition, the social scientists and commodity-based scientists struggled to understand each other's value-add and this made collaboration more challenging. A quote from the final report for the Phase 2 mango value chain project encapsulates the issue well:

The value chain research approach was more active and interventionist while the social project's approach emphasised observation, description and reflection, with a tendency to avoid direct involvement in actions to improve situations being studied. This reliance on two different methodologies, while entirely defensible for each project, added a further layer of complexity in terms of working to mutually agreeable timetables (Collins, Sun and Ayyaz 2015:38).



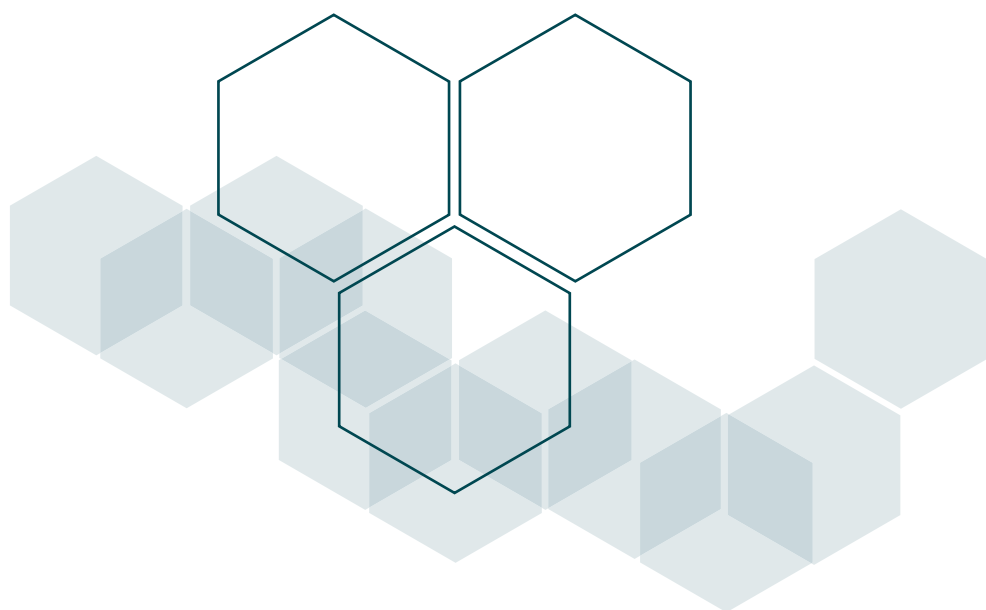
The challenges of cross-project collaboration were further exacerbated by the **program and project incentives**. Interviews highlighted that the incentives for projects, ACIAR RPMs and the overall program were not always aligned. For example:

- The ACIAR project proposal system is based around individual projects, rather than around projects within a program. This means that projects are not required to outline how they will collaborate with other projects or contribute to an overall program. As a consequence, the reporting system does not automatically include reporting on such work or hold a project accountable for a lack of collaboration.
- Project managers – who are often academics – are generally incentivised to publish as much as possible. Interviewees highlighted that this is often easier when working in a single discipline compared to cross-disciplinary work, reducing incentives for project collaboration.
- The ACIAR management structure means that projects are accountable to their RPMs rather than to a program coordinator. RPMs themselves have their own large portfolio of projects to run. Their workload and focus on a particular sector means RPMs may be reluctant to engage with a program that will create additional coordination and collaboration work, or that is perceived to be focused on a different sector to their own portfolio. This appears to have been the case for the policy enabling project, where it took significant time to get the policy RPM to engage with ASLP as it was perceived to be a horticulture program.

These factors created a situation where the **ASLP coordinator could attempt to influence projects, and their RPMs, to collaborate and work together, but had little power to compel projects to collaborate**. The ASLP coordinator also had some ability to create imperatives for collaboration. For example, they controlled program budget and so could exert influence through project budget allocations. But overall, there were few clear incentives for RPMs and projects to work in the interests of ASLP.

The end result of the context, the different methods and objectives, and the lack of incentive alignment was that the **program's aspirations to use diverse perspectives to create a holistic response to program challenges was not realised**. This points to 2 lessons for ACIAR if it wishes to capitalise on diverse perspectives in future programs:

- Project, program and ACIAR team selection should consider staff traits such as openness to collaboration, good communication, and enthusiasm about working in multidisciplinary teams.
- The design and implementation of programs should ensure the incentives for programs and projects are aligned. Approaches could include, for example, developing proposal and reporting systems that ensure cross-project collaboration is planned, implemented and reported on; and ensuring program coordinators have more power to compel projects to collaborate and work in the interests of the program.



Potential benefit 2: Increasing knowledge and learning

High: Strong evidence of sharing and learning between projects with evidence of how this learning has strengthened project implementation

A second potential benefit of a programmatic approach is that it can increase knowledge and learning between its constituent projects and areas of work. This can be achieved by:

- Sharing information between projects to build knowledge and strengthen outcomes.
- Comparing intervention approaches across different contexts.

ASLP focused on sharing information between projects to build knowledge and strengthen outcomes. Comparing intervention approaches was not a priority for ASLP.

The extent to which this benefit was realised is rated as high. The issues with the social science project notwithstanding, ASLP projects shared knowledge, and this strengthened outcomes. The interaction of the mango production and value chain projects provides a key example. This section highlights the divergent views expressed during the evaluation about ACIAR organisational learning systems and practices.

ASLP achieved knowledge sharing, which strengthened outcomes. A key example is that **the mango production and value chain projects were closely linked** and dependent on each other. One interviewee noted that 'all the achievements in the value chain project were really supported by the production project', with the projects working together to jointly determine what each project should focus on to avoid duplication, and referring any problems that were identified to the project best placed to address them. It is also clear that this interdependence was enabled by the projects coming under the ASLP, as the ASLP/ACIAR teams drove collaboration to ensure the projects were closely linked, for example, by facilitating the annual ASLP meetings.

Two other examples of knowledge sharing to strengthen outcomes were:

- The policy enabling project used issues identified in the commodity-based projects as the basis of its work on policy constraints for smallholder farmers.
- The citrus and mango projects collaborated on a best practice nursery manual.

This evaluation focused on sharing and learning between projects within ASLP. However, **during the course of the evaluation, other forms of programmatic and organisational learning were discussed.**

Interviewees discussed not only the extent to which projects under ASLP learned from each other, but other forms of learning such as:

- Learning within projects – for example, the extent to which recommendations from independent reviews were actioned by projects.
- Learning between different phases of a program (for example, ASLP Phase 1 learnings informing ASLP Phase 2).
- Learning between different ACIAR programs (for example, ASLP learnings informing the Transformative Agriculture and Enterprise Development Program (TADEP)).

Different interviewees provided very different views on the extent to which this learning took place. Some felt that independent project and program evaluations were taken very seriously by teams, and that recommendations were actioned. Strong learning examples were also provided, such as visits and mutual learning between ASLP and similar projects within the ACIAR program in the Philippines. Examples of where lessons from ASLP were adopted in other programs were also provided, for example, 'collaboration grants' were included in TADEP to provide a funding incentive for project teams to collaborate.

Other interviewees felt that learning was taken less seriously and was more ad hoc. Some interviewees reflected that independent evaluations were not always followed up. This position is supported by the final independent reviews of the ASLP Phase 2 projects, which map numerous recommendations from the ASLP Phase 2 mid-term review that had not been actioned at project completion. Interviewees also felt that learning between program phases and between different programs was not systematic, and that any learning that had taken place was due to the continuity of ACIAR staff with a commitment to certain programs, rather than specific learning systems or culture within ACIAR.

It is not within this evaluation's scope to fully assess learning culture and practices within ACIAR. That said, the **divergent views on organisational culture suggest that ACIAR may wish to revisit its approach to learning** and consider whether improvements are needed. This could include, for example, considering whether learning is intentional, whether there are systems and leadership in place to support a culture and practice of learning, and whether learning is broad-based or concentrated within a small number of key individuals. Any reconsideration of organisational learning could also include an examination of the incentive issues. For example, it may be helpful to consider the incentives for RPMs and projects to adjust their projects based on independent reviews, and for project leaders to make project changes in response to RPM directions.

Potential benefit 3: Increasing influence and adoption

Medium: Some examples or evidence of the program enhancing leverage or influence with stakeholders and communicating results

A further dimension of a programmatic approach is that it can assist with increasing influence and adoption. This can be done by:

- Enhancing leverage through joint action with government, market institutions or other stakeholders.
- Fostering sustainability by building relationships.
- Strengthening communication of research findings.

The extent to which this benefit was realised is rated as medium. Using a multifaceted approach, ASLP was able to foster strong relationships with government partners to enhance leverage and foster sustainability. However, ASLP missed the opportunity to increase its influence through strengthened communication of its research findings.

ASLP was effective at building relationships to increase influence, enhance leverage, and foster sustainability. The ACIAR team, including program staff based in Australia and Pakistan, focused significant time and resources on building relationships with senior Government of Pakistan officials. These efforts appear to have been successful as Pakistan partners considered ASLP to be credible and relevant.

ASLP's success in building relationships and using these for leverage and sustainability appears to have been driven by 3 factors:

- ASLP hired a highly competent Pakistan-based program staff member with a scientific background and strong networks with relevant Pakistan institutions. ASLP was able to draw on this staff member's credibility and networks to build strong relationships on behalf of the program.
- ASLP program staff focused on building one-on-one relationships with key Government of Pakistan policy makers, including through individual visits to their offices and informal socialising.
- ASLP complemented one-on-one relationship-building with a program-wide Steering Committee. This Steering Committee provided a direct line of sight – and an 'in' for the one-on-one relationships discussed above – to senior Government of Pakistan policymakers. The Steering Committee was also an effective forum for sharing ASLP's achievements and building support for ASLP.

The Steering Committee was an advisory body rather than a decision-making body, and so provided little practical support in terms of program decision-making. While a small number of interviewees felt it would have been beneficial for the Steering Committee to provide more practical support, its advisory nature also meant it was an effective forum for communication and information sharing without acting as a bureaucratic handbrake on program decision-making.

A program can add value by strengthening the communication of research findings. However, **ASLP missed an opportunity to increase its influence and adoption through strengthened communication of research findings.**

ASLP and its constituent projects identified new practices and policies, and produced a significant number of documents on these. These documents include fact sheets, good practice guides and training modules.

However, as highlighted in the project-level evaluations, **at the end of ASLP there was no institutional home for many of these materials**, and program materials were not collated into a central repository. Nor was there a plan or system to ensure these materials would be maintained and made available on an ongoing basis. The evaluation team understands that ACIAR did not collate program materials onto the ACIAR website until after ASLP Phase 2 had ended and that this was largely undertaken due to the initiative of a motivated individual. This represents a missed opportunity for ASLP, as the program's reach, sustainability, and potential for scale out by other partners could have been increased through better accessibility of program materials to a broad audience, including individuals and organisations not directly linked to ASLP.

The key lesson for ACIAR is that, for future programs, **better communication strategies and central repositories for program outputs should be considered to maximise the opportunities for program influence.**

Potential benefit 4: Streamlining management

Medium: Minimal benefits to streamlining reporting and donor relationships; governance and training adding value to the projects

A potential benefit of a programmatic approach is that it can streamline management by:

- Coordinating implementing entities and interactions with funders.
- Shared governance arrangements.
- Standardising management and specialised support (for example, M&E and reporting processes, approach to cross-cutting issues, and capacity development).

ASLP sought to maximise all of these benefits through its programmatic approach. **The extent to which ASLP realised these benefits is rated as medium.** ASLP streamlined management through coordinated governance and budget arrangements, and centralised training support to programs. ASLP also attempted to streamline the relationship with DFAT. Unfortunately the ACIAR–DFAT relationship experienced significant challenges in this regard, noting that ASLP’s experience will not be applicable to all ACIAR programs.

ASLP aimed to streamline management by **coordinating program-level interactions with the program funder, DFAT.** ASLP had a program coordinator managing the DFAT relationship, including M&E and reporting to DFAT. This created efficiencies for projects not having to deal directly with DFAT.

However, **there were significant tensions between ACIAR and DFAT around ASLP, which minimised the benefit of management streamlining.** Some of these tensions were driven by ASLP-specific issues. For example, ASLP’s end-of-program outcomes and the extent to which it was a development program were not clear in the program design. This issue flowed through into ASLP’s M&E and reporting. Multiple documents and interviews highlighted that:

- DFAT expected that ASLP would achieve development outcomes, while ACIAR felt DFAT expectations for impact and timeframes for program achievements were unrealistic.
- DFAT was not satisfied with program reporting, which often focused on summarising project achievements rather than overall program achievements. At the same time, ACIAR believed it did not get good guidance from DFAT on the program’s M&E framework and the type of reporting that would meet the needs of DFAT.

Importantly, there were tensions between DFAT and ACIAR that ASLP could not influence.

For example, there were frequent staff changes in DFAT and therefore little corporate memory about ASLP. DFAT staff in Islamabad appeared to have had minimal engagement with the program and did not visit its field sites. DFAT and ACIAR were also involved in broader, and apparently challenging, discussions around aid reporting and the need to retrofit program reporting to DFAT’s (then) new aid reporting framework.

While ASLP and ACIAR experienced challenges in the relationship with DFAT, **note that not all ACIAR programs are, or will be, funded by DFAT.** Therefore issues highlighted here will not be applicable to all programs. Nor should the challenges encountered in the relationship with DFAT discourage ACIAR from pursuing programmatic approaches in the future especially when those programs are predominately funded by ACIAR.

ASLP also aimed to streamline management through **shared governance and budget arrangements.** **The program was successful in this regard.** ASLP’s Steering Committee was an effective forum for relationship building and communication. Another area of program management that ACIAR highlighted as vital to program success was its budget system. Under this system, funds were held by an international organisation in Pakistan, rather than by a Government of Pakistan entity. This ensured the funds were not subject to restrictive government processes, such as the need to procure goods from registered government suppliers. ASLP paid a fee to the international organisation for this service, but many ACIAR interviewees considered this was worthwhile due to the flexibility provided by the international organisation.

A further benefit of the program approach was that **it streamlined approval processes with the Government of Pakistan.** ACIAR interviewees outlined that once Pakistan had approved ASLP, it was much simpler to gain approvals for individual projects, delivering an important streamlining benefit for ACIAR.

ASLP was able to centrally provide technical and training support to projects. This included, for example, support on gender and inclusion through the social science project, as well as specific training to project teams in areas such as gender, impact measurement and communications. This central support was a benefit of the program approach and was largely valued by the projects.

The ASLP approach came with transaction costs. Additional staff time and resources were needed to oversee the program, and busy ACIAR RPMs and project leaders needed to put more time and effort into collaboration and coordination. However, in the context of the benefits of the programmatic approach that were achieved, and the potential for even greater benefits, these transaction costs appear to be a worthwhile investment.



Conclusions and lessons learned

ASLP was conceived as a program and brought together complementary projects to achieve an overall set of outcomes. The program's projects identified new practices and policies to assist specific commodities and smallholders in Pakistan. The program was regarded as credible and relevant by the Government of Pakistan, and it increased the capacity of researchers and scientists. Unfortunately the lack of systematic data means it is not possible to draw conclusions on whether capacity was built for governments and the extension system, or whether increased capacity was used to scale out the program's work.

The framework provided in Appendix 1.2 highlights that there are a number of potential benefits of a programmatic approach. The ASLP experience demonstrates that when ACIAR uses a programmatic approach, **it needs to intentionally design, implement and resource activities to ensure these programmatic benefits are realised.** Examples of how this was achieved as part of ASLP included:

- The complementary nature of ASLP projects set up the program to achieve more than the sum of its parts.
- Learning between projects, particularly the mango projects, strengthened outcomes.
- The multifaceted approach to building relationships assisted the program to enhance leverage and foster sustainability.
- The program governance, budget and training arrangements streamlined management.

At the same time, **it was clear that there was potential for more benefits to be achieved through the programmatic approach, but this potential was not realised.** In particular, there was a lack of clarity around the program's theory of change and what could realistically be achieved by the program's completion, restricting its ability to achieve impact. The potential for the social science and commodity-based projects to provide a holistic response to challenges in Pakistan was not realised due to the late introduction of the social science project, as well as the lack of incentives for projects to collaborate, and challenges working in a multidisciplinary manner. In addition, there was a missed opportunity to better communicate the program's outputs to increase influence. There were also considerable challenges with the ACIAR-DFAT relationship, although these challenges will not apply to all ACIAR programs.

The ASLP experience highlights some lessons for ACIAR to consider. **Learning from and applying these lessons would help ensure that the ASLP experience was worthwhile, not only for the practical outputs it achieved, but for the foundation it provided for future ACIAR programs.**

Lessons learned

This evaluation highlights some general lessons for ACIAR projects and programs:

1. Programs (and the projects under them) **need monitoring systems that systematically collect data on changes in capacity and scale out**. This will allow programs to understand if, during their lifetimes, they are making progress towards these higher-level outcomes. If progress is not being made, adjustments can be made as required. Systematic monitoring systems would also ensure more data is available to make a case for whether outcomes have been achieved in the long-term.
2. **Programs should be very clear on what research-for-development programs can achieve as well as their limitations**. A clear program theory of change which demonstrates what a research-for-development can and can't realistically achieve can assist ACIAR to better manage its programs and manage the expectations of in-country partners and funders.
3. To capitalise on diverse perspectives and enable holistic responses, **project, program and ACIAR team selection should consider staff traits such as openness to collaboration, good communication, and enthusiasm about working in multidisciplinary teams**.
4. Diverse perspectives and holistic responses will be further enhanced **by ensuring the incentives for programs and projects are aligned**. Approaches could include, for example, developing proposal and reporting systems that ensure cross-project collaboration is planned, implemented and reported on; and ensuring program coordinators have more power to compel projects to collaborate and work in the interests of the program.
5. Program influence could be increased **through better communication strategies and central repositories for program outputs**, to ensure such outputs are available to a broad audience.
6. **ACIAR may wish to revisit its approach to organisational learning** and consider whether improvements are needed. This could include, for example, considering whether learning is intentional, whether there are systems and leadership in place to support a culture and practice of learning, and whether learning is broad-based or concentrated within a small number of key individuals.



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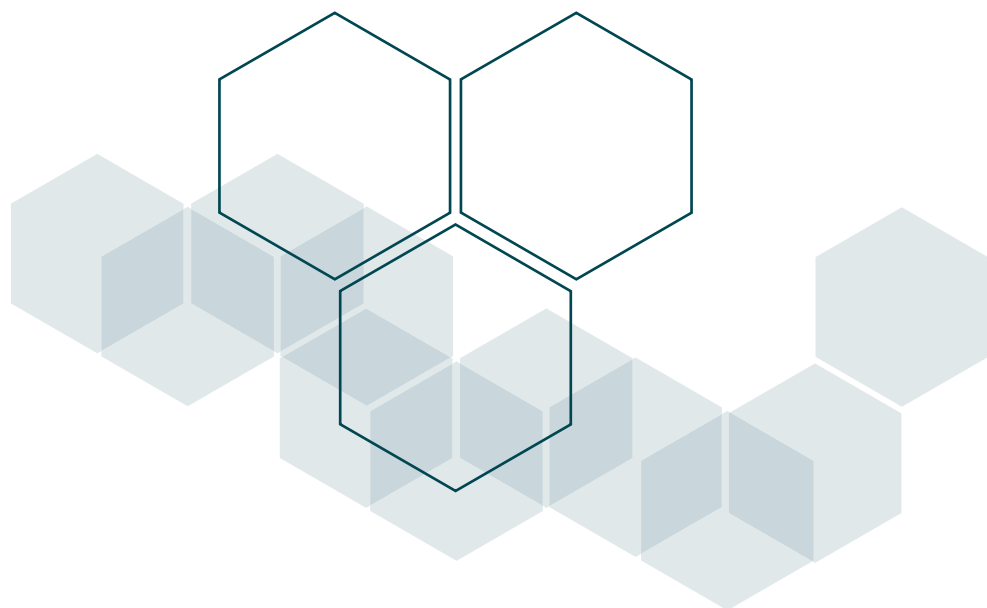
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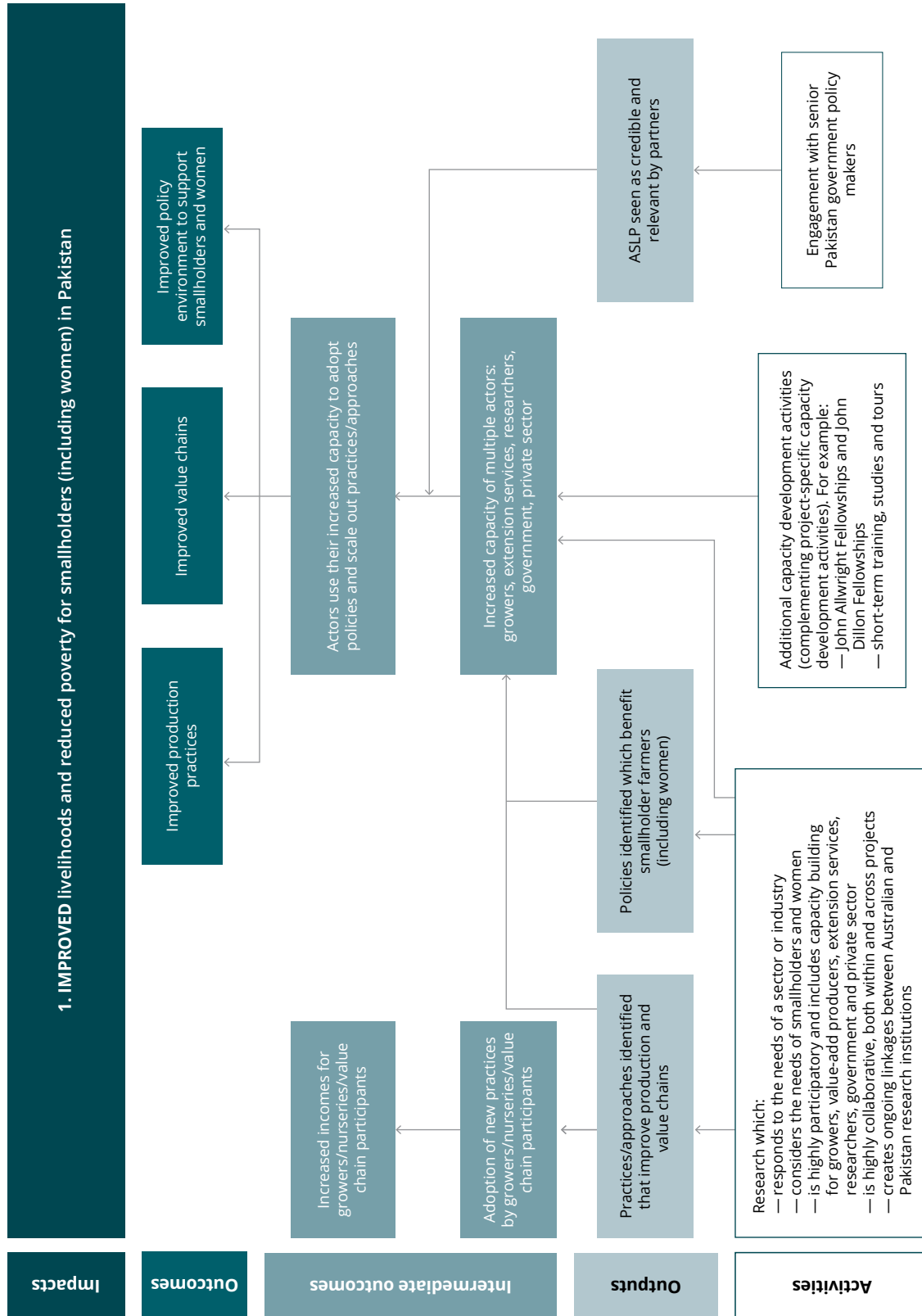
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Appendixes

Appendix 1.1: Theory of change

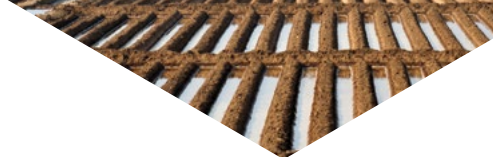


Appendix 1.2: Potential benefits of a programmatic approach and rubric

Dimension	Extent to which benefits were realised		
	Low	Medium	High
Increasing impact	<ul style="list-style-type: none"> Projects work collaboratively towards a program theory of change, combining results for greater impact. Extending the reach of interventions to multiple geographic areas. Broadening the diversity of perspectives and strategies to provide a holistic response to a common problem. 	<ul style="list-style-type: none"> Projects are loosely related to program goal objectives but operate independently. No program level theory of change. Geographic locations of projects are not strategic. 	<ul style="list-style-type: none"> Projects are highly interdependent and complementary. A combination of project outcomes is required to meet program goals. A strong overarching theory of change drives selection of projects. Projects may address different aspects of a common problem or operate in different locations to strategically broaden outcomes.
Increasing knowledge and learning	<ul style="list-style-type: none"> Sharing information between projects to build knowledge and strengthen outcomes. Comparing intervention approaches across different contexts. 	<ul style="list-style-type: none"> No or limited evidence of sharing and learning between projects. Examples of where learning has influenced project implementation. 	<ul style="list-style-type: none"> Strong evidence of sharing and learning between projects with clear evidence of how this learning has strengthened project implementation.
Increasing influence and adoption	<ul style="list-style-type: none"> Enhancing leverage through joint action with government, market institutions or other stakeholders. Fostering sustainability by building relationships. Strengthening communication of research findings. 	<ul style="list-style-type: none"> No or limited evidence that the program structure is being used to promote the program, or influence stakeholders. Some examples or evidence of the program enhancing leverage or influence with stakeholders and communicating results (over what could have been achieved by individual projects). 	<ul style="list-style-type: none"> The program routinely works to influence stakeholders to raise awareness of program outcomes, and increase adoption and sustainability of results. There is evidence that this has had a positive effect.
Streamlining management	<ul style="list-style-type: none"> Coordinating implementing entities and interactions with funders. Shared governance arrangements. Standardising management and specialised support (M&E and reporting processes, approach to cross-cutting issues, capacity development support). 	<ul style="list-style-type: none"> No or minimal benefits in relation to streamlining reporting or communication with funders and other stakeholders. No or minimal support for M&E, cross cutting issues, or capacity development. Governance provides oversight of projects, without significant value-add to the program. 	<ul style="list-style-type: none"> Clear benefits achieved by streamlining communication and reporting. Shared M&E Framework effectively used to aggregate program results. Program structure supports projects to strengthen approach to cross-cutting themes and build capacity on common issues. Governance contributes strongly to achievement of program-level outcomes.

Appendix 1.3: Summary of project contributions to selected outputs and outcomes

Project	Contribution	Examples of outcomes/evidence
Output: Practices/approaches identified that improve production and value chains		
Citrus	Strong	<ul style="list-style-type: none"> • Introduced and trialed 7 new citrus varieties and 8 new rootstocks. • Increased scientific knowledge in modern orchard and nursery management, covering areas such as pruning, fruit thinning, plant nutrition, pest control and irrigation. • Produced at least 8 training manuals, a joint nursery manual with the mango projects, and 13 peer-reviewed journal articles. • Trained at least 5,700 growers. • Trained women to conduct backyard nursery activities. • Conducted capacity building for researchers, scientists and extension workers, and supported students to obtain higher degrees.
Mango	Strong	<ul style="list-style-type: none"> • Identified evidence-based approaches to pruning, nutrition, disease and pest management, orchard floor management, and integration of management techniques. • Identified the source and management options for field and post-harvest diseases and pests. These included mango sudden death syndrome^a, mango malformation disease, gall midge, dendritic spots, and mango stem end rots. • Demonstrated that value chain approaches could work in Pakistan by supporting 4 value chains and associated outputs to ensure these value chains could function. • Produced at least 37 pamphlets and technical guides, a joint nursery manual with the citrus project, and 50 peer-reviewed journal articles. • Trained at least 6,000 growers. • Supported village women on a mango pickle value chain. • Conducted capacity building for researchers, scientists and extension workers, and supported students to obtain higher degrees.
Dairy	Strong	<ul style="list-style-type: none"> • Identified new practices for profitable smallholder dairy farming, milk value-adding and milk marketing, calf rearing and fodder production. • Identified key extension messages and developed and tested a new approach to extension, the 'whole family approach'. • Produced at least 35 modules and fact sheets, and 14 peer-reviewed journal articles. • Trained at least 1,500 farmers and worked with women on dairy value-added products. • Conducted capacity building for researchers, scientists and extension workers, and supported students to obtain higher degrees.
Social science	Good	<ul style="list-style-type: none"> • Established Community Service Centres in 4 focal villages as centres for training, community equipment, and meeting spaces. • Conducted training in low-income households in focal villages that responded to these household needs. For example, training for youth in commodity skills for citrus and mango villages; training for female youth in diary value addition and sewing skills. • Produced at least 9 publications.
Agricultural capability component	Good	<ul style="list-style-type: none"> • Supported capacity building through 16 John Allwright Fellowships for MPhil/PhD programs (7 female, 9 male) and 3 John Dillon Fellowships (3 male).



Appendix 1.3: Summary of project contributions to selected outputs and outcomes (cont.)

Project	Contribution	Examples of outcomes/evidence
Outcome: Adoption of new practices and incomes by direct program participants		
Citrus	Some	<ul style="list-style-type: none">The project directly trained growers and orchard managers, but no systematic data is available to support conclusions on adoption and increased incomes.
Mango	Good	<ul style="list-style-type: none">Pre-post studies showed that direct participants adopted value chain approaches and increased their incomes (including women in a mango pickle value chain).
Dairy	Strong	<ul style="list-style-type: none">A comparative study showed adoption rates of key messages ranged between 40% and 70%, with farm profits increasing by an average of 30%.
Social science	Good	<ul style="list-style-type: none">A pre-post study showed that almost 90% of male respondents and 86% of female respondents believed their project had met their needs; and 60% of respondents (both male and female) believed training had improved their knowledge and skills to earn more income. Female empowerment through involvement in household decision-making also increased substantially.

- (a) The Phase 1 production project determined the causal agent for mango sudden death syndrome – a significant achievement given researchers previously had diverse views on the disease's cause.

Appendix 1.4: Stakeholders consulted

Name	Title	Organisation or location
Dr Kazmi Munawar	Project Coordinator – Production (Phase 1) ACIAR Country Manager, Pakistan (Phase 2)	ACIAR
Mr Gerard McEvelly	Aik Saath Program Coordinator	ACIAR
Dr Les Baxter	Former ASLP Program Coordinator	ACIAR (former)
Dr Peter Horne	General Manager, Country Partnerships	ACIAR
Ms Irene Kernot	Research Program Manager, Horticulture	ACIAR
Dr Jayne Curnow	Research Program Manager, Social Sciences	ACIAR
Dr John Spriggs and Ms Barbara Chambers	Project leads	Social project, ASLP Phase 2
Name confidential	Program Manager	DFAT

Appendix 1.5: Program evaluation framework

The data and process used for addressing each of the key evaluation questions (KEQs) is summarised in this table. Bold questions are high priority and were explored in more depth.

Key Evaluation Question	Evidence/information required	Data sources	Data collection and analysis approach
<p>1. What was the process, timing (vis-à-vis constituent projects) and rationale for bringing projects together under this program?</p> <ul style="list-style-type: none"> – How is the program structured? 	<ul style="list-style-type: none"> • Documentation on discussion and decision processes • Perspectives of key stakeholders • Program structure documentation 	<ul style="list-style-type: none"> • Program concept / design documents, ROUs, file notes, etc. • Key program-level stakeholders (as above) 	<ul style="list-style-type: none"> • Documentation review, stakeholder interviews, triangulation
<p>2. What is the program's theory of change? To what extent have the intended program goal and outcomes been achieved?</p> <ul style="list-style-type: none"> – What was the contribution of each project? 	<ul style="list-style-type: none"> • Documented theory of change at program commencement and/or subsequently • Documented evidence of program progress and achievements • Assessments of project-level achievements • Perspectives of key stakeholders 	<ul style="list-style-type: none"> • Program concept / design documents, ROUs, variations • Program-level progress reporting and reviews • Project-level evaluations • Key program-level stakeholders (for example, program manager/ coordinator, ACIAR country managers, RPMs, DFAT, government partners) 	<ul style="list-style-type: none"> • Documentation review, stakeholder interviews, triangulation • ACIAR Outcomes Framework (as relevant) • Quantitative assessments (where feasible)
<p>3. What were the main factors that influenced program performance?</p> <ul style="list-style-type: none"> – To what extent were the program's scope, scale, structure and management arrangements appropriate? – How did the program's particular structure and management arrangements influence program achievements? – What external factors arose, for example, budgetary, natural hazards, policy settings, etc.? 	<ul style="list-style-type: none"> • Existing analyses of program achievements and contextual factors • Project-level assessments • Information on program structure and management • Perspectives of key stakeholders 	<ul style="list-style-type: none"> • Project-level evaluations • Program documentation, for example, operational guidance, annual reports, reviews, aid quality checks • Key program-level stakeholders (for example, program manager/ coordinator, ACIAR country managers, RPMs, DFAT; government partners) 	<ul style="list-style-type: none"> • Documentation review, stakeholder interviews, triangulation

Appendix 1.5: Program evaluation framework (cont.)

Key Evaluation Question	Evidence/Information required	Data sources	Data collection and analysis approach
<p>4. What benefits were realised by adopting a programmatic approach, compared to an individual project approach?</p> <ul style="list-style-type: none"> - What evidence is there of learning or cross-collaboration between projects within a program? - To what extent were project level outcomes mutually reinforcing within the program? - Did the programmatic approach result in improved implementation strategies and/or additional resourcing, for example, on gender equality? 	<ul style="list-style-type: none"> • Documented evidence of cross-project interactions (learning events etc.) • Project-level assessments • Information on program structure and management • Perspectives of key stakeholders 	<ul style="list-style-type: none"> • Program-level progress reporting and reviews (including aid quality checks) • Project-level evaluations • Assessments of KEQs 1–3 • Key program-level stakeholders 	<ul style="list-style-type: none"> • Documentation review, stakeholder interviews, triangulation
<p>5. What challenges arose from the programmatic approach?</p> <ul style="list-style-type: none"> - To what extent did the benefits outweigh the challenges? 	<ul style="list-style-type: none"> • Documentation on challenges • Perspectives of key stakeholders 	<ul style="list-style-type: none"> • Program-level progress reporting and reviews (including aid quality checks) • Project-level evaluations • Assessments of KEQs 1–4 • Key program-level stakeholders 	<ul style="list-style-type: none"> • Documentation review, stakeholder interviews, triangulation • Verification workshops for each program (pertinent for all program KEQs)



Part 2: Citrus projects

An evaluation of the
ACIAR Agriculture Sector Linkages Program

Abbreviations and acronyms

ACIAR	Australian Centre for International Agricultural Research
ASLP	Agriculture Sector Linkages Program
AUD	Australian Dollar
AusAID	Australian Agency for International Development
AVCCR	Agriculture Value Chain Collaborative Research Program
DFAT	Department of Foreign Affairs and Trade
FVDP	Fruit and Vegetable Development Project (Government of Punjab)
NARC	National Agriculture Research Centre (Pakistan)
NGO	Non-government organisation
ODA	Official development assistance
PHKN	Pakistan Hoslamand Khawateen Network
PKR	Pakistan Rupee
RPM	Research Program Manager (ACIAR)
TADEP	Transformative Agriculture and Development Enterprise Program

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Summary

From 2005 to 2015, the Australian Centre for International Agricultural Research (ACIAR) oversaw 2 phases of the Agriculture Sector Linkages Program (ASLP) in Pakistan, which was a research-for-development program in the Punjab and Sindh provinces of Pakistan focused on enhancing selected agricultural value chains for the ultimate benefit of the rural poor. The program had 2 phases: Phase 1 ran from 2005 to 2010, and Phase 2 was implemented from 2011 to 2015. The program was funded by the Department of Foreign Affairs and Trade (DFAT)⁷ and was managed by ACIAR. Both phases included commodity-based projects focused on citrus, dairy and mango. Phase 2 also included a social science research project. The ASLP goals are at Appendix 2.4.

Research projects within the ASLP that focused on Pakistan's citrus industry were:

- Phase 1: Increasing citrus production in Pakistan and Australia through improved orchard management techniques (HORT/2005/160)
- Phase 2: The enhancement of citrus value chains production in Pakistan and Australia through improved orchard management practices (HORT/2010/002).

The 2 citrus projects aimed to assist Pakistan to achieve its goals of improving citrus production and increasing citrus exports, and focused on 3 main streams of work:

- introducing new citrus varieties to Pakistan
- improving orchard management by citrus growers
- improving nursery management by nursery people.

Integrated under each of these workstreams were activities to increase scientific research capacity and improve extension services in Pakistan.

The projects were led by Industry and Investment NSW⁸ together with several collaborating partners from Pakistan. The total budget for both citrus projects was AUD2,974,541, with the Australian aid program contributing AUD2,058,574 of this total.

This evaluation is Part 2 of a suite of evaluations of the ASLP. It is a light touch evaluation which examines the achievements of the citrus projects, including project outputs, adoption and outcomes. It is not a comprehensive impact assessment. The evaluation aims to identify lessons that will inform the design and implementation of future ACIAR investments.



7 ASLP was originally funded by the Australian Agency for International Development (AusAID). AusAID was merged with DFAT in 2013.

8 At the time of the projects, the commissioned organisation was the NSW Government department, Industry and Investment NSW, of which the Department of Primary Industries was a part. At the time of publishing this report, the NSW Department of Primary Industries is part of the Department of Regional NSW.



Key findings



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

The ASLP citrus projects did not have an articulated theory of change when they were developed. Based on document review and interviews, **the evaluation team developed a suggested theory of change covering the 2 projects.**

A visual representation is at Appendix 2.1 and the key elements are:

- The projects were expected to increase the citrus growing season in Pakistan by conducting high quality trials of citrus varieties and rootstock. This would be supported by project work in importing new citrus varieties, establishing screenhouses, and training Pakistani scientists.
- The projects were expected to improve orchard management by citrus growers, and nursery management by nursery people, by providing training to these groups and to the extension workers who support them. These groups were then expected to apply new knowledge, and share new knowledge with their neighbours, resulting in the adoption of modern orchard and nursery management practices.

This theory of change implies there were 3 key assumptions that needed to hold in order for change to come about in the expected way. The assumptions were:

1. Knowledge about improving citrus production needed to be locally adapted, packaged and delivered in a participatory manner to make it useful to scientists, growers and nursery people.
2. Existing and new citrus varieties in Pakistan would meet market demands at profitable prices, giving growers and nursery people an incentive to adopt new varieties and try new management practices.
3. The best way to encourage growers and nursery people to change following project completion would be through peer-to-peer learning.

Key findings (cont.)

2

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

Under the workstream of introducing new citrus varieties, the projects achieved good results in terms of outputs, adoption and outcomes.

Seven new varieties of citrus and 8 new rootstocks were introduced to Pakistan. The projects provided capacity building for Pakistani scientists (including postgraduate studies) and supporting infrastructure such as screenhouses, which together ensured high quality trials of these citrus varieties and rootstock could be implemented. Stakeholders reported that high quality trials are continuing, scientific papers have been published, scientists continue to apply their increased capacity, and at least one new citrus variety has been commercialised, demonstrating good outcomes in this area.

While there have been strong achievements in relation to new citrus varieties, it is important to note that **varietal evaluation and the eventual spread of new citrus varieties and rootstock takes a significant amount of time**. These long timeframes have implications for adoption and outcomes in other project areas, as discussed below.

For improving both orchard management and nursery management, a number of notable outputs were delivered. For example, the projects directly trained 5,700 citrus growers in modern orchard management practices, and 494 nursery people in modern nursery management. The citrus projects included significant training and a partnership with the Government of Punjab's Fruit and Vegetable Development Project to support extension services. This training was underpinned by the generation and packaging of scientific knowledge into user-friendly training packages.

Unfortunately, **there is little rigorous data available on whether these capacity-building activities led to adoption by end users and subsequent outcomes.**

No systematic data was collected during the projects, meaning the evaluation relies heavily on a small number of interviews and document review. The small number and intentional selection of these interviewees means they were unlikely to be representative of the broad experience of program participants.

Data available from interviews and documents paints a mixed picture on adoption and outcomes.

The majority of interviewees stated that citrus growers and nursery people adopted the practices promoted by the ASLP projects, that adoption continued post-2015, and that this led to higher quality fruit and greater incomes. There appears to have been particularly good adoption of furrow irrigation. The citrus projects partnered with a provincial flood rehabilitation scheme, leading to significant adoption of furrow irrigation by citrus growers and 'spillover' adoption by stone fruit growers. In addition, the projects' partnership with the Government of Punjab likely led to increased capacity in extension services.

Strong adoption and outcomes are, however, disputed by some interviewees. Some suggested adoption by growers has been limited post-2015 because insufficient support has been available, and because of financial barriers for growers (even considering the low cost of the promoted management techniques). For nursery management, one key informant stated that only low-cost nursery management practices (for example, new budwood techniques) had been widely adopted, while the projects' final independent review concluded that adoption by nurseries had been limited because of a lack of business case for higher-health trees.



3

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

Given mixed data on adoption and outcomes in orchard and nursery management, it is useful to revisit the assumptions underpinning the project's theory of change. The validity (or otherwise) of these assumptions will help inform a judgement on whether outcomes were achieved, and whether project activities contributed to this.

From interview data, **it appears that the first assumption around participatory training approaches held.** The projects were able to package scientific data into user-friendly formats, and the participatory training approaches used to deliver this information were highly valued by stakeholders. Interviewees reflected on how much they learned and how vital the hands-on training approaches were to the learning process.

However, **it is questionable whether the assumption that citrus varieties would meet market demands at profitable prices was valid.** The projects' final independent review raised issue with the fact that market analysis wasn't undertaken when selecting varieties to trial, and suggested that existing citrus varieties in Pakistan do not meet market needs and are low value. Without market signals and profitable products, there may be few incentives for growers and nursery people to adopt new management practices. That said, as previously noted, testing and introducing new citrus varieties and rootstock takes a significant amount of time. The incentives for growers and nursery people may change as more new varieties become widely available.

It is also questionable whether the third assumption (post-project peer-to-peer learning) held. Post-2015, there was no active institutional home for the *capacity-building* activities of the projects, and interviewees noted that demand for expertise to assist growers outstripped supply. Without ongoing access to training or expertise, it appears unlikely that peer-to-peer learning alone would sustain or increase adoption or outcomes after 2015.

Considering the points under evaluation questions 2 and 3, it appears likely that a small number of growers and nursery people have successfully adopted the practices and achieved improved incomes as a result. It also appears likely that a small number of extension workers continue to use the knowledge to support the citrus industry. However, with no systematic data available, **it is challenging to make a confident assessment of whether the projects' activities translated into widespread outcomes for citrus growers and nursery people, or strong ongoing capacity in extension services.** Given the length of time needed to test and make new citrus varieties widely available, and the lack of an active post-project institutional home for training activities, some enabling conditions for widespread adoption appear to be lacking. This, however, may change as more citrus varieties become available in the future.

Key findings (cont.)

4

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

The ASLP citrus projects were developed in 2005. At that time, aid projects had less focus on gender, marginalised groups or social aspects of research. This is reflected in the citrus projects, **which did not have a strategy for addressing gender issues, or for considering marginalised groups such as people with disabilities or disadvantaged youth.**

Despite the absence of a gender strategy, **a small number of women were able to benefit from the project.** For example, during the Phase 2 project, a women's empowerment activity resulted in the training of 22 poor women in backyard nursery management techniques. These women continue to run backyard nurseries and support other women in their local areas. Interviewees and documents reported increased incomes and empowerment for these women.

The Phase 2 project was also 'pro-poor', or inclusive of poorer farmers. The project employed suitable strategies to reach smallholder farmers, such as:

- promoting low-cost practices
- using farmer field schools to reach large numbers of smaller growers
- using small demonstration sites to show modern practices could be effective on small plots.

At the same time, interviewees highlighted that many growers continued to face financial barriers to adoption; such financial barriers are likely to constrain the achievements of ACIAR projects.

5

How did management arrangements impact delivery of the project?

The Phase 1 project experienced relationship challenges between the teams based in Australia and Pakistan. The main Pakistan-based collaborator did not have sufficient time to engage with the project and his duties did not appear to be well deputised. This, combined with a difficult security situation in Pakistan that made it very challenging for the Australia-based team to visit, likely hampered the performance of the project. Fortunately, **the Phase 2 project was able to overcome many of these challenges.** It hired 2 in-country project coordinators and provided them with strong project ownership, resulting in improved performance.

ACIAR also experienced challenges in its management role. In particular, **mismatched reporting expectations between ACIAR and the program funder, DFAT meant ACIAR staff were often focused on meeting DFAT reporting needs** and so had less time to engage in project and program oversight.



6

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

The ASLP goals, while slightly different between Phases 1 and 2, focused on 3 key areas:

- enhancing the capacity of research and extension systems
- supporting poverty alleviation for smallholder farmers
- supporting value chains.

The citrus projects appeared to reasonably align with the ASLP goals. As discussed above, the projects enhanced the capacity of the citrus research, supported extension systems, and had a pro-poor approach. They could, however, have been designed to undertake significantly more work on market linkages. Only 2 small pieces of market linkages work were undertaken (a trial of a 'quality payment system' and a value chain scoping study). As previously noted, the projects' final independent review raised significant questions about whether more should have been done to link project activities to markets. This would likely have increased the projects' alignment with the ASLP goals, and potentially increased project effectiveness.

This evaluation also examined whether ASLP's 'programmatic' approach added value to the citrus projects. **The projects certainly benefited in minor ways from being part of a larger program.** For example, the citrus projects collaborated with the mango projects on a nursery manual.

However, the potential for significant value-add was not realised. In particular, there was little substantive interaction between the citrus projects and ASLP's Phase 2 social science project; they were described as 'disconnected and with their own agendas'. This was likely to the detriment of both projects. The citrus projects, for example, could have used data from the social science project to better understand the challenges in rural communities or to assess whether the citrus projects were contributing to change for poor and marginalised groups, and women.

Conclusion and lessons learned

Overall, **the results of the ASLP citrus projects are mixed**. In relation to introducing new citrus varieties, the projects achieved strong outputs, adoption and outcomes and contributed to the commercialisation of at least one new citrus variety. The projects' participatory, hands-on training approach was viewed very positively by stakeholders. The Phase 2 project was also pro-poor and achieved good outcomes for a small number of nursery women.

In orchard and nursery management, good outputs were achieved and it appears likely that some growers and nursery people adopted the ASLP practices. However, the lack of systematic data means it is difficult to draw robust conclusions on whether widespread adoption and outcomes have been achieved. Some enabling conditions for widespread adoption, such as an active long-term institutional home for training activities and market links for products, appear to be lacking – noting that the long-term timeframe for introducing new citrus varieties means market demands may improve in the future. In addition, the potential value-add of the ASLP 'programmatic' approach was not realised, particularly because of the lack of links between the citrus and social science projects.

Lessons learned

This evaluation highlights some general lessons for ACIAR projects and programs:

1. From their inception, **projects need monitoring systems that allow for the ongoing collection of data that can inform judgements on adoption and outcomes**. Ideally, data collection would focus on a model of behaviour change that is outlined in a project's theory of change. This would allow project staff and ACIAR to understand whether project beneficiaries are changing their behaviour as expected, create confidence that project activities are leading to adoption and outcomes, or inform program improvements where necessary.
2. **ACIAR and project teams should design and implement projects with long-term sustainability in mind**. Developing a post-project communications plan, and identifying and working with a partner who can act as an active long-term home for training and extension activities, can help ensure local people can benefit from project work beyond the life of the project.
3. **Gender analysis and social inclusion analysis, and the development of corresponding gender and social inclusion strategies, should be undertaken** at the start of project planning. This will assist projects to develop a more strategic approach to influencing gender equity and women's empowerment, and to ensure people with disabilities and other marginalised groups can benefit from projects.
4. **ACIAR and project teams should design projects with market linkages in mind**. This should apply even when the most pressing issues are related to commodity production. Ensuring there is a viable market for the high-quality products produced (and/or explicit strategies to foster future market development), and that market information is made available to producers, will likely enhance the success of production activities since project beneficiaries will see clear incentives to adopt new approaches and technologies.
5. **ACIAR should consider specific strategies to ensure projects benefit from being part of a broader program**. Such strategies could include allocating sufficient time and resources to cross-project collaboration; developing program structures that incentivise cross-project collaboration; and selecting project teams that are open to collaborative, interdisciplinary ways of working.



Introduction

Purpose, scope and audience

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

From 2005 to 2015, ACIAR managed the Agriculture Sector Linkages Program (ASLP)⁹, a research-for-development program funded by DFAT¹⁰, in the Punjab and Sindh provinces of Pakistan. The program focused on enhancing selected agricultural value chains for the ultimate benefit of the rural poor. There were 2 phases of the program: Phase 1 from 2005 to 2010, and Phase 2 from 2011 to 2015. Both phases included commodity-based projects focused on citrus, dairy and mango. Phase 2 also included a social science research project. The ASLP goals are at Appendix 2.4.

ACIAR commissioned a program-level evaluation of the ASLP to identify lessons that will inform the design and implementation of future ACIAR investments and improve the quality of outcomes.

Purpose

The program-level evaluation has 5 key purposes:

1. Compile performance information from each project under a program and investigate the contribution to specific project outcomes, with a particular focus on differential effects for women and men.
2. Generate project-level case studies for use in a qualitative cross-case analysis.
3. Summarise the contribution to outcomes of each program, with a particular focus on differential effects for women and men.
4. Establish how the different approaches to programmatic management adopted by each program influenced the achievement of outcomes.
5. Identify lessons related to programmatic management of agricultural research-for-development to inform future ACIAR investments.

Scope

The program-level evaluation focuses on the whole ASLP and its constituent projects.

This project-level evaluation assesses the 2 ASLP projects that focused on the citrus industry:

- Increasing citrus production in Pakistan and Australia through improved orchard management techniques (HORT/2005/160)
- The enhancement of citrus value chains production in Pakistan and Australia through improved orchard management practices (HORT/2010/002).

9 The third phase of the Pakistan program that began in 2015 is known as the Agriculture Value Chain Collaborative Research Program (AVCCR). However the projects to be evaluated all started under the earlier phase, known as ASLP. For simplicity, this program is referred to as ASLP in the remainder of this document.

10 ASLP was originally funded by the Australian Agency for International Development (AusAID). AusAID was merged with DFAT in 2013.

The evaluation provides an assessment against the following key evaluation questions:

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

Audience

The primary audience for this evaluation is ACIAR staff with direct responsibilities for programs and/or their constituent projects. This includes Canberra-based research program managers (RPMs), and field-based program managers and coordinators. The ACIAR Executive and senior managers, and DFAT fund managers, are also important audiences particularly for the program-level assessments and synthesis report.

Methodology

Data collection and analysis

Data was collected through a thematic analysis of the key project documents, particularly project annual and final reports, and the mid-term and final project reviews. Eleven semi-structured interviews were also undertaken with 15 project stakeholders (noting some were group interviews) and 2 semi-structured interviews were completed with ACIAR staff. Stakeholders were intentionally selected in consultation with ACIAR and the project leader. Interviews were conducted using Zoom and WhatsApp.

Systematic analysis of data collected through these processes was undertaken using NVivo qualitative data analysis software to distil findings. ACIAR working definitions and assessment frameworks for project outputs, outcomes and 'next users' were used to analyse, categorise and summarise findings (see Table 1).

Preliminary findings were shared and tested in a project validation workshop involving the stakeholders previously consulted. A separate discussion on preliminary findings was also held with ACIAR Canberra staff, and detailed written comments were submitted by the project leader. These activities provided the opportunity to 'ground-truth' the assessments, identify any key issues not addressed, clarify any areas of uncertainty and correct any misinterpretations. A draft evaluation report was then prepared for review by ACIAR and finalised in accordance with feedback received.

Table 1 ACIAR project outcome assessment terminology

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

Limitations

The evaluation team relied heavily on pre-existing documentation provided by ACIAR and the project team. These documents were of varying quality. Documentation generally focused on project outputs, with little evidence on adoption and outcomes. At the same time, there were insufficient evaluation resources to explore third party data or reporting that might provide additional useful information.

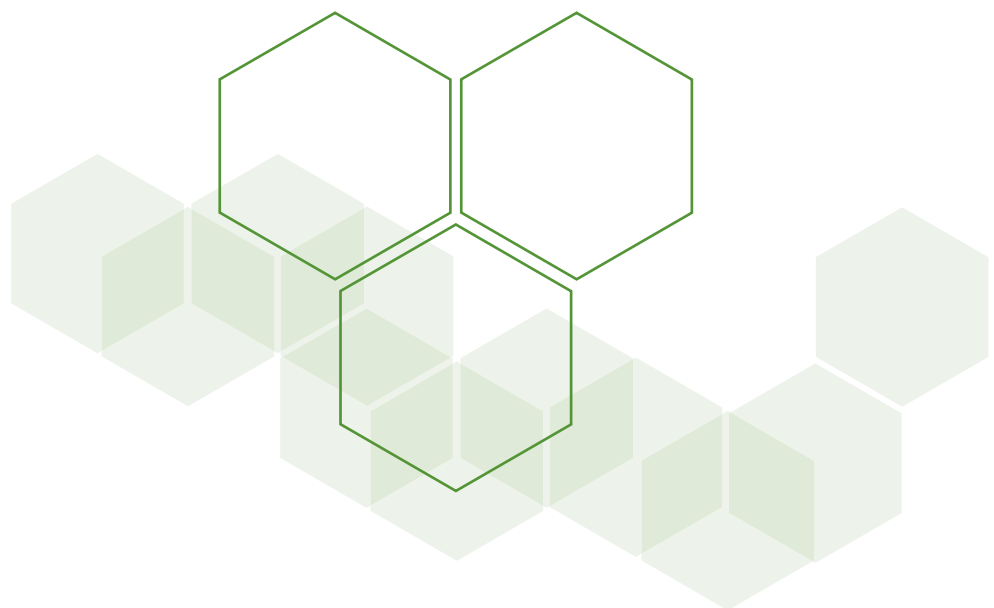
There were limitations on stakeholder consultations. Direct consultations mostly focused on ACIAR staff and implementing partners, and only a very small number of program beneficiaries could be interviewed. As primary data collection was restricted to online interviews, the evaluators had limited ability to build rapport with participants and interpret non-verbal communication. In addition, the length of time since projects were completed in 2015 may have made it challenging for interviewees to provide accurate data. In some cases, phone lines were poor and unclear, and English language skills of interviewees was limited.

Interviewees for the project were intentionally selected by ACIAR and the project leader. This means they were not a representative sample of project participants. Given the intentional selection process, and the length of time since the project ended, it is also likely that respondent experiences fall at the positive end of the spectrum, meaning data from interviews is likely positively biased.

Ethical considerations

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

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



Overview of projects

	Production projects	Value chain projects
Project number	HORT/2005/160	HORT/2010/002
Project title	Increasing citrus production in Pakistan and Australia through improved orchard management techniques	The enhancement of citrus value chains production in Pakistan and Australia through improved orchard management practices
Collaborating institutions	Industry and Investment NSW ^a National Agriculture Research Centre, Pakistan University of Agriculture, Faisalabad (Punjab, Pakistan) Citrus Research Institute, Sargodha (Punjab, Pakistan) Agricultural Research Institute, Tarnab (Peshawar, Pakistan) Fruit and Vegetable Development Project (Punjab, Pakistan)	
Project leaders	Dr Tahir Khurshid, Industry and Investment NSW Dr Iftikhar Ahmad, National Agriculture Research Centre	
Project duration	April 2007 to December 2010	April 2011 to September 2015
Funding	AUD1,136,726 (Australian aid program contribution: AUD729,865)	AUD1,837,815 (Australian aid program contribution: AUD1,328,709)
Countries	Australia and Pakistan	
Commodities	Citrus	
Related projects	(see next column)	(see previous column)

(a) At the time of the projects, the commissioned organisation was the NSW Government department, Industry and Investment NSW, of which the Department of Primary Industries was a part. At the time of publishing this report, the NSW Department of Primary Industries is part of the Department of Regional NSW.

Context

Pakistan is a predominately rural and agriculture-based society. In 2010, 68% of the population lived in rural areas and were directly or indirectly reliant on agriculture for their livelihood. At that time, agriculture contributed 13% to GDP and employed 42% of the labour force (Khurshid 2014).

Within agriculture, citrus is an important commercial horticultural crop. In 2010, Pakistan was the sixth largest producer of mandarin in the world and almost a third of fruit producing land was dedicated to citrus. Kinnow, the dominant variety of mandarin, accounted for almost 62% of total production in 2010. Oranges are also produced, albeit in much smaller quantities (Khurshid 2014).

Pakistan has a strong domestic market for citrus. There is also potential for increased exports – in 2010, around 10% of produce was exported. The Government of Pakistan has set ambitious targets to increase citrus exports and export earnings (Khurshid 2014).

The projects

Consistent with the importance of citrus in Pakistan and the Government of Pakistan's export aspirations, ASLP supported 2 citrus projects across 2 phases:

- Phase 1: Increasing citrus production in Pakistan and Australia through improved orchard management techniques (2007–2010) (HORT/2005/160).
- Phase 2: The enhancement of citrus value chains production in Pakistan and Australia through improved orchard management practices (2011–2015) (HORT/2010/002).

Both projects were led by Industry and Investment NSW. The leading Pakistan partner was the National Agriculture Research Centre (NARC) and there were multiple other Pakistani collaborating partners.

The specific objectives of the Phase 1 project were:

1. To improve nursery production practices and production incorporating quality assurance procedures for maintaining disease-free material and to introduce germplasm to extend the marketing season based on the climatic suitability to specific growing areas.
2. To demonstrate 'best practice' orchard management focusing on tree spacing, crop management, nutrition and irrigation management.
3. To enhance research, extension and production capacity of Pakistan citrus institutions and industry.

Phase 2 retained focus on introducing new germplasm and varieties, and orchard and nursery management. The objectives were adjusted, and an additional objective added related to a supply chain scoping study. The final objectives for the Phase 2 project were:

1. To introduce germplasm and develop germplasm evaluation capacity to extend the marketing season and assist in improving nursery production practices for maintaining and multiplying clean material.
2. To improve basic crop management practices, to examine the current irrigation practices and to assess the adaptability of pressurised irrigation systems.
3. To enhance the citrus crop management research, extension and production capacity of Pakistan citrus institutions and industry, and extend pro-poor benefit flows.
4. To carry out a scoping study in Pakistan and Kinnow-importing countries for the development of a citrus supply chain project (2015–2020).¹¹

In practice, it is helpful to think about the projects as supporting 3 main streams of activities. The first stream consisted of activities to support the **introduction of new citrus varieties into Pakistan**. Specific activities included introducing varieties and germplasm, testing these new plant materials, building supporting infrastructure such as screenhouses, and building the capacity of Pakistani scientists and the research system.

The second stream **involved activities to support improved orchard management by citrus growers**. This included, for example, generating new and packaging existing scientific knowledge on orchard management, and training citrus growers in modern management practices. Training was predominately provided through farmer field schools and focused on practices such as crop management, canopy management, tree reworking, plant nutrition, and irrigation.

This stream of work also included a trial of a 'quality payment system'. Under this trial, 5 farmers were supported to grow high quality citrus crops and to sell these directly to markets, cutting out the wholesalers who traditionally buy citrus fruit in Pakistan.

The third stream of work focused on **improved nursery management by nursery people**. Activities included training nurserymen and nurserywomen in modern orchard practices, including new budwood/grafting techniques, disease-free plant propagation and plant nutrition.

This workstream also included activities with the women's empowerment non-government organisation (NGO) Pakistan Hoslamand Khawateen Network (PHKN). Representatives from the NGO received training in nursery management techniques. They went on to train women in their network to generate income from backyard nursery activities.

Both the orchard management and nursery management workstreams **included efforts to improve the capacity of Pakistan's extension services**. This included, for example, providing training to, and training packages for, extension staff who could then on-train and share their knowledge with growers and nursery people.

¹¹ Note, a citrus supply chain project for 2015–2020 did not eventuate.



Findings

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

Project theory of change

The documentation of the citrus projects' did not include an articulated theory of change. This is not surprising, given the use of theory of change was limited in the Australian aid program when the projects were designed. However, drawing on documents and discussion with stakeholders, the review team developed a suggested theory of change which outlines how project activities were expected to lead to project outputs and outcomes.

A visual representation of the theory of change is at Appendix 2.1. This represents the theory of change at the end of the citrus projects, meaning any project evolutions have been incorporated.

The theory of change can be considered through 2 main lenses: scientific knowledge related to new varieties of citrus, and orchard and nursery management.

Under the topic area of **new varieties of citrus**, the theory of change shows that the key activities were to work with Pakistani scientists to select and import new citrus varieties and rootstocks. Training for scientists, as well as greenhouse infrastructure, would be provided to support this. This was expected to lead to high quality trials of citrus varieties and rootstock and, in turn, this would lead to identification of more citrus varieties for Pakistan and an extension of the growing season.

The **orchard and nursery management** topic took a different pathway to change. The initial focus was to identify existing scientific knowledge and conduct participatory research to adapt this to local conditions, as well as to generate new scientific knowledge. This was then packaged into user-friendly training modules. This was complemented by the creation of best practice demonstration sites as well as trials of the quality payment system.

Training for extension services, growers, and nurserymen and nurserywomen in these areas would then be conducted. This training took multiple forms, including study tours to Australia and Thailand, in-field training by Australia-based project staff, and farmer field schools.

The results, or outputs, of this training would be that extension staff, growers, and nurserymen and nurserywomen would have increased knowledge of modern management techniques and payment systems. These groups were also expected to share this knowledge with their peers.

It was then expected that these groups would apply their increased knowledge and adopt the modern techniques. This, in turn, would lead to more disease-free planting material and an increased supply of high quality citrus fruit. Staff who worked in extension services were also expected to increase their capacity and support the citrus industry on an ongoing basis.

Appropriateness of the theory of change

There was some evolution of the theory of change over the course of the 2 citrus projects. For example, the projects had an increasingly pro-poor focus over time. The project documentation for the first phase project highlighted that its focus was on medium to large citrus growers. This, however, evolved in the second phase to place a greater emphasis on small to medium growers, with a corresponding greater focus on using farmer field schools to reach such growers.

Consistent with this, the partners and key activities for the projects changed over time. The first phase focused on working with the research institutions, while the second phase was more outward looking with a greater focus on extension services and external organisations. There was also no mention of activities involving women in the project's first phase. This evolved in the second phase, where the nurserywomen's activity with PHKN was introduced. These evolutions are appropriate and consistent with the increasingly pro-poor focus of the projects.

The suggested theory of change is underpinned by a number of assumptions about how activities lead to outputs and outcomes:

- The first main assumption was that knowledge on citrus production needed to be locally adapted, packaged and delivered in a participatory manner to make it useful to scientists, growers and nursery people. Accordingly, the projects used training techniques, including study tours to Thailand and Australia, farmer field schools, demonstration sites, and direct training of extension and scientific staff by Australian project staff.
- A second key assumption in the theory of change was that citrus varieties in Pakistan (both new and existing) would meet market demands at profitable prices, thereby giving growers and nursery people an incentive to adopt new varieties and try new management practices. The underlying idea is that increased knowledge alone is not enough to change grower and nursery people's behaviour, and that incentives are also required.
- A third assumption of the theory of change is that the best way to encourage growers and nursery people to change following project completion would be through organic peer-to-peer learning.

The suggested theory of change is relatively simplistic about how behaviour change will happen for growers and nursery people. It outlines that increased knowledge will lead to the adoption of new behaviours, based on an assumption that people have price incentives to change (as outlined above). For future project theories of change, it would be useful for ACIAR and project teams to more deeply consider how adoption of new practices happens and how behaviour change can be brought about, drawing on existing models of behaviour change. Such models should be explicitly incorporated into project designs and theories of change to ensure they guide project activities and monitoring.



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

Outputs

The ASLP citrus projects delivered a considerable number of outputs. These can be categorised under 3 major topics: new citrus varieties¹², orchard management, and nursery management.

New citrus varieties

Under this topic, the projects delivered a number of outputs related to **scientific knowledge**. These included:

- the introduction and trials of 7 new citrus varieties and 8 new rootstocks
- associated infrastructure to support the generation of scientific knowledge, such as screenhouses and mother blocks
- 4 journal/conference papers.

In addition, **capacity building** for scientists was delivered. For example, training was provided to scientists and extension staff on varietal evaluation, and on the collection of yield and quality data. Eleven Pakistani students completed or are undertaking higher degrees on topics related to the project, using project collaborators as supervisors.

Orchard management

In the area of orchard management, project outputs included significant **capacity-building** activities for growers. The projects partnered with the farmer field schools run by the Fruit and Vegetable Development Project (FVDP) and also conducted study tours to Australia and Thailand. They also demonstrated alternative payment systems for growers (the quality payment system) and conducted a range of communication outreach activities through newsletters, SMS, and radio and television talks. According to the Phase 2 final report, the projects directly trained 5,700 citrus growers in modern orchard management techniques such as pruning, fruit thinning, plant nutrition, pest control and irrigation.

These *capacity-building* activities were underpinned by the generation and packaging of existing **scientific knowledge** into user-friendly formats. For example, the project developed phenological calendars for Kinnow mandarins and blood oranges for growers, and collected data to demonstrate the benefits of different irrigation systems. It also developed 8 training packages on nursery management, irrigation management and crop management for use by extension services. Eight journal/conference papers related to orchard management were also produced during the projects.

Nursery management

Similar to orchard management, nursery management activities focused on **capacity building** and its underpinning **scientific knowledge**. The projects trained 494 nurserymen and nurserywomen in modern practices such as chip budding, pest control, and plant nutrition. One conference paper on nursery management was also delivered.

Specifically for nurserywomen, representatives from women's empowerment NGO PHKN received training in nursery management techniques. They went on to train women in their network, with a total of 22 women trained to assist them to undertake backyard nursery activities and generate income from these.

As noted in the introductory section, **capacity building for extension workers** was integrated into the orchard management and nursery management workstreams. The FVDP was run by the Government of Punjab, and the partnership between this and the citrus project likely built the capacity of FVDP's extension staff. Capacity-building activities often focused on training for extension staff to ensure they could provide quality on-training to growers and nursery people. For example, the Phase 2 final report notes that 30 district officers were trained in crop management, while throughout the projects a number of study tours to Australia and Thailand were conducted. Further, the nursery manual and 8 training packages referred to above were developed for extension staff to use when delivering training to growers and nursery people.

12 This includes activities focused on citrus varieties, rootstock, budstock and germplasm.

Adoption

Although the projects delivered a number of outputs, the data on the adoption of these outputs is mixed. This is particularly the case for orchard management and nursery management.

New citrus varieties

Based on interviews with key stakeholders, it appears that new scientific processes are being adopted in Pakistan. Interviewees reflected that scientific trials of new varieties and rootstocks are ongoing, and that this ongoing testing is supported by the scientific, nursery and grower communities. The trials include scientists working with nurseries and growers to conduct field testing. Further, the screenhouses and motherblocks developed by the projects continue to be used.

While ongoing adoption in this area is positive, it is important to note that varietal evaluation and the eventual spread or commercialisation of new citrus varieties and rootstocks takes a significant amount of time. One interviewee noted it took 40–50 years for Pakistan's most common citrus variety, Kinnow, to be widely used by farmers. These long timeframes have implications for adoption and outcomes in other project areas, as discussed below.

Orchard management

There is mixed data on whether the modern orchard management practices promoted by the ASLP citrus projects have been adopted by growers.

On one side, the majority of stakeholders interviewed stated that farmers were adopting the new orchard management techniques. They cited, for example, low-cost techniques such as tree pruning, fruit thinning, and furrow irrigation as practices that were becoming more widespread and accepted.¹³ This is supported by project documentation, which claims good adoption of a number of practices.

Some interviewees claimed quite impressive adoption rates. The ASLP projects partnered with a provincial flood rehabilitation project to implement furrow irrigation and, according to 2 interviews, this resulted in significant adoption. One interviewee stated that 4,000 growers adopted furrow irrigation. Another outlined that almost 100% of the 4,049 hectares under citrus in Khyber Pakhtunkhwa are under furrow irrigation. In addition, it was shared that through work with the flood rehabilitation project, benefits had spilled over to the stone fruit industry. For example, virtually 100% of the 5,600 hectares of stone fruit orchards in Peshawar had adopted furrow irrigation.¹⁴

Another interviewee was involved in the quality payment system trial. He stated that 60%–70% of growers in his area had adopted systems to sell their fruit directly to markets. A further interviewee outlined that quality payment systems had also spilled over to stone fruit orchards, with 1,200 acres of stone fruit orchards in Peshawar using the quality payment system.

The stakeholders interviewed claimed that adoption happened by growers seeing others using good practices, learning from these growers, and then adopting the practices themselves.

On the other hand, doubts around adoption were raised by some interviewees and by the final independent review of the project. These interviewees felt that, while adoption was taking place at the end of the project in 2015, it was likely to have decreased since then given the lack of ongoing training and support. Interviewees also highlighted that there were financial barriers to adoption, with the majority of small farmers unable to access the financial resources to adopt new practices. This applied even to the low-cost management techniques listed above. The final independent review also reported that Pakistan's canal system inhibited the adoption of alternative irrigation techniques, stating that 'widespread adoption of furrow irrigation cannot be expected without a clearer understanding of the operational constraints of the canal systems' (McEville and Laghari 2015:18).

Nursery management

Similar to orchard management, there is mixed data on adoption of improved nursery management techniques. Again, interviewees stated that nurseries continued to adopt the practices promoted by ASLP, and to share their knowledge with other nursery people and growers. This included nurserywomen, with interviewees from the PHKN stating that women continued to engage in backyard nursery activities. PHKN had also set up 10 nursery management support groups, each with 5–6 members. The 22 women trained by ASLP act as leaders of these groups and so are able to continually share their knowledge.

13 The projects also conducted research on higher cost management techniques, such as drip irrigation. However, given the higher costs involved it is not expected that there would be widespread adoption of such techniques.

14 Note interviewees shared these figures, noting the evaluation team have not cited any studies/data that reinforce these claims.



This position is somewhat supported by interviewees from the university system. One interviewee felt that adoption by nurseries had been mixed and depended on the resources required to change practices. As a result, low-cost practices such as new budwood techniques had been adopted as routine practice in most nurseries. Medium-cost practices, for example using polybags and compost for plant propagation, had some uptake. High-cost practices, such as building screenhouses to propagate disease-free plants, had very low adoption rates.

A different perspective was provided by the final independent review. It noted that 'adoption of better practices by nurseries is very limited. There has been little concerted effort to create a compelling business case for growers to demand high-health trees' (McEvilly and Laghari 2015:15).

Under both orchard and nursery management, extension services appear to have adopted training provided by the citrus projects. At the conclusion of Phase 2, the project presented the 8 training packages and the nursery manual it produced to the NARC. Much of this information still appeared on the NARC website in late-2020.¹⁵ The projects' partnership with the Government of Punjab's FVDP appears likely to have increased the capacity of government extension services. Interviewees also provided a small number of notable examples of people who had received training through ASLP and continued to use their expertise to provide extension services to growers and nursery people.

Outcomes

For new citrus varieties, there are good indications of strong outcomes. However, for orchard management and nursery management, outcome achievement is uncertain given the mixed data available.

New citrus varieties

There are outcomes in 2 areas under the topic of new citrus varieties: innovation enabled and capacity built.

ASLP citrus projects' work on new citrus varieties has **enabled innovation** in Pakistan. Of particular note is that one variety of mandarin, Daisy, has been tested and found suitable for Pakistan, and is now being produced commercially. The introduction of this new variety has also increased the citrus growing season in Pakistan.

In addition, interviewees highlighted that further varieties of citrus and rootstock continue to be tested. Researchers also noted they are in the process of completing registration for new citrus varieties (for example, Salustiana) and rootstock (for example, Carrizo), which would allow these to be made widely available. This represents a significant achievement for the ASLP citrus projects.

The citrus projects have also **built capacity** of Pakistani scientists. The final independent review stated that, although it was hard to quantify, they judged that the project had increased the knowledge and skills of researchers. The review did highlight some concerns with the overall capacity of research institutes. However, the ongoing work on new citrus varieties since the end of the projects in 2015 suggests that the ASLP projects have built ongoing scientific capacity. Further, students who commenced higher degrees under the projects' auspices have continued with their studies, with such students publishing at least 6 citrus-related articles in peer-reviewed journals.

Orchard management and nursery management

Rigorous data on outcomes achieved in orchard management and nursery management was difficult to obtain. Unfortunately, no systematic data appears to exist that would support conclusions on achievement of outcomes under these topics.

Project documentation and interviews with project stakeholders revealed a patchwork of claims on innovation being enabled and capacity being built. Claims include that:

- 80% of fruit produced using ASLP techniques is A-grade, compared to 30%–40% of fruit produced that does not use ASLP techniques.
- Growers have earned an additional PKR7,300 per acre for fruit produced under furrow irrigation, compared to fruit produced under flood irrigation (Khursid et al. 2015:44).
- For growers who participated in the quality payment system, increases in grower returns of 33%–50% of income was reported.
- For nurseries that adopt new practices, the final project report stated the sale price of seedlings increased from PKR35 to PKR100. Similarly, in an interview, a nurseryman stated he had been able to increase the price of his seedlings from PKR50–60 to PKR200.
- For nurserywomen from PHKN, the final project report stated that their profit margin increased by 50%.

¹⁵ See, for example, <http://www.parc.gov.pk/index.php/en/component/content/category/156-aslp-project>, accessed 05 October 2020.

For extension staff, it is similarly difficult to obtain systematic data on whether the extension system was sustainably supporting the citrus industry at the end of the project, or continues to sustainably support Pakistan’s citrus industry today. Interviewees highlighted a small number of examples of staff trained through ASLP who continue to provide extension services in Pakistan. They also highlighted that research institutions continued to make support available. However, interviews also outlined that demand for such services outstripped what was available, while a number of interviewees highlighted that they were most likely to learn about new practices from their peers.

Discussion

The data above suggest there have been positive results from the projects. However, a key point to note is that there was no systematic data available on adoption and outcomes, and the available data comes from a small number of interviewees and project staff. As previously noted, these interviewees are unlikely to be representative of all participants in the projects. Overall, the lack of systematic data makes it challenging to make a robust assessment of the extent of adoption and outcomes.

Table 2 summarises adoption of project outputs, while Table 3 summarises capacity built through the projects.

Table 2 Levels of adoption of key project outputs

Project	New technologies or practical approaches	New scientific knowledge	Knowledge or models for policy and policymakers
ASLP citrus projects	Nf – Orchard management Nf – Nursery management NF – Extension staff	NF – New citrus varieties, including scientific capacity	Not applicable

Notes:

O No uptake by either initial or final users

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

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

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

Table 3 Capacity built relevant to project outcomes

Who	Skills and knowledge
Citrus growers and nursery managers	<ul style="list-style-type: none"> Best practice orchard and nursery management, for example, pruning, irrigation, nutrition
Extension services (government and private)	<ul style="list-style-type: none"> Best practice orchard and nursery management, for example, pruning, irrigation, nutrition
Research / academic community in Pakistan	<ul style="list-style-type: none"> Individual capacity built through higher degrees (11 students) Identifying and testing new citrus varieties and rootstock

Note: There appear to be positive results from the citrus projects for stakeholders, but systematic data on capacity outcomes is not available.



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

Factors influencing adoption and impact

In considering the factors that influenced adoption and impact of project outputs, it is helpful to consider the projects' theory of change and the extent to which the assumptions underpinning it are valid. Through this, we see that the participatory training approaches used in the project were valued by stakeholders and influenced how well knowledge was shared. However, other key assumptions around the projects' links to markets and how outputs would be disseminated post-project do not appear to have held.

Participatory training approaches

One of the projects' assumptions was that knowledge should be locally adapted, packaged and delivered in a participatory manner to make it useful to scientists, extension staff, growers and nursery people. The participatory approaches used included study tours to Thailand and Australia, farmer field schools, demonstration sites, and direct training by Australian project staff of extension and scientific staff.

Interviews with stakeholders confirmed that these approaches were very effective in sharing knowledge with scientists, growers and nursery people. Interviewees who had participated in study tours reflected on how much they had learned and how influential these tours were for them, even many years after they had completed them. Further, interviewees noted how Australia-based project staff visited Pakistan regularly in the Phase 2 project and directly delivered training to scientists and extension workers in the field. This hands-on approach seems to be relatively unusual and, combined with the strong technical and teaching skills of the Australia-based project staff, led many stakeholders to view this knowledge sharing approach as highly effective.

Finally, staff of the FVDP described a highly participatory, grower-centred approach to farmer field schools, combined with the use of best practice demonstration sites. This is consistent with good development practice. Such participatory, hands-on training approaches are likely to have contributed to the achievement of the projects' outputs.

Market links

A second key assumption in the theory of change is that citrus varieties in Pakistan (both new and existing) meet market demands at profitable prices, thereby giving growers and nursery people an incentive to change varieties and management practices.

The validity of this assumption is questionable. For example, the trialling and testing of new varieties did not consider market needs, while questions were raised about the demand for Kinnow, a relatively seedy mandarin.

The final external review raised the lack of market links as a significant issue. The program reviewers questioned why market analysis wasn't undertaken as part of selection of new varieties to trial, and suggested existing varieties in Pakistan do not meet market needs and are low-price. They also highlighted that 'there is little point in continuing to run nursery training courses until there is market demand (i.e. from growers) for high-health trees. An economic analysis of the cost: benefit of high-health vs traditional trees may assist' (McEvilly and Laghari 2015:15).

At the same time, it takes a significant amount of time for new citrus varieties to be tested and made widely available to growers, and market conditions can change over time. Therefore, a full market viability analysis prepared in advance of varietal development may be of limited value unless updated periodically. While the final external review identified demand issues with existing citrus varieties, it is possible that as further citrus varieties become commercially available in the future, they may meet this assumption and provide greater incentives for growers and nursery people to change practices.

Post-project knowledge dissemination

A third assumption of the theory of change is that the best way to encourage growers and nursery people to change following project completion is through peer-to-peer learning. With the end of the ASLP projects in 2015 and the FVDP (which ran farmer field schools) in 2016, it is not clear that there was an active institutional home or continuation for training packages developed. This issue was highlighted by the final external review, which noted that there was no communications plan to develop and maintain resources, creating doubt about the future of extension programs.

Without a concerted training or communications plan, it appears unlikely that peer-to-peer learning alone would be sufficient to sustain or increase adoption or outcomes for nursery people and growers. It also means there may not have been clear direction for the ongoing and widespread use of ASLP training packages in extension services. See Table 4 for a summary of factors influencing adoption and impact.

Table 4 Factors influencing adoption and impact

	Factor	Key findings
Knowledge	Do potential users know about the outputs?	The participatory nature of the training provided is likely to have resulted in knowledge transfer. However, the lack of a communications plan at project-end and the reliance on informal peer-to-peer learning means post-project knowledge sharing and contribution to extension capacity may be limited.
	Is there continuity of staff in organisations associated with adoption?	Not identified as a constraint for these projects.
	Are outputs complex in comparison with the capability of users?	Not identified as a constraint for these projects. Interviewees noted that the nursery and orchard management practices being promoted were relatively simple to implement.
Incentives	Are there sufficient incentives to adopt the outputs?	The projects' lack of market links raised doubts about whether growers and nursery people have sufficient incentives to adopt new management practices. At the same time, it takes significant time for new citrus varieties to become available. When new varieties are available, incentives for growers and nursery people to change may increase.
	Does adoption increase risk or uncertainty?	Risk or uncertainty related to new practices were overcome through the use of 'demonstration plots' to show effectiveness.
	Is adoption compulsory or effectively prohibited?	Not identified as a constraint for these projects.
Barriers	Do potential users face capital or infrastructure constraints?	The adoption of some modern orchard and nursery management techniques came with capital and infrastructure requirements. Interviewees indicated that, although low-cost orchard management practices were promoted, many growers face financial constraints to implementing them. Resource requirements for some nursery management practices varied depending on the practice, with higher adoption for lower cost practices.
	Are there cultural or social barriers to adoption?	There are significant cultural and social barriers to women's involvement in the citrus industry. These were largely not considered or addressed in the project.



Discussion

Considering the data reported above, it appears likely that a small number of growers and nursery people have successfully adopted the practices and achieved improved incomes as a result. It also appears likely that a small number of extension workers continue to use the knowledge to support the citrus industry. However, with no systematic data available, it is unknown whether the projects' activities have translated into widespread outcomes for citrus growers and nursery people, or strong ongoing capacity in extension services. Given the length of time needed to test and make new citrus varieties widely available, and the lack of an active post-project institutional home for training activities, some enabling conditions for widespread adoption appear to be lacking. This, however, may change as more citrus varieties become available in the future.

The challenges of establishing adoption and outcomes for growers, nursery people and extension workers highlights a key lesson for future ACIAR programs: **from their inception, projects need monitoring systems that allow for the ongoing collection of data that can inform judgements on adoption and outcomes.** Ideally, data collection would focus on a model of behaviour change that is outlined in a project's theory of change. This would allow project staff and ACIAR to understand whether project beneficiaries are changing their behaviour as expected. This, in turn, can create confidence that project activities are leading to adoption and outcomes, or inform program improvements where necessary.¹⁶

A further lesson is that **ACIAR and project teams should design and implement projects with long-term sustainability in mind.** The lack of an active institutional home for training activities and a post-project communications plan means that extension staff may not have continued to benefit post-project. In turn, this means that support for growers and nursery people to adopt practices may not have been as accessible as would be desirable. Considering long-term sustainability at project inception will increase the likelihood of benefits for local people beyond the life of the project.

¹⁶ Note, both of these issues were highlighted in the 2013 ASLP mid-term review, which highlighted that projects needed to provide clearer 'impact pathways' and put sufficient effort into collecting evidence on their likely impact.

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

It is important to note that the ASLP citrus projects were developed in 2005. At the time, there was much less focus on gender, marginalised groups or social aspects of research in research-for-development programs. This is reflected in the citrus projects, which did not have strategies for addressing gender issues, or for considering marginalised groups, such as people with disabilities or people facing disadvantage. However, despite the lack of strategies in these areas, the Phase 2 projects positively benefited a small number of women and were inclusive of poorer smallholder farmers.

A key development for ASLP was the addition of the social science project in Phase 2. This project did significant work on gender and social inclusion issues.

Gender equity

Women appear to play a very limited role in the citrus industry in Pakistan. Interviewees noted that women generally did not work in nurseries or orchards due to cultural barriers and the physical nature of the work.

The ASLP citrus projects did not have a gender equity strategy. Project documentation is 'gender blind'; it does not address gender issues, power dynamics or the roles of women in the citrus industry. ACIAR project documentation at the time of the citrus projects did not request this information from projects.

Despite the lack of recognition of gender issues, the projects did involve women in 2 meaningful ways. First, female scientists and students were involved in many aspects of the projects. Interviewees reflected that there did not appear to be substantive barriers to equity between men and women in the science and academic aspects of the project.

Second, a women's empowerment activity was included in the second phase project. This activity was largely driven by the initiative of the project leader, who identified an opportunity to do more in gender equity and actively sought an NGO partner for this work.

In this activity, the project worked with the local women's NGO PHKN. Women from the network were trained in nursery management techniques. They then provided on-training to 22 poor women from local villages to conduct nursery activities in their backyards. Further, these 22 women now lead around 10 nursery support groups of around 5–6 women, with each group sharing their knowledge of nursery practices. The work undertaken – backyard-based nursery activities – is appropriate to the context, as it allows women to work in the privacy of their homes.

Although quantitative data on the activity outcomes is not available, PHKN representatives described the results as 'very positive' for the women involved. They noted the income obtained from selling seedlings is not large, but it is helpful in the context of the poverty of the households involved. This positive view is supported by the final external project review, which noted the activity effectively empowered women and supported small home businesses.

While the success of the nurserywomen activities is clear, it only reached a small number of women and assisted with relatively small-scale businesses. The citrus projects reached a significantly larger number of men, and possibly resulted in significantly better results for some men given the relatively larger scale of their farm and nursery businesses. A key lesson highlighted by PHKN representatives was that **women's training and business needs should be included from the start of project planning to ensure better depth and breadth of women's involvement.**



Social inclusion

This section of the report focuses on the extent to which the citrus projects were 'pro-poor', or focused on poorer smallholder farmers. Stakeholders were not aware of any citrus project activities that addressed the needs of marginalised groups, such as people with disabilities, ethnic or religious minorities, or disadvantaged youth.

The Phase 1 citrus project focused on 'medium to large growers' and so cannot be considered pro-poor. This changed in the Phase 2 project, with project documentation explicitly stating that 'small to medium growers' would be targeted.

In interviews, some senior project staff noted confusion about what is meant by a 'pro-poor' approach. They felt ACIAR did not have a clear definition of this, and that greater guidance on pro-poor approaches from ACIAR would be beneficial. That notwithstanding, the Phase 2 project employed appropriate strategies to reach smallholder farmers. For example:

- The project promoted low-cost practices such as pruning, fruit thinning, and furrow irrigation.
- The project aimed to reach large numbers of small to medium farmers through farmer field schools.
- To support training and farmer field schools, the project set up good practice demonstration sites. These demonstration sites were often on a small plot within the farm of a medium-sized grower. This was an appropriate strategy as:
 - medium-sized growers were able to take on the risk associated with trialling modern practices
 - the small size of the plots demonstrated the modern practices could be effective on smallholder farms.

Despite the pro-poor approaches, a number of interviewees highlighted that many growers still face financial barriers to adopting new orchard management practices. One interviewee said that up to 90% of farmers face financial challenges. Other interviewees noted that where growers did not have sufficient resources to implement practices, they modified them to suit the resources available (for example, by reducing the amount of fertiliser used). Smallholder farmers' financial challenges are likely to continue to constrain the achievements of ACIAR projects, and ACIAR and project teams should continue to design projects with these constraints in mind.

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

The management arrangements for the projects experienced both challenges and successes. The Phase 1 project experienced challenges in the relationship between the teams based in Australia and Pakistan, but lessons were learned and the management arrangements improved in the second phase. The role of ACIAR in project management was improved through the establishment of a Pakistan country office. At the same time, the ACIAR management role was hindered by challenges with the program funder.

Relationship between Australia- and Pakistan-based teams

There were significant management challenges in the relationship between the teams based in Australia and Pakistan. In particular, it appears there was inadequate management support from Pakistan counterparts, particularly in the first phase project. The final external review report noted that 'reliable and proactive in-country project leadership with excellent linkages with the Australian project leader was needed. However, this was clearly lacking. While this was counterbalanced by the in-country experience of the Pakistani-born Australian project leader, the dysfunction acted as a drag on the project' (McEvilly and Laghari 2015:4).

There are 2 key factors that may have contributed to this situation. First, in the first phase project, the security situation in Pakistan deteriorated significantly. It was very difficult for Australia-based staff to visit Pakistan and, during any visits, they could not visit the field. This made it challenging to build appropriate relationships between project staff.

Second, the main Pakistan-based collaborator held a senior role at a Pakistani research organisation. His existing research and workload meant he did not have sufficient time to engage with the citrus projects. At the same time, his roles did not appear to be deputised well to other team members, and it was difficult to hold him accountable given his existing senior position. As a result, the Australia-based project leader took on far more in-depth management of the project, a challenging role to play from Australia.

The management situation improved for the Phase 2 project. Drawing on lessons learned from the first phase, 2 in-country project coordinators were hired. These staff were dedicated to coordination and collaboration of project activities. The project focused on hiring young, motivated staff who were open to new ideas and could be held accountable for their performance. This also necessitated a shift in the role of the Australia-based project leader, as it became important for him to delegate greater responsibility and ownership to staff in Pakistan. Overall, the strategy of hiring in-country project coordinators and providing them with strong project ownership appears to have been an effective strategy for improving project performance in Pakistan.

Fortunately, the security situation in Pakistan improved later in the projects, allowing more visits to Pakistan by Australia-based staff. This helped build relationships, including when Australia-based staff were able to provide more hands-on training.

ACIAR role in project management

Interviewees noted that ACIAR did not always have staff resources to support projects, and the program overall, to an ideal level. A key reason for this was the mismatched expectations between ACIAR and the program funder, DFAT. It appears these organisations had quite different terminology and expectations about what the projects should achieve. The ASLP mid-term review noted that DFAT expectations were often unrealistic, as it expected broad productivity improvements that a research-for-development project was unlikely to fulfil. Interviewees also highlighted that DFAT had reporting expectations that ACIAR struggled to meet. As a result, ACIAR staff were often very focused on meeting DFAT reporting needs, and so had less time to engage in project and program oversight.

Interviewees also highlighted that ACIAR did not open a Pakistan country office until towards the end of ASLP. An ACIAR in-country presence helped to raise its profile, ensuring stakeholders understood that ASLP was overseen by ACIAR. The ACIAR in-country presence also ensured it could build and leverage broader relationships with the Pakistani government, and link to other donor programs. While the absence of ACIAR in Pakistan earlier in the program was not highlighted as a problem, it appears that overall program success could have been enhanced by an in-country office.



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

The ASLP goals, while slightly different between Phase 1 and Phase 2, focused on 3 key areas:

- enhancing the capacity of research and extension systems
- supporting poverty alleviation for smallholder farmers
- supporting value chains.

Capacity of research and extension systems

There is good alignment between the citrus projects and the goal of enhancing the capacity of Pakistan's research and extension systems. The projects have contributed to a better research capacity. While efforts were made to increase extension capacity, the lack of systematic data precludes a robust assessment of whether this was achieved.

Poverty alleviation for smallholder farmers

The Phase 2 project was well aligned with the ASLP goal of supporting smallholder farmers. To summarise, the Phase 2 project had a number of appropriate strategies to reach and address the needs of smallholder farmers, noting that the lack of systematic data means it is challenging to make a robust assessment of whether this resulted in widespread changes in practices in this group.

Supporting value chains

There is a mixed picture on the extent to which the citrus projects were aligned with and contributed to a goal of supporting value chains.

On one hand, the projects largely focused on citrus production; that is, improving the quantity and quality of fruit. Interviewees noted there were clear reasons for this focus on production: Pakistan needed to improve significantly in this area and there were key pieces of work to be done. Without improvements in production, it would not be possible to improve market linkages.

At the same time, the projects conducted minimal work on connecting products to markets. Two main activities were undertaken. First, a quality payment system was trialled in the Phase 2 project. Under this trial, a small number of farmers were supported to implement best practice orchard management techniques. They were also linked directly to markets in order to sell their produce without the wholesalers that are commonly used in Pakistan. The trial appears to have been successful, with reporting indicating growers increased their profit margins by up to 50%. At the same time, the trial was small and only involved 5 farmers.

Second, a value chain scoping study was conducted towards the end of the Phase 2 project. The purpose was to consider value chain issues that could form the basis of a follow-up citrus project (note this follow-up project did not eventuate).

At the same time, the final independent review raised significant questions about whether more should have been done to link project activities to markets. Serious concerns were raised about whether new and existing varieties of citrus would meet market demands at profitable prices, which appears to be a fundamental issue for the success of the citrus projects. The lack of market demand for high-health nursery products was also raised as a barrier to the adoption of modern nursery management techniques. Further, interviewees highlighted that the projects focused on 'production first', with the idea that market links should come after that. Interviewees questioned this, suggesting an approach which simultaneously addressed production and markets would be more effective.

Overall, the project design could have included significantly more work on value chains and market linkages. This would have increased the alignment of the projects with the ASLP goals.

A key lesson for ACIAR is **that projects should be designed with market linkages in mind**. This should apply even when the most pressing issues are related to commodity production. Ensuring there is a viable market for the high-quality products produced (and/or explicit strategies to foster future market development), and that market information is made available to producers, will likely enhance the success of production activities since project beneficiaries will see clear incentives to adopt new approaches and technologies.

Programmatic level value-add

This review also examined the extent to which ASLP's 'programmatic' approach added value for the citrus project. From the evidence available, it is clear that while the citrus projects benefited in minor ways from being part of a larger program, the potential for significant value-add was not realised.

ASLP put in place a small number of processes to facilitate a 'programmatic' approach. In both phases, a key approach was an annual meeting of project teams in Australia. These annual meetings were designed to help build relationships and foster collaboration between the different project teams.

A further approach was added for ASLP's second phase, when the 'social project' was added to the program. This project, which was run by a team from the University of Canberra, aimed to:

- increase the engagement of rural poor who may benefit from the commodity-based projects (citrus, dairy and mango)
- increase collaboration between project teams
- foster effective collaborative development in rural Pakistan.

The citrus project received some relatively minor benefits from the above strategies. For example:

- it collaborated with the mango projects on a manual to improve nursery management, and on training for nurserymen and nurserywomen
- it could access small additional funds for conferences or events.

Interviewees also reflected that, while the benefits to the citrus projects were minor, the project experienced no disadvantages from being part of ASLP.

It appears there was significant potential for much greater value-add for the citrus projects from coming under the ASLP umbrella. Greater value-add might have been possible with better commodity and geographic alignment. Interviewees highlighted that the dairy project, with its focus on livestock, had little in common with the horticulture projects. The citrus and mango projects were geographically dispersed and had different seasons and harvest times.

The greatest unrealised potential came from the lack of collaboration between the citrus project and the social project. The proposal for the Phase 2 citrus project (in 2010) planned strong engagement with the new social project, stating that outcomes from the social project would be used to inform the citrus project and that this would inform the citrus project's strategies for engaging with marginalised groups. Joint workshops, activities and sharing of staff between the different projects were also envisioned.

Unfortunately, very little substantive interaction between the 2 projects took place, likely to the detriment of both projects. It seems there was good potential for the citrus project to use data from the social project to better understand the challenges facing rural communities, and to better understand if the citrus project was contributing to change for poor and marginalised groups, and women. However, one interviewee described the citrus and social projects as 'disconnected' and with their own agendas. The final independent review noted collaboration between the 2 projects was minimal.

There are a number of factors that appear to have contributed to the lack of collaboration between the ASLP projects, particularly the social and the commodity-based projects. For example:

- The social project did not commence until Phase 2 of ASLP, when the other projects, their approaches and their geographic locations, were already well established.
- The program and projects had insufficient time and resources devoted to encouraging and facilitating collaboration between projects. There appears to have been an assumption that Australia-based annual meetings would naturally lead to relationship building and collaboration in Pakistan, an assumption that does not appear to have held.
- The ACIAR ASLP program manager had insufficient time to facilitate collaboration or consider systems/incentives for collaboration, given the challenges they faced working with DFAT.
- There appeared to be misunderstandings from the beginning about what each project would do and what collaboration might look like.
- Social scientists and commodity-based scientists worked in silos and struggled to understand each other's potential value-add.

The challenges highlight an important lesson for ACIAR: that **specific strategies should be considered to ensure projects benefit from being part of a broader program**. Such strategies could include:

- Ensuring sufficient time and resources are allocated to cross-project collaboration, both in Australia and in the project country.
- Developing program structures that incentivise or even enforce cross-project collaboration. This could include, for example, having a 'lead' contractor who is responsible for and has authority to bring about cross-project collaboration.
- Ensuring project team selection processes consider staff traits such as openness to collaboration, good communication, and willingness to work in interdisciplinary teams.



Conclusions and lessons learned

Overall, **the results of the ASLP citrus projects are mixed**. In relation to introducing new citrus varieties, the projects achieved strong outputs, adoption and outcomes, and contributed to the commercialisation of at least one new citrus variety and to increased scientific capacity in Pakistan. The projects' participatory, hands-on training approach was viewed very positively by stakeholders. The Phase 2 project was also pro-poor and achieved good outcomes for a small number of nurserywomen.

In orchard and nursery management, good outputs were achieved, and it appears likely that some growers, nursery people and extension staff adopted and promoted the ASLP practices. However, the lack of systematic data makes it challenging to make a robust assessment of whether widespread adoption and outcomes have been achieved, or whether capacity of extension staff has been sustained.

Some enabling conditions for widespread adoption, such as an active long-term institutional home for training activities and a lack of market links for products, appear to be lacking – noting that the long-term timeframe to introduce new citrus varieties means market demands may improve in the future. In addition, the potential value-add of the ASLP 'programmatic' approach was not realised, particularly because of the lack of links between the citrus and social science projects.

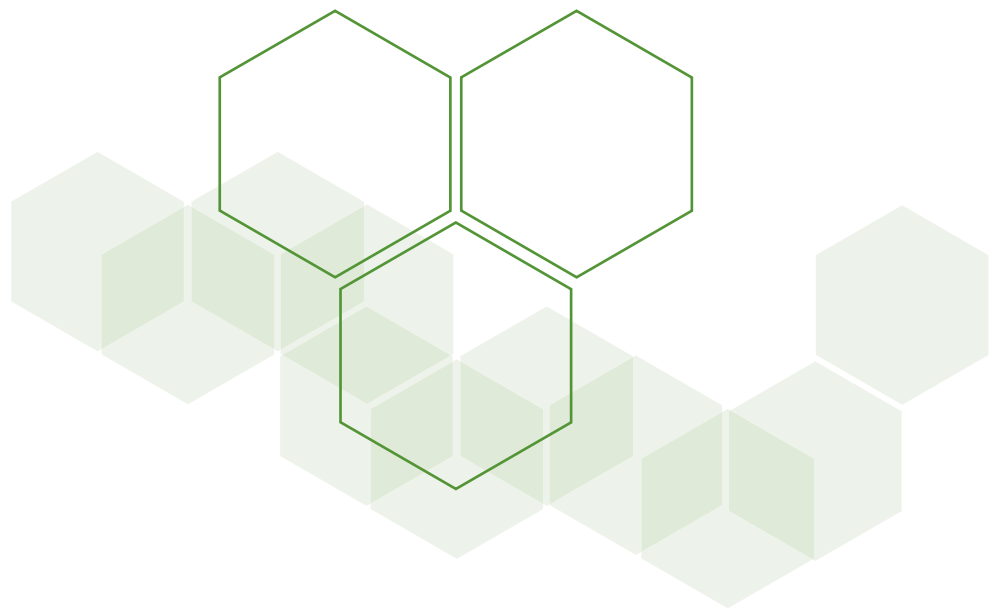
Lessons learned

This evaluation highlights some general lessons for ACIAR projects and programs:

- 1. From their inception, projects need monitoring systems that allow for the ongoing collection of data that can inform judgements on adoption and outcomes.** Ideally, data collection would focus on a model of behaviour change that is outlined in a project's theory of change. This would allow project staff and ACIAR to understand whether project beneficiaries are behaving, and changing behaviour, as expected. This, in turn, can create confidence that project activities are leading to adoption and outcomes, or inform program improvements where necessary.
- 2. ACIAR and project teams should design and implement projects with long-term sustainability in mind.** Developing a post-project communications plan, and identifying and working with a partner who can act as an active long-term home for training and extension activities, can help ensure local people can benefit from project work beyond the life of the project.
- 3. Gender analysis and social inclusion analysis, and the development of corresponding gender and social inclusion strategies, should be undertaken.** This will assist projects to develop a more strategic approach to influencing gender equity and women's empowerment, and to ensuring people with disabilities and other marginalised groups can benefit from projects.
- 4. ACIAR and project teams should design projects with market linkages in mind.** This should apply even when the most pressing issues are related to commodity production. Ensuring there is a viable market for the high quality products produced (and/or explicit strategies to foster future market development), and that market information is made available to producers, will likely enhance the success of production activities since project beneficiaries will see clear incentives to adopt new approaches and technologies.
- 5. ACIAR should consider specific strategies to ensure projects benefit from being part of a broader program.** Such strategies could include allocating sufficient time and resources to cross-project collaboration; developing program structures that incentivise cross-project collaboration; and selecting project teams that are open to collaborative, interdisciplinary ways of working.

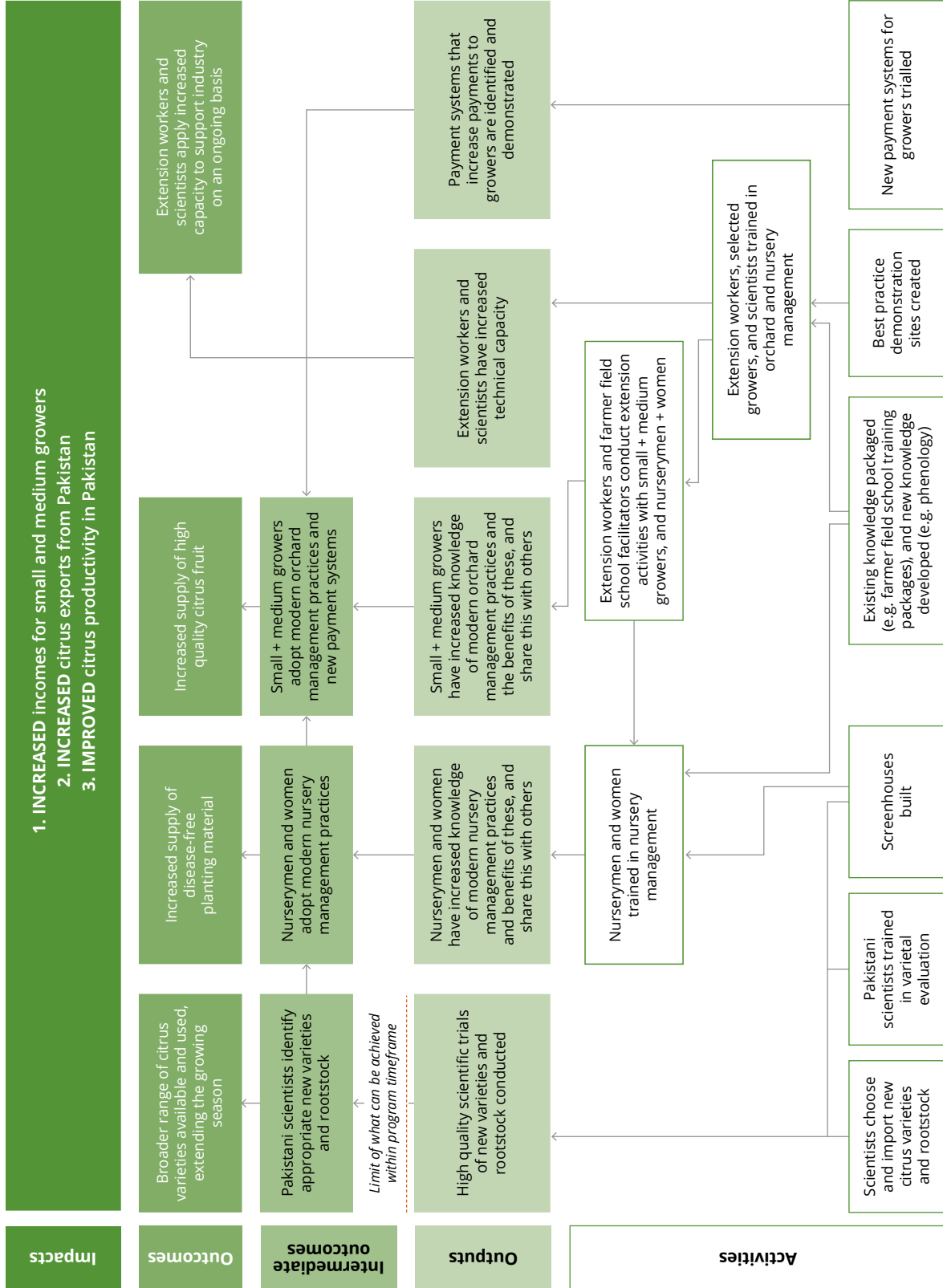
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Appendixes

Appendix 2.1: Theory of change



Appendix 2.2: Stakeholders consulted

Name	Title	Organisation or location
Dr Tahir Khurshid	Project Leader	NSW Department of Primary Industries
Mr Nisar Naeem	Senior Research Officer	KP Agriculture Research Pakistan
Mr Abdul Rehman	Research Officer	Citrus Research Institute, Sargodha
Mr Asif Ali Khan	Agriculture Extension Specialist	Fruit and Vegetable Development Project
Dr Ghulam Nabi	Professor Department of Horticulture	KP Agriculture University
Dr Jaffar Jaskani	Professor Department of Horticulture	University of Agriculture Faisalabad
Dr Shazia Ahmad	Professor	Fatima Jinnah Woman University, Rawalpindi
Mr Iffar Kalsoom		PHKN
Ms Tehmina Afzaal		PHKN
Mr Mian Ayaz	Citrus Grower	Peshawar
Mr Hamad Ahmed	Progressive Grower	Sargodha region
Mr Muhammad Ilyas Warriach	Progressive Grower	Sargodha
Mr Hastam Khan	Nursery person	Tarnab Peshawar
Mr Muhamad Afzal	Nursery person	Sargodha
Mr Abdul Ghafoor	Freelance Consultant	Sargodha
Dr Kazmi Munawar	Country manager, Pakistan	ACIAR
Mr Gerard McEvelly	Aik Saath Program Coordinator	ACIAR



Appendix 2.3: Project evaluation framework

The data and process used for addressing each of the key evaluation questions (KEQs) is summarised in the table. Bold questions are high priority and were explored in more depth.

Key Evaluation Question	Evidence/information required	Data sources	Data collection and analysis approach
1. What was the project's theory of change; and how did this evolve during implementation? <ul style="list-style-type: none"> - Was the theory of change appropriate to the project context and desired results? 	<ul style="list-style-type: none"> Documented theory of change at project commencement Information on subsequent changes Information on project context Perspectives of key stakeholders regarding appropriateness of the theory of change 	<ul style="list-style-type: none"> Project concept / design documents and variations Project progress reports, annual plans, etc. Key stakeholders (project managers and collaborating partners, program manager/ coordinator, government authorities, producers, businesses) 	<ul style="list-style-type: none"> Desk review of available documents Interviews with key stakeholders Triangulation of findings from different sources Project verification workshops
2. What outcomes (intended and unintended) has the project achieved or contributed to? <ul style="list-style-type: none"> - What was the unique knowledge contribution of the project/cluster that was/is expected to influence practice/policy? - To what extent is there evidence of adoption of new practices based on research process and findings? 	<ul style="list-style-type: none"> Robust, documented evidence of progress towards planned outputs and outcomes (including progress along adoption pathways), and any unintended consequences Theory of change assessment from KEQ1 Perspectives of key stakeholders, to test/validate written reporting, including 'next users' of research outputs 	<ul style="list-style-type: none"> Annual and/or final reports Mid-term and/or final reviews Key stakeholders (as above) 	<ul style="list-style-type: none"> Desk review of available documents Interviews with key stakeholders Triangulation of findings from different sources Project verification workshops ACIAR progress assessment and analysis tools (e.g. Table 1 and Table 2)
3. How did project activities and outputs contribute to the outcomes achieved? <ul style="list-style-type: none"> - To what extent and how did they differ from what was planned? 	<ul style="list-style-type: none"> Theory of change assessment from KEQ1 Documented evidence of impact pathways, as per KEQ2 Perspectives of key stakeholders including 'next users' of research outputs 	<ul style="list-style-type: none"> Annual and/or final reports Mid-term and/or final reviews Key stakeholders (as above) 	<ul style="list-style-type: none"> Documentation review, stakeholder interviews, triangulation, verification workshops Analysis of adoption and impact pathways, including 'next users' (e.g. Table 1 and Table 2)

Appendix 2.3: Project evaluation framework (cont.)

Key Evaluation Question	Evidence/Information required	Data sources	Data collection and analysis approach
<p>4. What strategies were adopted to address gender equity and social inclusion and how effective were these?</p> <ul style="list-style-type: none"> – How did the project impact men and women differently? 	<ul style="list-style-type: none"> • Evidence of analysis/awareness of the potential gender equity issues that may impact on the project • Evidence of steps taken to address the issues identified • Evidence of level of participation of women and men in research activities • Evidence of changes in women's and men's control of assets, resources and decision-making, and gender equity (e.g. through impacts on female researchers; gendered knowledge generation; influence on inclusivity within partner organisations) • Perspectives of key stakeholders 	<ul style="list-style-type: none"> • Documented gender strategy or analysis (if available) • Existing reports providing gender-disaggregated data and/or discussion of gender issues, for example, annual and/or final reports, mid-term and/or final reviews • Any existing gender audits or inclusion-focused reviews • Key stakeholders (as above) 	<ul style="list-style-type: none"> • Documentation review, stakeholder interviews, triangulation, verification workshops • Gender analysis to explore the level and type of participation of men and women, and influence on positive or harmful gender norms
<p>5. How did management arrangements impact delivery of the project?</p> <ul style="list-style-type: none"> – What other factors influenced project performance? 	<ul style="list-style-type: none"> • Any existing reporting and commentary on management arrangements • Perspectives of key stakeholders • Evidence of contextual factors external to the project that may have impacted performance 	<ul style="list-style-type: none"> • Annual and/or final reports • Mid-term and/or final reviews • Key stakeholders (as above) 	<ul style="list-style-type: none"> • Documentation review, stakeholder interviews, triangulation, verification workshops • ACIAR progress assessment tools
<p>6. How well did the project align with and contribute to the overall goals of its umbrella program?</p> <ul style="list-style-type: none"> – To what extent has the programmatic approach added value at project level? 	<ul style="list-style-type: none"> • Assessment of KEQs 1–5 • Information on program goal and approach • Relevant existing reporting and commentary • Perspectives of key stakeholders 	<ul style="list-style-type: none"> • Annual and/or final reports • Mid-term and/or final reviews • Key stakeholders (as above) 	<ul style="list-style-type: none"> • Assessment of consistency and value-add, based on analysis for KEQs 1–5 and supplementary program-level documentation, stakeholder interviews and verification workshops



Appendix 2.4: ASLP goals

ASLP ran for 2 phases between 2005 and 2015.

The goals of ASLP's first phase (2005–2010) were:

1. To transfer Australian knowledge and expertise to key sectors of Pakistan agribusiness to increase profitability and enhance export potential.
2. To contribute to poverty alleviation of smallholder farmers through collaborative research and development.
3. To enhance the capacity of the Pakistan research, development and extension system to deliver targeted and practical research outputs to agribusiness and farmers.

The goals for the second phase were adapted, but retained a core focus on building value chains to support smallholder farms and building technical capacity in Pakistan. The Phase 2 goals were:

1. Pro-poor value chains: To support 'keystone' interventions to sustainably enhance selected value chains, and increase understanding and delivery of benefits to the rural poor through productivity improvements and market and employment opportunities.
2. Agricultural capability: To enhance agriculture capability and sustainably improve agricultural value chains by providing short-term 'smart linkages', scoping studies and other initiatives, as well as longer-term formal training, that are demand-driven and catalytic, and complement the initiatives supported under other components of the program.
3. Enabling policy: To support policy analysis and interventions which improve or enable better economic and natural resource management, particularly where they underpin or strengthen pro-poor value chains and more sustainable farming systems.

Appendix 2.5: Project team members

#	Team member	Gender	International/National researcher
1	Dr Tahir Khurshid	M	International
2	Mr Jeremy Giddings	M	International
3	Dr Nerida Donovan	F	International
4	Mr Graeme Sanderson	M	International
5	Mr Steven Falivene	M	International
6	Mr Andrew Creek	M	International
7	Dr Iftikhar Ahmad	M	National
8	Dr Hafeez-ur-Rehman	M	National
9	Mr Altaf-ur-Rehman	M	National
10	Mr Nawab Khan	M	National
11	Dr M Jaskanu	M	National
12	Dr Abdul Samad	M	National
13	Mr Ghulam Nabi	M	National
14	Mr Mian Majeed	M	National
15	Dr Abdul Aziz	M	National
16	Dr Muhammad Raza	M	National
17	Mr Adul Rahman	M	National
18	Mr Ghulam Nabi	M	National
19	Dr Mohammad Jaskani	M	National
20	Mr Asif Khan	M	National
21	Mr Khaloon	M	National



Appendix 2.6: Research outputs

Peer-reviewed journal articles	
Publication	Author (gender, nation)
Ali W, Khurshid T, Giddings J and Nabi G (2016) 'The effect of furrow and flood irrigation systems on water use efficiency and yield of sweet orange orchards in Pakistan', <i>Acta Horticulturae</i> , 1128:151–153.	Ali (Male, Pakistan) Khurshid (Male, Australia) Giddings (Male, Australia) Nabi (Male, Pakistan)
Donovan NJ, Khurshid T, Falivene SG and Bowes J (2016) 'Improving citrus nursery production practices in Pakistan under an Australian aid program', <i>Acta Horticulturae</i> , 1128:161–164.	Donovan (Female, Australia) Khurshid (Male, Australia) Falivene (Male, Australia) Bowes (Male, Australia)
Jaskani MJ, Shafqat W, Tahir T, Khurshid T, Ur-Rahman H and Saqib M (2016) 'Effect of rootstock types on leaf nutrient composition in three commercial citrus scion cultivars of Pakistan under the ASLP Citrus Project', <i>Acta Horticulturae</i> , 1128:131–136.	Jaskani (Male, Pakistan) Shafqat (Male, Pakistan) Tahir (Male, Pakistan) Khurshid (Male, Australia) Ur-Rahman (Male, Pakistan) Saqib (Male, Pakistan)
Khan, MA, Khurshid T and Asif MU (2016) 'Extension activities of a citrus project in Pakistan with assistance from the Australian aid program', <i>Acta Horticulturae</i> , 1128:193–196.	Khan (Male, Pakistan) Khurshid (Male, Australia) Asif (Male, Pakistan)
Khurshid T, Hardy S, Sanderson G and Baxter L (2008) 'To optimise citrus production through management techniques under agriculture sector linkages program (ASLP/ ACIAR) in Pakistan, Bhutan and Australia', <i>Proceedings of International Society of Citriculture</i> , 1:492–494.	Khurshid (Male, Australia) Hardy (Female, Australia) Sanderson (Male, Australia) Baxter (Male, Australia)
Nisar N, Samad A, Nabi G and Khurshid T (2016) 'Evaluation of sweet orange (<i>Citrus sinensis</i>) scion cultivars on 'Bigarade' rootstock in Malakand division under the ASLP Citrus Project', <i>Acta Horticulturae</i> , 1128:197–202.	Nisar (Male, Pakistan) Samad (Male, Pakistan) Nabi (Male, Pakistan) Khurshid (Male, Australia)
Rehman M, Singh Z and Khurshid T (2018) 'Alleviation of chilling injury induced by cold quarantine treatment in Midnight Valencia and Lane Late sweet orange fruit', <i>Australian Journal of Crop Science</i> , 12(10):1616. Impact factor: 0.55	Rehman (Male, Pakistan) Singh (Male, Australia) Khurshid (Male, Australia)
Rehman M, Singh Z and Khurshid T (2018) 'Methyl jasmonate alleviates chilling injury and regulates fruit quality in 'Midnight' Valencia orange', <i>Postharvest Biology and Technology</i> , 141:58–62.	Rehman (Male, Pakistan) Singh (Male, Australia) Khurshid (Male, Australia)
Rehman M, Singh Z and Khurshid T (2018) 'Pre-harvest spray application of abscisic acid (S-ABA) regulates fruit colour development and quality in early maturing M7 Navel orange', <i>Scientia Horticulturae</i> , 229:1–9.	Rehman (Male, Pakistan) Singh (Male, Australia) Khurshid (Male, Australia)
Rehman M, Singh Z and Khurshid T (2018) 'Pre-harvest spray application of prohexadione-calcium and paclobutrazol improves rind colour and regulates fruit quality in M7 Navel oranges', <i>Scientia Horticulturae</i> , 234:87–94.	Rehman (Male, Pakistan) Singh (Male, Australia) Khurshid (Male, Australia)
Rehman M, Singh Z and Khurshid T (2019) 'Nitric oxide fumigation alleviates chilling injury and regulates fruit quality in sweet orange stored at different cold temperatures', <i>Australian Journal of Crop Science</i> , 13(12):1975–1982.	Rehman (Male, Pakistan) Singh (Male, Australia) Khurshid (Male, Australia)

Appendix 2.6: Research outputs (cont.)

Peer-reviewed journal articles	
Publication	Author (gender, nation)
Rehman M, Singh Z, Khurshid T, Malekipoor R and Tokala VY (2021) 'Preharvest spray application of methyl jasmonate promotes fruit colour and regulates quality in M7 Navel orange grown in Medireranean climate', <i>Australian Journal of Crop Science</i> , 15:387–393.	Rehman (Male, Pakistan) Singh (Male, Australia) Khurshid (Male, Australia) Melekipoor (Male, Australia) Tokala (Male, India)
Zaheer I, Iftikhar S, Khurshid T, Ahmad KS and Gul MM (2020) 'Isolation and ITS-rDNA based molecular characterization of plant pathogenic fungal species in postharvest citrus fruits', <i>Sydowia</i> , 71:267–278.	Zaheer (Female, Pakistan) Iftikhar (Female, Pakistan) Khurshid (Male, Australia) Ahmad (Female, Pakistan) Gul (Female, Pakistan)
Conference proceedings	
Publication	Author (gender, nation)
Ahmad I, Khurshid T, Jaskani J, Naeem N, Nabi G, Hayat A, Tahir T, Ali W and Ur-Rahman H (2014) 'Enhancement of citrus industry through improved production practices in Pakistan under the AusAid Program', <i>International Society of Horticultural Science Conference</i> , Brisbane, Australia.	Ahmad (Male, Pakistan) Khurshid (Male, Australia) Jaskani (Male, Pakistan) Naeem (Male, Pakistan) Nabi (Male, Pakistan) Hayat (Male, Pakistan) Tahir (Male, Pakistan) Ali (Male, Pakistan) Ur-Rahman (Male, Pakistan)
Ahmed R, Khurshid T, Rahman A, Rahman AU, Hayat A and Zaka M (2014) 'The Comparison of Furrow and Flood Irrigation system in 'Kinnow' mandarin under an Australian aid program', <i>International Society of Horticultural Science Conference</i> , Brisbane, Australia.	Ahmed (Male, Pakistan) Khurshid (Male, Australia) Rahman, A (Male, Pakistan) Rahman, AU (unknown) Hayat (Male, Pakistan)
Donovan N, Khurshid T and Falivene S (2014) 'Improving citrus nursery production practices in Pakistan under the Australian aid program', <i>International Society of Horticultural Science Conference</i> , Brisbane, Australia.	Donovan (Female, Australia) Khurshid (Male, Australia) Falivene (Male, Australia)
Falivene S, Khurshid T, Tahir T, Wajid A and Kazmi M (2004) 'Introduction of a more effective 'Kinnow' mandarin fruit payment system in Pakistan under Australian Aid project', <i>International Society of Horticultural Science Conference</i> , Brisbane, Australia.	Falivene (Male, Australia) Khurshid (Male, Australia) Tahir (Male, Pakistan) Wajid (Male, Pakistan) Kazmi (Male, Pakistan)
Khan M, Khurshid T, Shahbaz M and Ahmad S (2014) 'The extension activities of citrus project in Pakistan with assistance from the Australian aid program', <i>International Society of Horticultural Science Conference</i> , Brisbane, Australia.	Khan (Male, Pakistan) Khurshid (Male, Australia) Shahbaz (Male, Pakistan) Ahmad (Male, Pakistan)
Khurshid T (2012) 'Enhancement of citrus value chain production in Pakistan and Australia under the AusAid program', <i>Proceedings of the International Society of Citriculture</i> , Valencia, Spain.	Khurshid (Male, Australia)
Khurshid T (2014) 'The Response of Phenological Stages to Climatic Extremes and its Effects on Citrus Production and Quality', <i>International Society of Horticultural Science Conference</i> , Brisbane, Australia.	Khurshid, T (Male, Australia)



Conference proceedings	
Publication	Author (gender, nation)
Khurshid T (9–12 October 2015) 'An update of the ACIAR Pakistan project', <i>ACIAR project leaders conference</i> , Brisbane.	Khurshid (Male, Australia)
Khurshid T (2017) 'Citrus nursery management and production practices in Pakistan', <i>Proceedings of the 11th International Society of Citrus Nursery Congress</i> , Mildura, Australia.	Khurshid (Male, Australia)
Khurshid T (2018) 'Recent development in citrus production technology and export production opportunities', <i>Pakistan Horticulture Expo</i> , Lahore. (Invited to speak by the Chief Minister of Punjab)	Khurshid (Male, Australia)
Khurshid T, Rahman H and Ahmad I (2008) 'Increasing citrus production through orchard management techniques under Agriculture Sector Linkages Program', <i>Australian Society of Horticultural Science Conference</i> , Gold Coast.	Khurshid (Male, Australia) Rahman (Male, Pakistan) Ahmad (Male, Pakistan)
Khurshid T, Jaskani M, Nabi G, Tahir T, Ali W, Rahman A, Khan M and Rahman H (2012) 'Enhancement of citrus value chain production in Pakistan and Australia under the AusAid Program', <i>International Society of Citriculture Science Conference</i> , Valencia, Spain.	Khurshid (Male, Australia) Jaskani (Male, Pakistan) Nabi (Male, Pakistan) Tahir (Male, Pakistan) Ali (Male, Pakistan) Rahman, A (Male, Pakistan) Khan (Male, Pakistan) Rahman, H (Male, Pakistan)
Khurshid T, Sanderson G and Donovan N (2012) 'The evaluation of Chinese rootstock for tree growth, yield and quality of Lane Late oranges grown in Australia', <i>International Society of Citriculture Science Conference</i> , Valencia, Spain.	Khurshid (Male, Australia) Sanderson (Male, Australia) Donovan (Female, Australia)
Muhammad J, Shafqat W, Tahir T, Khurshid T and Rahman H (2014) 'Effect of rootstock types on leaf mineral composition in three commercial citrus scion varieties of Pakistan', <i>International Society of Horticultural Science Conference</i> , Brisbane, Australia.	Muhammad (Male, Pakistan) Shafqat (Male, Pakistan) Tahir (Male, Pakistan) Khurshid (Male, Australia) Rahman (Male, Pakistan)
Nisar N, Nabi G, Samad A and Khurshid T (2014) 'Evaluation of sweet orange (<i>Citrus sinensis</i>) scion varieties on Bigarade rootstock in Malakand district under the ASLP citrus project', <i>International Society of Horticultural Science Conference</i> , Brisbane, Australia.	Nisar (Male, Pakistan) Nabi (Male, Pakistan) Samad (Male, Pakistan) Khurshid, T (Male, Australia)
Tahir T, Falivene S and Khurshid T (2014) 'Hand thinning in 'Kinnow' mandarin to increase the size and quality of fruit under the ASLP citrus project in Pakistan with assistance from the Australian aid program', <i>International Society of Horticultural Science Conference</i> , Brisbane, Australia.	Tahir (Male, Pakistan) Falivene (Male, Australia) Khurshid (Male, Australia)
Ur-Rahaman H, Nabi G, Ali I, Tahir T and Ahmed M (2014) 'Effect of Orchard Floor Management Practices on Soil Properties, Growth and Yield of 'Kinnow' (<i>Citrus reticulata</i> Blanco)', <i>International Society of Horticultural Science Conference</i> , Brisbane, Australia.	Ur-Rahaman (Male, Pakistan) Nabi (Male, Pakistan) Ali (Male, Pakistan) Tahir (Male, Pakistan) Ahmed (Male, Pakistan)
Wajid A, Khurshid T, Naeem N, Samad A, Nabi G and Giddings J (2014) 'The effect of furrow and flood irrigation system on water use efficiency and yield of sweet orange under ASLP citrus project with assistance from Australian aid program', <i>International Society of Horticultural Science Conference</i> , Brisbane, Australia.	Wajid (Male, Pakistan) Khurshid (Male, Australia) Naeem (Male, Pakistan) Samad (Male, Pakistan) Nabi (Male, Pakistan) Giddings (Male, Australia)

Appendix 2.6: Research outputs (cont.)

University thesis	
Publication	Author (gender, nation)
Adiya Z (n.d.) <i>Management of Citrus Canker Disease by Plant Extracts</i> , Fatima Jinnah Women University, Rawalpindi.	Adiya (Male, Pakistan)
Afzal S (2013) <i>Response of 'Rough Lemon' (Citrus jambhiri L) seedling against different potting media</i> [MSc thesis], University of Agriculture, Faisalabad.	Afzal (Female, Pakistan)
Fatima N (n.d.) <i>Effect of fruit thinning on quality and profitability of 'Kinnow' mandarin (Citrus reticulata Blanco)</i> [PHD thesis], University of Agriculture, Faisalabad.	Fatima (Female, Pakistan)
Iram Z (n.d.) <i>Aggressiveness analysis and molecular characterization of pathogens associated with citrus fruits of Khanpur</i> , Fatima Jinnah Women University, Rawalpindi.	Iram (Female, Pakistan)
Iram Z (n.d.) <i>Isolation and characterization of post-harvest fungal pathogens of citrus varieties from the domestic markets of Rawalpindi and Islamabad</i> , Fatima Jinnah Women University, Rawalpindi.	Iram (Female, Pakistan)
Iram Z (n.d.) <i>Molecular Identification and Pathogenicity of fungi Associated with Citrus Fruit Diseases of Sargodha Orchards</i> , Fatima Jinnah Women University, Rawalpindi.	Iram (Female, Pakistan)
Javeria N (n.d.) <i>Prevalence incidence and severity of citrus from the domestic markets of Rawalpindi and Islamabad</i> , Fatima Jinnah Women University, Rawalpindi.	Javeria (Female, Pakistan)
Khan A (n.d.) <i>Identification and characterization of fungal pathogen associated with citrus fruit disease of Sargodha orchards</i> , Fatima Jinnah Women University, Rawalpindi.	Khan (Female, Pakistan)
Khan U (n.d.) <i>Molecular Characterization of citrus canker pathotypes</i> , Fatima Jinnah Women University, Rawalpindi.	Khan (Female, Pakistan)
Madiha T (n.d.) <i>Detection, Quantification and Molecular characterization of Fusarium species associated with Malformation in Mango Orchards of Punjab and Sindh</i> , Fatima Jinnah Women University, Rawalpindi.	Madiha (Male, Pakistan)
Malik I (2013) <i>Response of sweet orange cultivars budded on citrus rootstocks under the climatic conditions of Peshawar</i> [MSc thesis], University of Agriculture, Peshawar.	Malik (Male, Pakistan)
Naeem M (2014) <i>Response of Lemon cultivars to Cox Orange mandarin rootstock</i> [BSc thesis], University of Agriculture, Peshawar.	Naeem (Male, Pakistan)
Rahman Z (2014) <i>Growth responses of the Australian sweet orange varieties on different rootstocks in the climatic conditions of Peshawar</i> [MSc thesis], University of Agriculture, Peshawar.	Rahman (Male, Pakistan)
Rehman M (2012) <i>Performance of citrus rootstocks in different potting media under the screenhouse conditions</i> [MSc thesis], University of Agriculture, Peshawar.	Rehman (Male, Pakistan)
Saman F (n.d.) <i>Identification of Skin Disorders of Citrus reticulata by Classical and Molecular Method</i> , Fatima Jinnah Women University, Rawalpindi.	Saman (Female, Pakistan)
Shafqat W (2014) <i>Effect of Rootstock types on leaf nutrient composition of three Citrus Scion varieties</i> [MSc thesis], University of Agriculture, Faisalabad.	Shafqat (Male, Pakistan)
Shireen F (n.d.) <i>Effect of chemical thinning on growth and fruit quality of 'Kinnow' mandarin Citrus reticulata Blanco</i> [MSc thesis], University of Agriculture, Faisalabad.	Shireen (Female, Pakistan)
Sumyia I (n.d.) <i>Assessment and molecular characterization of citrus canker causing pathotypes</i> , Fatima Jinnah Women University, Rawalpindi.	Sumyia (Female, Pakistan)
Ullah R (2012) <i>Influence of Gibberellic acid on fruit set and growth of sweet orange</i> [MSc thesis], University of Agriculture, Peshawar.	Ullah (Male, Pakistan)
Zarafshan S (n.d.) <i>Assessment and control of Huanglongbing disease of citrus</i> , Fatima Jinnah Women University, Rawalpindi.	Zarafshan (Female, Pakistan)



Part 3: Dairy projects

An evaluation of the
ACIAR Agriculture Sector Linkages Program

Abbreviations and acronyms

ACIAR	Australian Centre for International Agricultural Research
ASLP	Agriculture Sector Linkages Program
AUD	Australian Dollar
AusAID	Australian Agency for International Development
DFAT	Department of Foreign Affairs and Trade
NGO	Non-government organisation
ODA	Official development assistance
RPM	Research Program Manager (ACIAR)
VBSE	Village-based Seeds Entrepreneurs

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Summary

From 2005 to 2015, the Australian Centre for International Agricultural Research (ACIAR) oversaw the 2 phases of the Agriculture Sector Linkages Program (ASLP) in Pakistan, which was a research-for-development program in the Punjab and Sindh provinces of Pakistan, focused on enhancing selected agricultural value chains for the ultimate benefit of the rural poor. The program had 2 phases: Phase 1 ran from 2005 to 2010, and Phase 2 was implemented from 2011 to 2015. The program was funded by the Department of Foreign Affairs and Trade (DFAT)¹⁷ and was managed by ACIAR. Both phases included commodity-based projects focused on citrus, dairy and mango. Phase 2 also included a social science research project. The ASLP goals are at Appendix 3.4.

Research projects within the ASLP that focused on strengthening the dairy value chains in Pakistan were:

- Phase 1: Improving dairy production in Pakistan through improved extension services (LPS/2005/132).
- Phase 2: Strengthening dairy value chains in Pakistan through improved farm management and more effective extension services (LPS/2010/007).

The 2 dairy projects aimed to improve farm management and make extension services more effective, and focused on 4 main outcome areas:

1. Increasing the productivity and profitability of smallholder dairy farmers.
2. Improving the quality and availability of livestock feed to smallholder farmers throughout the year.
3. Developing model dairy farm systems and pro-poor extension approaches that could be scaled out throughout Pakistan.
4. Developing the capacity of future and current scientists, dairy extension and industry personnel who could research the production and marketing of milk from the farm to the consumer.

Led by Charles Sturt University (Australia) with University of Sydney, in partnership with the University of Veterinary and Animal Sciences, Lahore (Pakistan), the projects involved partnerships and collaboration with institutions in Australia and Pakistan. The projects were funded by the Australian Government with contributions from other sources, and were implemented from 2007 to 2015 with a total funding value of AUD3,770,000.

This evaluation is Part 3 of a suite of evaluations of the ASLP. It examines the achievements of the dairy projects, with a view to identifying lessons that will inform the design, implementation, and the quality of outcomes of future ACIAR investments.



¹⁷ ASLP was originally funded by the Australian Agency for International Development (AusAID). AusAID was merged with DFAT in 2013.



Key findings



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

The dairy projects did not have an articulated theory of change. The evaluation team developed a suggested theory of change based on program documents covering the 2 projects, as outlined in Appendix 3.1. Key elements of the theory of change are:

- The projects were expected to **increase smallholder dairy farms' milk production rates and profits** by farmers adopting efficient practices and technology in livestock health, reproduction, and nutrition management. The projects would train farmers, provide extension services, improve farmers' access to high quality livestock feed, and develop dairy value chains.
- The projects were expected to **produce model dairy farms and extension approaches that could be scaled out** throughout Pakistan by piloting pro-poor dairy farming extension approaches and developing dairy value-adding and market innovation approaches. The projects would train extension workers and develop less intensive farming extension programs.
- The projects were expected to **increase scientific evidence-informed decision-making** as part of developing the dairy sector in Pakistan by scientists and primary investigators adopting enhanced research techniques and leading research on dairy. The projects would build the research capabilities of scientists and have twinning arrangements between Australian and Pakistani researchers and research institutions.

The dairy projects were relevant to addressing the issue of rapidly increasing local demand for milk in Pakistan and the need to improve the dairy productivity and profits of smallholder dairy farmers who make up 80% of Pakistan's milk producers.

Key findings (cont.)

2

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

Project activity and research reports, external review reports, key informant interviews and case studies provide sufficient evidence that the projects' outcomes have been achieved or will most likely be achieved.

Farmers' adoption of scientific and extension knowledge and practices has resulted in recorded increases in sales and profits from increased milk yields, healthier calves, and milk value-added products such as ghee, cream, ice-cream, and yoghurt. Farmers have adopted efficient farming practices in livestock health and nutrition management, and to a limited extent, agronomic practices, seed production and forage conservation.

Extension workers delivered inclusive extension services and continued to strengthen linkages between research knowledge, extension services and farmers' practices. This resulted in higher adoption rates among farmers. The projects have also **enabled innovation through improved extension approaches, the most significant being the 'whole family approach'**. The approach recognises the value of participation by women, young people and children in the smallholder farm system and has resulted in adoption rates of up to 80% of extension knowledge and practices. However, finalising a less intensive extension program and model farm system was not fully achieved, largely due to the lack of continuity of the process, caused by the high turnover of livestock department staff.

Pakistani researchers have led and contributed to dairy research and have generated numerous scientific knowledge products. Australian scientists and students who participated in *capacity-building* activities have improved exposure and expertise in dairy research. Scientific knowledge outputs have also been adopted by farmers and extension workers. The results suggest blending international and national expertise enriches the quality of capacity development activities and research outputs.

Women and youth have increased agency and participation in training, meetings, and extension services. Men, to an extent, have improved attitudes towards women and young people participating, and sharing project benefits.

However, the long-term sustainability of these outcomes depends on a few factors. Some were outside the projects' control, but all need to be considered during the design and monitoring of future projects. Well established dairy/beef markets and supply chains, and access to quality livestock feed and extension services, will support smallholder farmers' ability to maintain farming practices and sales. Commitment is needed from the Government of Pakistan to ensure equitable policies and well-resourced teams of dairy experts provide conducive operating conditions for farmers, extension staff, researchers, and other stakeholders. Community willingness to continue to transform cultural attitudes and barriers that limit women's participation will ensure sustainability of benefits and increase opportunities for women who contribute up to 80% of work inputs in dairy farms.



3

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

Project review documents and interviews suggest that there has been successful adoption of knowledge and practices resulting in positive impact. However, some outcomes were delayed because they required additional activities or risks to be better managed. Both projects were extended by 3 months in 2010 and 2015, respectively, to allow for activity completion.

Farmers' ability to adopt new knowledge and practices was dependent on their access to resources and milk markets. Adoption required some level of input and investment by farmers such as land, water, equipment, animals, seeds, time and money. Adoption rates for extension messages that required inexpensive inputs were higher than for those that required more inputs. Access to markets influenced farmers' ability to negotiate and sell milk and milk products to achieve profits. Project reviews have recommended that future projects include more detailed dairy and beef value chain analysis and strategies.

Inclusive and effective stakeholder engagement significantly influenced adoption rates by farmers, extension workers and scientists, and strengthened the interface between scientific knowledge, extension programs and farmer experiences. The projects employed effective strategies for inclusive and effective stakeholder engagement, such as engaging farmer networks, working through farm advisors, and increasing the number of women extension workers. These strategies should be considered for similar projects in the future. However, the projects continuously addressed challenges of working with different groups of stakeholders, so finalising a less intensive extension program and model farm system suitable for scale out was not fully achieved. Future projects should consider such risks and ensure stakeholder engagement and communication strategies are in place to ensure consistent support in the scale out of programs.

Capacity building cut across the project outputs and significantly influenced adoption and impact among project stakeholders. The *capacity-building* activities ensured not only strong project results but will likely contribute to an improved dairy sector in the future. Future ACIAR projects will also need to consider a planned approach to balancing research focus; and address the growing issue of Pakistani students opting not to return to Pakistan after overseas studies.

Key findings (cont.)

4

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

The projects started during a period when addressing gender equity and social inclusion was not an explicit priority of Australia's overseas aid programs. Through ongoing learning processes, the need to move from men-only participation to include women and other marginalised groups led to the piloting of the **'whole family approach' to extension which has doubled adoption rates**, compared to just working with men. ASLP Phase 2 also implemented a social research project that included dairy farming communities.

Program data and interviews suggest **males and females have benefited in various ways**. Male and female extension workers have adopted gender equality and social inclusion principles to deliver more inclusive extension services. Women have increased agency and have actively contributed to decision-making on their farms; and have adopted options to increase profit margins by manufacturing products like cheese, ghee and cream. Men have more inclusive attitudes towards sharing decision-making and benefits with women and youth. Children's participation was instrumental in influencing families to adopt profitable calf-rearing strategies.

While there are clear benefits, it is **unclear how the projects addressed** or were effective in addressing:

- the **added burden of the projects on women** (for example, was their increasing role and participation in certain areas of dairy farming offset by a reduced workload in other areas?)
- **potential child safeguarding issues** arising from project activities (for example, child labour, exposure to diseases)
- **lessening the gap between more resourced registered farmers and less resourced unregistered and traditional farmers**.

Future projects should consider conducting gender equity and social inclusion analysis to inform project design, which should be monitored throughout delivery.

5

How did management arrangements impact delivery of the project?

The decision to collaborate with the University of Veterinary and Animal Sciences, Lahore, and use its financial systems over the partner government's systems, **avoided potential delays in financial flows and activity implementation**. The projects consistently worked with key government departments and collaborated with multiple Australian and Pakistani institutions, each bringing unique strengths to the projects.

The projects recognised the value of blending Australian and Pakistani management expertise. An Australian team member was based in Pakistan during the first project which allowed close collaboration with Pakistani counterparts and cultivated relationships between teams in Australia and Pakistan. Having a **Pakistani team leader and dedicated project team who were engaged in both projects was also a critical success factor** – they understood the local context and could think and work politically with stakeholders. However, the external project review (Staal and Granzin 2015) and key informant interviews have questioned the sustainability of this arrangement in relation to adoption of approaches by central and local government officials. The projects worked closely with the government's livestock department to ensure transfer of skills to staff, but the department continuously faced high turnover of staff, limiting opportunities to develop and retain skilled researchers and extension workers, post-project.

Project review documents and key informant interviews also indicated the lack of:

- clear strategies to communicate project outputs to be taken up by key actors in dairy development
- a practical 'output to outcome to impact' strategy
- a robust monitoring, evaluation and learning system.

These limited opportunities for the projects' ongoing learning, risk management and adaptation to changing contexts.



6

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

The ASLP goals, while slightly different between Phases 1 and 2, focused on 3 key areas:

- enhancing the capacity of research and extension systems
- supporting poverty alleviation for smallholder farmers
- supporting value chains.

The **dairy projects gained ministerial approval from the Government of Pakistan and were well aligned with and contributed to the overall goals of ASLP.** The projects have enhanced the research skills of Pakistani and Australian researchers in dairy production, which has informed dairy extension approaches that have benefited dairy farmers. Smallholder farmers have increased the productivity and profitability of their dairy farms by adopting new farming techniques and extension service advice. The projects have certainly supported dairy value chains, which have contributed to the profitability of dairy farmers; however, benefits have been limited to a few groups of farmers.

The **dairy projects had the potential to achieve more by coordinating efforts across mango, citrus, dairy, and social research projects** to influence national dairy and agriculture sector policies and extension services and support competitive market conditions. Project review documents and interviews suggest better coordination and synergies at the ASLP program level could have achieved this and could have increased the projects' ability to influence policymakers.

Conclusion and lessons learned

The ASLP dairy projects have achieved strong results in most key areas. Smallholder farmers have increased sales and generated profits. Dairy extension workers, scientists and university students have led dairy research and strengthened the interface between scientific knowledge, extension services and farmers' practices. The projects' 'less intensive dairy extension approach' continues to be developed. There is evidence that elements like the 'whole family approach' to extension has effectively doubled adoption rates. More effort, however, was needed to get all stakeholders to finalise the approach to scale out.

The sustainability of the projects' results depends on:

- fair dairy supply chains and favourable market conditions that are supported by effective government policies and appropriate resources
- dairy research and extension services continuing to be relevant to farmers' needs and the needs of the dairy sector as a whole
- smallholder farming communities' willingness to ensure inclusiveness and that project benefits are shared.

The projects were aligned to the ASLP goals of enhancing the capacity of research and extension systems; supporting poverty alleviation for smallholder farmers; and supporting value chains. They also demonstrate the value of blending Australian and Pakistani expertise, and the benefits of identifying and using local partner systems that support efficient financial flows and activity implementation.

Lessons learned

This evaluation highlights some general lessons for ACIAR projects and programs:

- 1. Cross-cutting issues need to be considered in project designs and appropriate strategies developed and resourced to address them.** Important cross-cutting issues include gender equality and social inclusion, child protection, environment protection and 'do no harm'. Addressing these would remove barriers to participation, reduce potential harmful impacts on project beneficiaries and enhance results and sustainability.
- 2. Effective relationship management and stakeholder engagement is essential for timely project and program delivery and ownership of results.** Mapping internal and external stakeholders and managing relationships with power holders and power brokers is an ongoing process. A planned approach to managing relationships helps harness collective strengths and makes best use of resources. For large initiatives like the dairy projects, effective stakeholder engagement has significant influence on adoption rates and impact.
- 3. Market and value chain analysis and development, and business development plans, are essential for future project components that aim to generate profits.** These are foundational activities that should be managed very early during project implementation to guide downstream activities to maximise adoption and results of projects. For example, the scale out of the Village-based Seeds Entrepreneurs (VBSE) program could have benefited from a clear business plan. Milk market and value chain development could have benefited from clearer strategies at the beginning of the projects to ensure greater impact.



Introduction

Purpose, scope and audience

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

From 2005 to 2015, ACIAR managed the Agriculture Sector Linkages Program (ASLP)¹⁸, a research-for-development program funded by DFAT¹⁹, in the Punjab and Sindh provinces of Pakistan. The program focused on enhancing selected agricultural value chains for the ultimate benefit of the rural poor. There were 2 phases of the program: Phase 1 from 2005 to 2010, and Phase 2 from 2011 to 2015. Both phases included commodity-based projects focused on citrus, dairy and mango. Phase 2 also included a social science research project. The ASLP goals are at Appendix 3.4.

ACIAR commissioned a program-level evaluation to identify lessons that will inform the design and implementation of future ACIAR investments and improve the quality of outcomes.

Purpose

The program-level evaluation has 5 key purposes:

1. Compile performance information from each project under a program and investigate the contribution to specific project outcomes, with a particular focus on differential effects for women and men.
2. Generate project-level case studies for use in a qualitative cross-case analysis.
3. Summarise the contribution to outcomes of each program, with a particular focus on differential effects for women and men.
4. Establish how the different approaches to programmatic management adopted by each program influenced the achievement of outcomes.
5. Identify lessons related to programmatic management of agricultural research-for-development to inform future ACIAR investments.

Scope

The program-level evaluation focuses on the whole ASLP and its constituent projects.

This project-level evaluation assesses the 2 ASLP projects that focused on the dairy industry:

- Improving dairy production in Pakistan through improved extension services (LPS/2005/132)
- Strengthening dairy value chains in Pakistan through improved farm management and more effective extension services (LPS/2010/007).

18 The third phase of the Pakistan program that began in 2015 is known as the Agriculture Value Chain Collaborative Research Program (AVCCR). However the projects to be evaluated all started under the earlier phase, known as ASLP. For simplicity, this program is referred to as ASLP in the remainder of this document.

19 ASLP was originally funded by the Australian Agency for International Development (AusAID). AusAID was merged with DFAT in 2013.

The evaluation provides an assessment against the following key evaluation questions:

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

Audiences

The primary audience for this evaluation is ACIAR staff with direct responsibilities for programs and/or their constituent projects. This includes Canberra-based research program managers (RPMs), and field-based program managers and coordinators. The ACIAR Executive and senior managers, and DFAT fund managers, are also important audiences particularly for the program-level assessments and synthesis report.



Methodology

Data collection and analysis

Data was collated from key project documents, particularly project annual and final reports, and the mid-term and final project reviews. Seven semi-structured interviews were also undertaken with representatives of 6 stakeholder organisations²⁰ and 2 semi-structured interviews were completed with ACIAR staff. Stakeholders were intentionally selected in consultation with ACIAR. Interviews were conducted using Zoom and WhatsApp.

Systematic thematic analysis of data collected through these processes was undertaken using NVivo qualitative data analysis software to distil findings. ACIAR working definitions and assessment frameworks for project outputs, outcomes and 'next users' were used to analyse, categorise and summarise findings (see Table 5).

Preliminary findings were shared and tested in a project validation workshop involving the stakeholders previously consulted. These activities provided the opportunity to 'ground-truth' the assessments, identify any key issues not addressed, clarify any areas of uncertainty, and correct any misinterpretations. A draft evaluation report was then prepared for review by ACIAR and finalised in accordance with feedback received.

Table 5 ACIAR project outcome assessment terminology

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

²⁰ The list of stakeholders consulted is at Appendix 3.2.

Limitations

There were limitations on stakeholder consultations. Direct consultations mostly focused on ACIAR staff and implementing partners. No program beneficiaries could be interviewed due to their remote locations and poor phone and internet connectivity. As primary data collection was restricted to online interviews, the evaluators had limited ability to build rapport with participants and interpret non-verbal communication.

The length of time since projects were completed in 2015 may have also made it challenging for interviewees to provide accurate data. In addition, there is a third phase of the dairy project²¹, which may have made it hard for some interviewees to recall and separate out what was achieved up until 2015 and what is being worked on in the third phase. In some cases, phone lines were poor and unclear, and English language skills of interviewees was limited.

Interviewees for the project were intentionally chosen by ACIAR. This means they were not a representative sample of project participants and, given their ongoing contact with ACIAR, it is possible that their experiences fall at the positive end of the spectrum. This means data from interviews is likely positively biased.

Ethical considerations

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

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

²¹ The dairy project went into a third phase under the Aik Saath program.



Overview of projects

Project number	Production projects	Value chain projects
	LPS/2005/132	LPS/2010/007
Project title	Improving dairy production in Pakistan through improved extension services	Strengthening dairy value chains in Pakistan through improved farm management and more effective extension services
Collaborating institutions	University of Veterinary and Animal Sciences, Lahore, Pakistan Livestock & Dairy Development Department, Punjab, Pakistan Livestock & Fisheries Department, Sindh, Pakistan Charles Sturt University, Australia University of Sydney, Australia	
Project leaders	Dr Peter Wynn, Charles Sturt University (August 2007 to February 2015) Dr David McGill, Charles Sturt University (February to December 2015)	
Duration	August 2007 to June 2011	January 2011 to December 2015
Funding	AUD1,455,834 ^a (Australian aid program contribution: AUD1,455,834)	AUD2,322,778 (Australian aid program contribution: AUD2,051,013) ^b
Countries	Australia and Pakistan	
Commodities	Dairy	
Related projects	(see next column)	(see previous column)

(a) Additional budget from other sources, if any, were not available in the project documents provided to the evaluation team.

(b) The project also received financial support from Charles Sturt University, University of Veterinary and Animal Sciences (Pakistan), other Pakistani collaborators, and the Bill and Melinda Gates Foundation.

Context

The population of Pakistan is forecast to increase from 169 million in 2010 to 234 million by 2025. Within the Pakistan economy, agriculture, including livestock, is the largest sector and is important for food security and poverty alleviation. An estimated 36 million of the rural population are engaged in livestock production. These farming households derive 30% to 40% of their income from their livestock (Government of Pakistan 2009).

Nearly 30% of household expenditure on food items is on milk and dairy products. Although national milk supplies have been increasing, supply does not match domestic demand, and with the projected population growth, the deficit between domestic supply and demand for milk is expected to grow. National milk production has been increasing at about 5% per annum, exceeding 42 million tonnes in 2008, from around 12 million tonnes in 1990.

This growth has been achieved by more than doubling the population of milking animals over that period to 33.7 million buffalo and 38.3 million cattle (in 2012–13), and by adopting better feeding practices and animal health management. The adoption of better feeding practices and animal health management require rapid development as know-how at the farm level is rudimentary (Wynn et al. 2006:5).

Smallholder milking herds comprise both buffalo and cattle in different proportions depending on location and markets, with cattle used to maintain year-round production. Approximately 70% of smallholder farmers in Pakistan have buffalo and cattle herds of less than 5 animals, while 20% to 25% own 5 to 10 animals. Smallholder farms are often family-owned and much of the labour is sourced within the household. Women are mostly involved in daily management activities, such as feeding and watering, while the men are involved in marketing (Zia et al. 2011). Services to the dairy sector are provided by provincial and district government agencies and a range of non-government organisations (NGOs). Only 40% of farmers receive some form of support from the State Livestock Ministry due to the lack of extension workers with experience that crosses the nutrition-reproduction-disease management, farm economics or whole farm management interface.

The projects

The projects addressed the Government of Pakistan's priority to rapidly increase milk productivity to meet local demand for milk in Pakistan, and the need to improve the dairy productivity and profits of smallholder dairy farmers who make up 80% of Pakistan's milk producers. ASLP supported the following 2 dairy projects across its 2 phases:

- Phase 1: Improving dairy production in Pakistan through improved extension services (2007–2011) (LPS/2005/132).
- Phase 2: Strengthening dairy value chains in Pakistan through improved farm management and more effective extension services (2011–2015) (LPS/2010/007).

The projects were led by Charles Sturt University with University of Sydney, in partnership with the University of Veterinary and Animal Sciences, Lahore, with collaboration across institutions in Australia and Pakistan.

The specific objectives of the Phase 1 project were:

1. To demonstrate the economic and social benefits of improved extension services to smallholder dairy farmers.
2. To enhance the scope and quality of information used for training extension personnel.
3. To enhance the research capacity of Pakistani scientists in priority fields relevant to the ongoing development of the dairy sector.
4. To promote the benefits of agency linkages and enhanced extension services to national and provincial research and extension agencies and NGO groups.

During Phase 1, the dairy project focused on improving the profitability of smallholder dairy farmers through the introduction of new extension approaches and materials. The projects worked with 3 different farmer groups across 56 villages, including:

- registered farmers who directly benefited from the projects' extension services
- unregistered farmers who indirectly benefited through peer-to-peer learning with neighbours and friends who were registered farmers
- traditional farmers²² who did not have any direct interaction with the projects' extension services at all so were considered the control group.

During Phase 2, the extension program was expanded with an emphasis on the poor and marginalised producers. The project worked with men's and women's extension groups in each of the 56 villages, totalling more than 1,500 registered female and male farmers. The Phase 2 project objectives were:

1. To determine the most effective way the extension approach from LPS/2005/132 could be scaled out with a lower level of direct supervision to different areas of Pakistan.
2. To develop and promote strategies for optimising feed resources for smallholder dairy farmers.
3. To identify and promote profitable strategies for calf rearing.
4. To identify and promote strategies for improving smallholder profitability through marketing opportunities of a higher quality product.
5. To build the capacity of future and current extension and industry personnel driving the production and marketing of milk from the farm to the consumer.

Overall, both projects delivered activities that contributed to achievements in 4 main areas:

- increasing the productivity and profitability of smallholder dairy farmers
- improving the quality and availability of livestock feed to smallholder farmers throughout the year
- developing model dairy farm systems and pro-poor extension approaches that could be scaled out throughout Pakistan
- developing the capacity of future and current scientists, dairy extension and industry personnel who could drive research and the production and marketing of milk from the farm to the consumer.

22 Traditional farmers may have accessed extension services from provincial government and other NGOs.



Findings

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

Project theory of change

The documentation of the dairy projects did not include an articulated theory of change. This is not surprising, given the use of theory of change was limited in the Australian aid program when the projects were designed. Drawing on documents and discussion with stakeholders, the review team developed a suggested theory of change which outlines how project activities were expected to lead to project outputs and outcomes.

A visual representation of the theory of change is at Appendix 3.1. This represents the theory of change at the end of the dairy projects, meaning any project evolutions have been incorporated.

The projects were expected to **increase smallholder dairy farms' milk production rates, sales, and profits**. To achieve this, the projects would support farmers to adopt efficient practices and technology in livestock health, reproduction, and nutrition management. The projects would train farmer groups in new animal husbandry practices, including profitable calf rearing; provide pro-poor extension services; improve farmers' access to high quality livestock feed; and develop dairy value chains and market options.

The projects would support the set-up of **village-based seeds entrepreneurs (VBSE) to operate profitable operations** as part of improving farmers' access to high quality livestock feed. VBSE were expected to adopt business practices and technologies for maintaining consistent supplies for quality forage crops and seeds. The projects would research viable seeds and forage crops options, train, and support VBSE to set up and market high yield seeds and quality fodder, and train farmer groups on livestock health and nutrition management and calf rearing.

Model dairy farms and inclusive extension approaches that could be scaled out throughout Pakistan were also a key focus. These were anticipated to be achieved through piloting pro-poor dairy farming extension approaches and developing dairy value-adding and market innovation approaches. The projects would increase the interface between scientific research, extension activities and farmers' experiences; develop practical extension messages and materials for farmers and extension workers; train extension workers on new extension approaches; conduct dairy value chain and supply chain activities; and develop less intensive farming extension models.

The projects were expected to **increase scientific evidence-informed decision-making as part of developing the dairy sector in Pakistan** by scientists and primary investigators adopting research techniques and leading research on dairy. The projects would build the research capabilities of Pakistani and Australian scientists through ongoing training, workshops, and professional development activities; research scholarships, conference presentations and research publications; veterinary student internships and exchange programs; and twinning arrangements between Australian and Pakistani researchers and research institutions.

Appropriateness of the theory of change

The overall focus of the projects to increase profitability of smallholder dairy farmers through improved dairy research, extension services and production and marketing methods remained consistent throughout the 2 projects.

Project documents highlight a few changes in activities and outputs over time. Phase 2 saw increased pro-poor and more inclusive extension approaches. The project learned in Phase 1 that the 'whole family approach' to extension services increased adoption rates and yielded better results. Extension services in Phase 2 also broadened from only targeting men to including women extension workers, women farmers, and their children. In Phase 1, farmers who were better resourced with land and animals were more likely to adopt new extension services. Phase 2 increased focus on improving the inclusion of poorer and marginalised farmer groups in extension activities.

In Phase 2, improving farmers' feed resources, calf rearing and milk value-adding capacity were more developed and focused. These built on research and learning on dairy nutrition, fodder production and calf management in Phase 1.

Building the capacity of farmers, extension workers, scientists and students as future researchers and scientists was a key feature of both projects. Phase 2 featured more applied research and capacity development events that focused on areas such as nutrition, calf rearing and milk marketing, and involved students from Pakistan and Australia.

Three key assumptions were made at the design and implementation of projects:

1. **Farmers' knowledge and access to resources and markets.** The projects assumed that farmers would consistently follow extension advice and would have the necessary financial and non-financial resources – such as reliable access to water and/or access to credit – to make changes in their farms and adopt new livestock health and nutrition practices. The projects also assumed that influencing the behaviour of farmers could be most effectively achieved through farmer advisor trainings and group meetings, extension support by well-informed extension workers, and the development of milk markets and milk value-adding activities.
2. **Animal health and nutrition.** The projects assumed farmers would, in the long-term, continue to have consistent access to vaccines, high quality fodder, water and equitable extension services from government and other extension service providers, including NGOs, to maintain healthy herds and high milk productivity.
3. **Extension workers, scientists, and future scientists.** The projects assumed trained extension workers, scientists and future scientists would, in the long-term, continue to provide quality services and research to smallholder farmers and the dairy sector in Pakistan.

The indicative theory of change is relatively simplistic about how behaviour change would happen for smallholder dairy farmers, extension workers and scientists. For farmers, it is assumed that increased knowledge and consistent access to extension services, and financial and non-financial resources, would lead to the adoption of new behaviours. For dairy extension workers, scientists, and future scientists, it is assumed that increased knowledge and expertise would continue to support dairy farmers and the dairy sector in Pakistan.

Developing theories of change for future projects will present an opportunity for ACIAR and project teams to more deeply consider how adoption of new practices happens and how behaviour change could be brought about, drawing on existing models of behaviour change. Such models should be explicitly incorporated into project designs and theories of change to ensure they guide project activities and monitoring.



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

Outputs

The projects delivered a range of outputs throughout the 2 ASLP phases. These outputs are summarised under 3 headings below, according to the expected project results. Outputs relating to increased sales and profits for smallholder farmers and VBSE are described under one heading as they share multiple activities.

Increasing milk production, sales, and profits of smallholder dairy farmers and VBSE

The projects delivered outputs related to capacity building and practices of farmers to increase milk production, sales and profits. Capacity building for farmers – delivered through trained project farm advisers and extension workers – focused on basic feeding and husbandry practices, animal breed selection and reproduction, calf rearing, and ration formulation. This was complemented by ongoing extension support and extension materials for farmer groups. The projects reached more than 1,500 farmers in 56 villages across 7 project districts in Sindh and Punjab.

Milk value-adding and market development activities with individual farmers and farmer groups were also a key focus of the extension programs. Farmers were introduced to milk value-adding strategies to produce milk-based products such as ice-cream, ghee and cream. Milk value-adding activities provided opportunities for the greater involvement of women farmers in the projects. The projects also introduced various milk marketing strategies, such as community-based milk selling systems, that farmers and farmer groups could continue to manage to sustain profit levels from their sales.

Profitable calf rearing strategies and fodder production initiatives were also delivered to increase milk production and sales for smallholder farmers. Calf rearing activities included trials on various breeds of cattle and buffalo and were delivered in innovative ways, such as competitions for children which also encouraged community engagement.

The projects worked with at least 20 communities in Punjab and Sindh to establish VBSE for berseem and other fodder species (maize/millet/oats) as part of ensuring consistent supply of high quality fodder throughout the year. These included set-up of demonstration plots and awareness sessions among farmer groups.

The above outputs were informed by existing local and international knowledge as well as new scientific knowledge that scientists and students generated during the projects. The projects carried out trials and research on economic and policy constraints for profitable smallholder dairy farming, milk value-adding and milk marketing, calf rearing, and fodder production. For example, student researchers and scientists from Sindh Agriculture University, University of Veterinary and Animal Sciences, and University of Agriculture Faisalabad conducted 3 calf rearing research projects on weaning age, milk feeding and growth performance as well as trials to identify effective and adoptable alternative colostrum feeding strategies involving buffalo calves from local animal markets.

Establishing model dairy farm systems and inclusive extension approaches

The projects delivered outputs to build the capacity and practices of dairy extension workers, and strengthen linkages between research knowledge, extension services and farmers' practices, to establish model dairy farm systems and inclusive extension approaches.

In Phase 1, the projects identified key extension messages and developed and tested a new approach to extension, the 'whole family approach' which they continued to develop in Phase 2. New extension materials, based on messages from Phase 1, were also developed for use by farmers and extension workers in Phase 2. The materials were developed collaboratively by the project team with all Pakistani veterinary universities, livestock department research staff, Australian partners, and smallholder farmers. They incorporated new scientific knowledge generated by the projects, existing knowledge and best practices, and feedback from farmers and extension workers. The materials were also translated into local languages and included 10 modules²³, 25 fact sheets as well as fodder and feed calendars, and a ration formulation booklet.²⁴

The projects explored innovative ways to scale-out extension messages. These included integrating messages into the 'whole family approach', individual farm visits, practical demonstrations at the farmer's doorstep, problem-based learning techniques, and fun community activities such as quizzes, live drama and video shows.

Training workshops and ongoing meetings and activities were delivered to selected extension workers from the government livestock departments of Punjab and Sindh. These events updated extension workers' scientific knowledge and were opportunities for extension workers to provide feedback and reflection on their field experiences with farmers. The process allowed for the continuous review, adaptation, and trial of the extension messages and program, as part of establishing model dairy farm systems and less intensive inclusive extension approaches. A condensed version of the trainings was delivered to 20 extension workers; 10 each in the provinces of Baluchistan and Khyber Pakhtunkhwa.²⁵

Pakistani researchers actively leading dairy research and contributing to dairy sector

The projects built the capacities of experts, academics, scientists and student scientists in Pakistan and Australia to lead dairy research and contribute to the development of the dairy sector. The projects provided strategic short-term training opportunities, which included student forums, an ongoing internship program, and participation in local and international conferences and workshops in Pakistan, Australia, Indonesia, China and Thailand. For example, at least 35 Pakistani veterinary and agronomy students were trained under the internship program and 5 young meat scientists participated in a meat judging competition and visit to Australia.

The projects also had twinning arrangements and promoted linkages between Pakistani and Australian students, scientists and institutions. Australian and Pakistani scientists and dairy experts have completed collaborative review publications and held joint workshops and seminars on breeding and genetics of Sahiwal cattle, statistics, feed formulation, and fodder growth/production. Students from Pakistan and Australia participated in annual inter-country visits and forums, although the events for 2014 and 2015 were cancelled due to security issues.

The projects have also trained and supported PhD and Master students to implement research, publish papers in international scientific journals and present research papers at international conferences on various topics including milk value-add and supply chains, dairy sector policies, livestock reproduction and calf rearing, and fodder production. For example, at least 8 PhD and 14 Master students from Pakistan and Australia were supported to research challenges relating to profitable smallholder farming enterprises which have been incorporated into the projects' extension materials. Research work has been presented at more than 25 national and international conferences and at least 11 scientific publications have been finalised.

23 **10 Extension Modules:** Cow Comfort/Animal Husbandry, Animal Nutrition, Animal Reproduction, Calf Rearing, Animal Health/Disease Management, Ration Formulation, Dairy Breeds and their Selection, Milk Value-addition, Improved Fodder Agronomic Practices, Community Mobilisation.

24 The Fodder and Feed calendar and Ration Formulation booklets were developed by the Nutrition Focus Group, which was set up to develop strategies for optimising feed resources for dairy farmers. They included representatives from national and international research institutions and the private sector.

25 Project activities primarily focused on the provinces of Sindh and Punjab. The projects only trained extension workers in the 2 provinces.



Adoption

During Phase 1, the projects collected case studies and conducted a longitudinal study of farmers. In Phase 2, separate impact assessments were undertaken with farmers and extension workers to understand the results of the extension programs. The studies included an assessment of adoption levels of knowledge, understanding and practices that the projects promoted through the extension program. Data from these studies, end of project reports and interviews indicate that adoption rates were generally high for scientists but variable for extension workers and farmers.

Increasing milk production, sales and profits of smallholder dairy farmers and VBSE

Data indicate **adoption rates varied among different farmer groups for different extension messages** about increasing milk production, sales and profits.²⁶ The projects promoted 7 key extension messages from their extension modules, and farmers' adoption of these messages was assessed by the impact study.²⁷ Overall, the average adoption rate of these messages by all farmer groups ranged from 40%–70%, with messages that required farmers to make capital expenditure resulting in lower adoption rates. On the other hand, messages that were easier and less costly to implement, such as improved calf rearing, had higher adoption rates (70%).

Registered farmers recorded the highest adoption rates of key extension messages. For example, 96% of registered farmers adopted messages on vaccination and deworming, compared to 84% of the traditional farmer group. Registered farmers were direct beneficiaries of the extension services. These female and male farmer groups had opportunities to participate in all extension activities, including accessing monthly extension support from the projects. Traditional farmers did not have any direct interaction with the projects' extension services at all so were considered the control group.²⁸

Unregistered farmers recorded lower adoption rates of key extension messages, but the rates were still relatively high. For example, 93% of unregistered farmers adopted messages on improved vaccination and deworming. Unregistered female and male farmers benefited indirectly through their peer-to-peer learning with neighbours and friends who were registered farmers (direct project beneficiaries).²⁹ The high adoption rates recorded among indirect beneficiaries indicates high quality extension service delivery by the projects, and that the promoted knowledge, practices and technology was relevant to the needs of farmers.

Trial berseem VBSE farmers adopted agronomy practices that helped grow quality fodder at low cost. Project documents report VBSE farmers recorded a one-third increase in forage yields and more than a three-quarter increase in seed yields. Based on the success of the VBSE trials, the initiative has been extended to at least 20 other villages in Punjab and Sindh.

The adoption of milk value-adding marketing and value chain practices was limited. The projects developed milk marketing and value-adding modules that were rolled out as part of the extension program. As a result, some farmers and farmer groups, particularly female farmer groups, were able to increase profits by up to threefold per litre of milk. This indicates adoption of knowledge and practices at community level; however, these results were limited to small pockets of farmer groups.

26 Key messages included untying of animals and providing free access to water; vaccination and deworming; calf rearing and colostrum feeding; and high-quality fodder production.

27 The projects measured adoption levels between 3 different farmer groups: registered farmers, unregistered farmers, and traditional farmers.

28 Traditional farmers may have accessed extension services from provincial government and other NGOs.

29 Included direct observation of registered farmers in their farms and information exchanges with communities.

Establishing model dairy farm systems and inclusive extension approaches

Female and male extension workers in Sindh and Punjab recorded high levels of adoption of knowledge and practices. Workers were selected from government livestock departments in Sindh and Punjab, and participated in at least 10 training workshops and relevant project meetings over 5 years. Impact assessments of capacity building indicate extension workers gained higher levels of technical knowledge, communication skills and levels of self-confidence when compared to their counterparts who were not part of the program.³⁰

Project-trained extension workers in Baluchistan and Khyber Pakhtunkhwa recorded a 20% adoption rate, despite having received a few days' training and very limited follow-on support from the projects. When compared to their counterparts in Sindh and Punjab, who received many more opportunities for training and follow-on support, this result suggests the less intensive approach to capacity development for extension workers needs further development.

The **project-trained extension staff were instrumental in influencing adoption rates among registered farmers** who were reached through the projects' extension program. The projects measured the impact of extension approaches through the adoption of knowledge and practices by different farmer groups (as discussed in the previous section). This supports a key project assumption: that behaviour change of farmers could be most effectively achieved through farmer adviser training and group meetings, and extension support by well-informed extension workers.

Project documents and interviews also report **private sector companies, such as Nestlé, and research institutions, such as Sindh Agriculture University, have adopted the projects' extension materials.** These have been adapted and printed for their own extension programs and farmer communities. This has been an unintended positive result of the project.

Pakistani researchers leading dairy research and contributing to dairy sector

Pakistani and Australian student scientists, scientists and dairy experts who participated in the projects' *capacity-building* programs **recorded a high adoption of dairy research knowledge and practices.** Capacity-building programs, such as short trainings, student forums and research into applied issues affecting smallholder farmers, enabled researchers and experts to incorporate research outcomes into extension materials, and publish papers in international journals and present at conferences.

Project documents report more than 30 Pakistani postgraduate students completed their research work under the projects' guidance. The outcomes of their research were incorporated into the projects' extension materials, informed project management, and were published in 'high impact factor' journals. For example, 2 PhD theses included reviews of dairy policies at the national and provincial levels, and developed recommendations to address economic and policy constraints for profitable smallholder dairy farming. The results were published in scientific journals, presented at an international conference and shared with the broader ASLP team.

30 Technical knowledge (p<0.001), communication skills (p=0.002) and levels of self-confidence (p=0.013).



Outcomes

Project activity and research reports, external review reports, key informant interviews and case studies provide sufficient evidence that the projects' outcomes have been achieved or will most likely be achieved.

Increasing milk production, sales and profits of smallholder dairy farmers and VBSE

The projects built the capacity of smallholder dairy farmers to increase their milk production, sales and profits. **Farmer adoption of scientific and extension knowledge and practices resulted in recorded increases in sales and profits** from increased milk yields, healthier calves and milk value-added products such as ghee, cream, ice-cream, and yoghurt. For example, by the end of Phase 2:

- 40% of farmers were providing their animals free access to feed and water, resulting in an average 25% increase in milk production per animal per day.
- 70% of farmers were using new health and feeding practices to ensure healthy calf growth. As a result, calf mortality rates reduced to as low as 5% in some cases, and calf growth rates increased by 250–400g per day through to weaning, resulting in farm profits increasing by an average of 30%.
- A limited number of individuals and farmer groups were using recommended milk marketing and milk value chain strategies, which resulted in 25%–40% increased profits.
- Female farmers' involvement in different milk value-adding activities grew over time. This resulted in increased production and sale of value-added milk products such as ghee, cream, ice-cream and yoghurt, which added to farmer profits.
- Berseem VBSE farmers in trial areas increased forage yields by 37% and seed yields by 82%. Farmers producing improved berseem seeds also received a 60% increase in income per kilogram compared to traditional varieties. However, this result was limited to farmers in areas where the berseem VBSE program was trialled. While it suggests that the VBSE program worked, VBSE trials were conducted towards the end of Phase 2 (2014–2015), so there was limited time to scale out the initiative. After trials it was then rolled out to 20 villages in Sindh and Punjab. Stakeholders consulted during the evaluation agreed the VBSE program had limited results in Phase 2. The external review (Staal and Granzin 2015) at the end of Phase 2 suggested the program needed a clear business plan to ensure a successful scale out to all villages.

The projects also enabled innovation among smallholder farming communities. For example, female farmers who previously used traditional methods to produce butter and ghee obtained cream separator machines, which reduced processing time. New VBSE operators had started using refined agronomic practices and improved varieties of berseem clover forage seeds to produce and use/sell high quality fodder.

Establishing model dairy farm systems and inclusive extension approaches

The projects built the capacity of **extension workers to deliver inclusive extension services and strengthen linkages between research knowledge, extension services and farmers' practices**. Project reports and interviews indicate a correlation between the increased capacity of extension workers and farmers' increased adoption of new knowledge and practices. The impact study data on extension workers also indicate that project-trained workers increased their technical knowledge, communication skills and confidence to deliver extension services. Project-trained extension workers changed their community engagement approach from mostly didactic to more contextual and inclusive approaches, where they invest in building relationships and trust with farmer groups to impart key extension messages that farmers could adopt. This approach and its results were increasingly being recognised by the livestock departments in Sindh and Punjab.

The projects also **enabled innovation through improved extension approaches, the most significant being the 'whole family approach'**. The approach recognises the value of participation by women, young people and children in the smallholder farm system, and resulted in adoption rates of up to 80% of extension knowledge and practices. By the end of Phase 2, women and youth had increased agency and participation in trainings, meetings, and extension services. Men, to an extent, had improved attitudes towards inclusion of women and young people in participation, and in sharing project benefits.

Finalising a less intensive extension program and model farm system was not fully achieved, largely due to the lack of continuity of the process, caused by the high turnover of livestock department staff.

Pakistani researchers leading dairy research and contributing to dairy sector

The projects built the capacity of **Pakistani researchers and students (as future scientists) to actively lead dairy research and generate numerous scientific knowledge outputs and publications.**

In addition, Australian scientists and students who participated in *capacity-building* activities gained improved exposure to, and expertise in, dairy research. The results suggest blending international and national expertise enriches the quality of capacity development activities and research outputs.

Scientific knowledge outputs were also adopted by farmers and extension workers. Most significant were scientific knowledge in profitable calf rearing, improving forage seeds and milk marketing. As previously described, adoption of these outputs resulted in farmers increasing milk yields, sales and profits, improving calf health and reducing calf mortality rates, and increasing forage and seed yields. The projects also strengthened the interface between research knowledge, extension services and farmers' practices. These were the result of the projects' improved extension services which also utilised scientific knowledge outputs.

The dairy projects also made **scientific achievements in calf rearing research.** Calf rearing research trials were initially conducted by 3 Pakistan universities and successfully demonstrated that calf mortality could be reduced, and growth rates increased.³¹ The success of these trials enabled Dr Bhatti from University of Agriculture, Faisalabad, to secure additional grants from external donors to conduct further research in profitable calf rearing and to supervise at least 20 postgraduate students.

31 University of Agriculture, Faisalabad, Sindh Agriculture University, and University of Veterinary and Animal Sciences.



Discussion

Overall, the data suggest positive results for the projects. Evidence gathered from project documents, interviews and verification workshops was sufficient to assess the level of adoption and outcomes of the projects.

However, the long-term sustainability of these outcomes depends on a few factors. Some were outside the projects' control, but all need to be considered during the design and monitoring of future projects. For example, well established dairy/ beef markets and supply chains, and access to quality livestock feed and extension services, will support smallholder farmers' ability to maintain farming practices and sales. Commitment is needed from the Government of Pakistan to ensure equitable policies and well-resourced teams of dairy experts provide conducive operating conditions for farmers, extension staff, researchers and other stakeholders.

Community willingness to continue to transform cultural attitudes and barriers that limit women's participation is also needed, as this will ensure benefits and increase opportunities for women who contribute up to 80% work inputs in dairy farms.

Table 6 summarises adoption of project outputs, while Table 7 summarises capacity built through the projects.

Table 6 Levels of adoption of key project outputs

Project	New technologies or practical approaches	New scientific knowledge	Knowledge or models for policy and policymakers
ASLP dairy projects	Nf – Milk value-adding and milk marketing Nf – Fodder production NF – Calf rearing NF – Extension approaches NF – Extension staff, smallholder farmers and scientists	Nf – Improved berseem varieties and agronomic practices NF – Calf rearing	N – dairy policies research

Notes:

O No uptake by either initial or final users

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

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

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

Table 7 Capacity built relevant to project outcomes

Who	Skills and knowledge
Male and female smallholder farmers	<ul style="list-style-type: none"> Best practice dairy management in areas such as feed, water, animal health, and milk value-adding For women and youth: increased agency in trainings and meetings For men: improved attitudes to women and youth involvement in the projects
Berseem farmers	<ul style="list-style-type: none"> Best practice in increasing forage and seed yields, and producing improved berseem seeds
Extension workers	<ul style="list-style-type: none"> Technical knowledge of best practice dairy management Improved communication skills Increased confidence to deliver extension services Strengthened links between research, extension services and farmers
Research / academic community in Pakistan	<ul style="list-style-type: none"> Individual capacity built through obtaining higher degrees Ability to actively lead dairy research and generate scientific knowledge

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

Factors influencing adoption and impact

Project review documents and interviews suggest that there has been successful adoption of knowledge and practices resulting in positive impact. However, some outcomes were delayed because they required additional activities, or risks to be better managed. Key factors that influenced adoption and impact are described in this section.

Farmers' access to resources and markets

The projects trained smallholder farmers on husbandry practices, provided enhanced extension services, and established community-based fodder producers and seed entrepreneurs that enabled farmers to access high quality livestock feed throughout the year.

Farmers' ability to adopt the new knowledge and practices was dependent on their access to resources and milk markets. Adoption required some level of input and investment by farmers, such as land, water, equipment, animals, seeds, time and money. Adoption rates for extension messages that required inexpensive inputs were higher than those that required expensive inputs. For example, there was a 95% adoption rate among registered farmers for vaccination and deworming compared to a 40% adoption rate for untying of animals and providing them free access to water. The high adoption rate for vaccination was the result of farmers being aware of the benefits of vaccination and deworming, and that vaccines and deworming medication could be easily accessed at low cost. On the other hand, untying of animals and providing them free access to water required farmers to invest in animal fences and ensure farms had consistent water supply. One interviewee also noted that in some areas, farmers did not own land or had no money to grow fodder.

Access to markets influenced farmers' ability to negotiate and sell milk and milk products to gain profits. The projects also worked with farmers to develop some successful examples of supply chain interventions; however, the results remained limited to the individual and farmer group level. Farmers made sales and profits depending on their location, and the existence of milk processing companies and wholesalers in these locations. In some instances, farmer groups were able to collectively influence prices in their locations. The projects' achievements in milk value chains and milk marketing were also limited due to the complex nature of milk marketing systems and milk value chains in Pakistan. Project stakeholders noted milk markets do not function well and corruption was significant, making it challenging for this project to undertake significant work on improving markets. Project reviews have recommended that future projects include more detailed dairy and beef value chain analysis and strategies.

Inclusive and effective stakeholder engagement approaches

Inclusive and effective stakeholder engagement significantly influenced adoption rates by farmers, extension workers and scientists, and strengthened the interface between scientific knowledge, extension programs and farmer experiences. The projects employed effective strategies for inclusive and effective stakeholder engagement, such as engaging farmer networks, working through farm advisers, and actively increasing the number of women extension workers. These strategies should be considered for similar projects in the future.

However, interviews and project documents also highlight the projects continuously faced and addressed challenges of working with different groups of stakeholders, particularly, smallholder farmers, and Punjab and Sindh livestock departments. For example, finalising a less intensive extension program and model farm system that could be scaled out was not fully achieved, largely due to the lack of continuity in the process, caused by the high turnover of livestock department staff. Future projects should consider such risks and ensure stakeholder engagement and communication strategies are in place for consistent support in scale out of programs.



Strong focus on capacity building

Capacity building cut across the project outputs and significantly influenced adoption and impact among project stakeholders.

The *capacity-building* activities ensured not only strong project results, but will likely contribute to an improved dairy sector in the future.

Scientific research was a key component of capacity building. The external review in 2015 identified some research topics were less relevant and some new knowledge had not been disseminated and/or adopted. During consultations, project stakeholders also noted that not all scientific knowledge was relevant to all farmers, so some knowledge generated was likely to have lower dissemination and adoption.

For future projects, ACIAR will need to consider a planned approach to balancing research that is relevant to many farmers versus more specialised knowledge that is useful to smaller groups.

Numerous stakeholders also highlighted the issue of growing numbers of Pakistani students on scholarships opting not to return to Pakistan after their studies due to better work opportunities outside of Pakistan. ACIAR will need to discuss with the Government of Pakistan how they could support future students to return to Pakistan after completing their studies overseas to minimise further skills drain. See Table 8 for a summary of factors influencing adoption and impact.

Table 8 Factors influencing adoption and impact

	Factor	Key findings
Knowledge	Do potential users know about the outputs?	Not identified as a constraint for these projects.
	Is there continuity of staff in organisations associated with adoption?	Staff turnover within the livestock departments in Sindh and Punjab provinces was a major factor in delaying the finalisation of a less intensive extension approach that could be scaled out through Pakistan. The projects acknowledged this very early and continued to explore multiple avenues to maintain connections with the livestock departments.
	Are outputs complex in comparison with the capability of users?	The external review in 2015 identified some research topics were less relevant and some new knowledge generated by the projects had not been disseminated and/or adopted. However, project stakeholders confirmed during consultation that not all scientific knowledge was relevant to all farmers, so some of the knowledge generated was likely to have lower dissemination and adoption.
Incentives	Are there sufficient incentives to adopt the outputs?	Not identified as a constraint for these projects.
	Does adoption increase risk or uncertainty?	At the farmers' level, adoption required some level of input and investment, such as land, water, equipment, animals, seeds, time and money. Adoption rates for extension messages that required inexpensive inputs were higher than those that required more expensive inputs. The projects worked with farmers to understand levels of input and investment required through farmer group meetings and trainings, extension materials and demonstration farms.
	Is adoption compulsory or effectively prohibited?	Not identified as a constraint for these projects.
Barriers	Do potential users face capital or infrastructure constraints?	Farmers' access to resources influenced levels of adoption and impact. Adoption of new extension knowledge and practices required various levels of input from farmers. Adoption rates of extension messages requiring more financial inputs were lower among farmers with capital constraints.
	Are there cultural or social barriers to adoption?	The cultural and social status of Pakistani women in general was a barrier to adoption. ASLP addressed this through the inclusion of women extension workers and extension worker training; implemented the 'whole family approach' to extension services; and delivered outputs specifically targeting women's farmer groups.

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

The projects started during a period when addressing gender equity and social inclusion was not an explicit priority of Australia's overseas aid programs. The dairy projects did not have a planned strategy to address gender equity and social inclusion, but as the projects evolved, elements of gender equity and social inclusion were integrated into project activities with some positive results observed.

A key development for ASLP was the addition of the social science project in Phase 2. This project did significant work on gender and social inclusion issues.

Gender equity

Women farmers were initially not included in extension programs even though they provided significant labour inputs into their family farms. Project extension services in Phase 1 predominately targeted male farmers as they were traditionally considered heads of households and key decision-makers on their farms. A review of the extension program in Phase 1 highlighted the significant lack of involvement of women in project activities, which led to the piloting of the 'whole family approach' to extension. The approach ensured the whole smallholder farm household (women, children and men) were targeted through extension services. This involved increasing the diversity of the trained extension worker cohort from men only to include female extension workers. Extension workers worked simultaneously with male and female farmer groups throughout Phase 2 to ensure female and male farmer groups received the same extension messages and services. Women farmers also had opportunities to increase their economic activities and diversify their income sources through milk value-adding training and activities. One interviewee noted that women generally had control over their income from milk product sales; however, men continue to play a dominant role in major decision-making within families.

The 'whole family approach' to extension doubled adoption rates of extension messages, when compared to working with male farmers only. Project data and interviews suggest males and females have benefited in various ways. Male and female extension workers have adopted principles of inclusion to deliver more inclusive extension services. Female farmers have increased agency, contributed to decision-making in their farms, and adopted options to increase profit margins by manufacturing and selling products like cheese, ghee and cream. Male farmers have also shown more inclusive attitudes towards sharing decision-making and benefits with women and young people in their communities.

Overall, the project was able to contribute to strong results for women farmers due to its ability to adapt and learn during implementation. Future ACIAR projects with extension programs targeting smallholder farmers should consider the achievements of the dairy projects in addressing gender equity and the 'whole family approach' to extension, as a potential model to adapt or replicate.



Social inclusion

The projects primarily worked with registered smallholder farmers in target communities. The registered farmers were direct beneficiaries of the projects' monthly extension services and activities. Project documents and interviews suggest registered farmers and their families were educated and market-oriented, had social connections and better access to resources compared to unregistered farmers. A second group of farmers, the unregistered farmers, indirectly benefited from the projects. Unregistered farmers lived in the same communities as the registered farmers and indirectly benefited by adopting new knowledge and practices through observations and interactions with registered farmers. While adoption rates for both registered and unregistered farmers were high overall, the rates and results for registered farmers were always higher than for unregistered farmers, with margins of between 5% to 25% for different extension messages.

Apart from working with registered and unregistered farmer groups, project documents did not highlight working with any marginalised groups or people with disability. One interviewee highlighted some farmers chose not to be involved or could not participate because of internal community conflicts – often caused by religious differences.

As part of the 'whole family approach' to extension, children (including teenagers) were encouraged to participate in the extension program, particularly the calf rearing program. Interviews with project teams indicated this was a strategy to influence future generations to remain interested in dairy farming as a career choice as there was anecdotal evidence that young people were becoming less interested in dairy farming. Children were engaged through school-based and community-based activities and were instrumental in influencing families to adopt profitable calf rearing strategies.

While the projects have, to an extent, addressed gender equity and social inclusion, it is unclear how the projects addressed or were effective in addressing:

- The added burden of the projects on women, for example, was their increasing role and participation in certain areas of dairy farming offset by a reduced workload in other areas?³²
- Lessening the gap between more resourced registered farmers and less resourced unregistered and traditional farmers. Did this gap widen because of the projects?
- Potential child safeguarding issues arising from project activities – these include child labour issues and children's exposure to diseases and toxins from poor handling of milk and milk products.³³

Future projects should consider conducting gender equity and social inclusion analysis to inform project design; these issues should then be monitored throughout delivery (ACIAR 2017).

32 For example, see <http://www.fao.org/3/a-i6786e.pdf>

33 For example, see <http://www.fao.org/3/i3098e/i3098e.pdf>

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

Initially, ACIAR and the Government of Pakistan arranged for the Phase 1 project to be based in Lahore within the Punjab Government's Dairy Development Department. While the optics of this arrangement were good, interviews identified 2 key issues outside of the project team's control that affected management and implementation. The first issue was that accessing project funds took a long time. Funds were tied up federally and long bureaucratic government processes delayed disbursements, resulting in delayed activity implementation.

The second issue was staff turnover and bureaucratic processes within the department. The projects needed to work with extension workers to access farmers, but approvals for relevant officers to be engaged took time and effort, resulting in initial implementation delays. Following discussions with ACIAR, approval was granted for the University of Veterinary and Animal Sciences to host the projects instead.

The decision to collaborate with the University of Veterinary and Animal Sciences, Lahore, and use its financial systems rather than the partner government's systems, avoided further delays in financial flows and activity implementation. The project team, however, consistently worked with key government departments and collaborated with multiple Australian and Pakistani institutions to deliver the projects. Each brought their unique strengths:

- collaboration with Pakistani universities gave the projects access to veterinary students to work as interns on the projects
- collaboration with dairy departments facilitated access to dairy farmers
- collaboration with Nestlé provided employment pathways for students and adoption of project extension materials.

The projects also explored working with NGOs and other funding bodies active in the same sector, but there were challenges in advancing these relationships due to different organisational priorities.

The projects also recognised the value of blending Australian and Pakistani management expertise. An Australian team member was based in Pakistan during Phase 1, which allowed close collaboration with Pakistani counterparts and cultivated relationships between teams in Australia and Pakistan. Having a Pakistani team leader and dedicated project team engaged in both projects enabled high quality project delivery – national team members understood the local context and could think and work politically with stakeholders.

However, the external project review and key informant interviews questioned the sustainability of adoption of approaches by central and local government officials. The projects worked closely with the government's livestock department to ensure transfer of skills to staff, but the department continuously faced high turnover of staff, limiting opportunities to develop and retain skilled researchers and extension workers, post-project. This issue also contributed to the delay in finalising a less intensive extension approach – an expected outcome of the projects.

Project review documents and key informant interviews also highlighted the lack of:

- clear strategies to communicate project outputs for take-up by key actors in dairy development
- a practical 'output to outcome to impact' strategy
- a robust monitoring, evaluation and learning system.

These limited opportunities for the projects' ongoing learning, risk management and adaptation to changing contexts. Future projects should consider the development of these strategies and an appropriate monitoring, evaluation and learning system to track progress and learning.



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

The ASLP goals, while slightly different between Phases 1 and 2, focused on 3 key areas:

- enhancing the capacity of research and extension systems
- supporting poverty alleviation for smallholder farmers
- supporting value chains.

The dairy projects gained ministerial approval from the Government of Pakistan and were well-aligned with, and contributed to, the overall goals of ASLP.

Capacity of research and extension systems

There was good alignment between the dairy projects and the ASLP goal of enhancing the capacity of research and extension systems. The projects have built the capacity of Pakistani researchers and students (as future scientists) to actively lead dairy research and generate numerous scientific knowledge outputs and publications. Research has informed dairy extension approaches that have benefited dairy farmers.

Poverty alleviation for smallholder farmers

There was good alignment between the dairy projects and the ASLP goal of supporting poverty alleviation for smallholder farmers. The projects have built the capacity of smallholder dairy farmers to increase their milk production, sales and profits. Farmers' adoption of extension program knowledge and practices has resulted in recorded increases in sales and profits from increased milk yields, healthier calves, and milk value-added products such as ghee, cream, ice-cream, and yoghurt.

Supporting value chains

There was good alignment between the dairy projects and the ASLP goal of supporting value chains. However, achievements have been limited to a few groups of farmers due to the complex nature of milk marketing systems and milk value chains in Pakistan. Project stakeholders noted milk markets in Pakistan do not function well and corruption was significant, making it challenging for this project to undertake significant work on improving markets. Milk value chain analysis was conducted as part of a PhD research. The projects further engaged a consultant to assess marketing options for dairy farmers; however, this could not be completed due to conflicting schedules. The projects also worked with farmers to develop some successful examples of supply chain interventions, but this remains limited to the farmer level. Project reviews have recommended that future projects include more detailed dairy and beef value chain analysis and strategies.

Programmatic level value-add

This review also examined the extent to which ASLP's 'programmatic' approach added value for the dairy projects. In ASLP's second phase, a social science research project was added to the program and was run by a team from the University of Canberra. It aimed to:

- increase the engagement of rural poor who might benefit from the commodity-based projects (citrus, dairy and mango)
- increase collaboration between project teams
- foster effective collaborative development in rural Pakistan.

The social science research project worked with 2 dairy project communities and took a participatory action research approach to its delivery. The project ended in 2015, at around the same time the Phase 2 dairy project was ending. This meant that project impact was limited to the 2 participating dairy project communities. However, the research work provides valuable learning that future dairy projects could draw on. These include:

- Adequate resources must be allocated to address gender equity and social inclusion, particularly the meaningful involvement of women and young people.
- Influencing behavioural change takes time and should always consider social dimensions to be sustainable – this affects adoption of knowledge, practices and technology, and sustainability of project benefits.
- Utilising technology such as mobile phones could assist farmers to better manage their farms and improve project reach of up-to-date information and extension messages.

The dairy projects had the potential to achieve more by coordinating efforts across mango, citrus and social science research projects to influence national dairy and agriculture sector policies and extension services, and support competitive market conditions. Project review documents and interviews suggest better coordination and synergies at the ASLP program level could have increased the projects' ability to influence policymakers. Interviews and ASLP reports also highlighted challenges with activity coordination and unclear ways of working between the dairy, mango, citrus and social research project teams. Added to this, each team faced vast geographical dispersion of target beneficiaries. It appears each project team was committed to delivering their own project outputs and had different priorities at different times, so coordinating inter-project activities and learning was challenging. This is an important learning that could be considered for future ACIAR programs.

The challenges highlight an important lesson for ACIAR that was also identified under the citrus projects' evaluation: specific strategies should be considered to ensure projects benefit from being part of a broader program. Such strategies could include:

- Ensuring sufficient time and resources are allocated to cross-project collaboration, both in Australia and in the project country.
- Developing program structures that incentivise or even enforce cross-project collaboration. This could include, for example, having a 'lead' contractor who could be responsible for and has authority to bring about cross-project collaboration.
- Ensuring project team selection processes consider staff traits such as openness to collaboration, good communication, and willingness to work in interdisciplinary teams.



Conclusions and lessons learned

The ASLP dairy projects have achieved strong results in most key areas. Smallholder dairy farmers have increased sales and have generated profits from adopting knowledge, practices and technology to increase milk yields and fodder production, raise healthier calves, and produce milk value-added products. Women farmers have also increased agency because of their involvement in project activities. Dairy extension workers, scientists and university students have led dairy research and strengthened the interface between scientific knowledge, extension services and farmers' practices. The projects' 'less intensive dairy extension approach' continues to be developed. There is evidence that the 'whole family approach' to extension had effectively doubled adoption rates; however, more effort was needed to get all stakeholders to finalise the approach to scale out.

The sustainability of projects' results depends on:

- equitable dairy supply chains and favourable market conditions that are supported by effective government policies and appropriate resources
- dairy research and extension services continuing to be relevant to farmers' needs and the needs of the dairy sector as a whole
- smallholder farming community willingness to ensure inclusiveness and that project benefits are shared.

The projects were aligned to the ASLP goals of enhancing the capacity of research and extension systems, supporting poverty alleviation for smallholder farmers, and supporting value chains. They also demonstrate the value of blending Australian and Pakistani expertise, and the benefits of identifying and using local partner systems that support efficient financial flows and activity implementation.

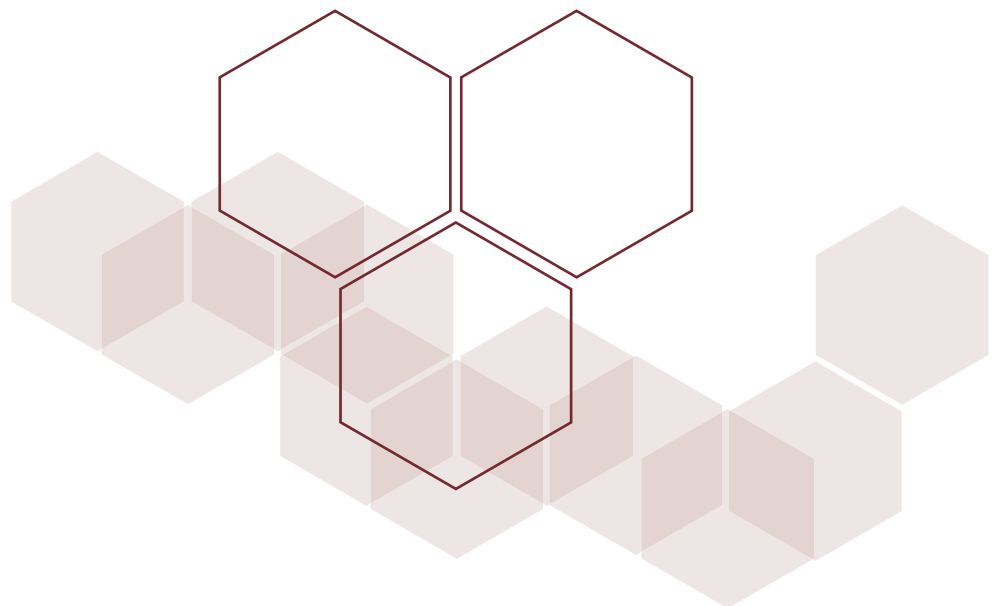
Lessons learned

This evaluation highlights some general lessons for ACIAR projects and programs:

- 1. Cross-cutting issues need to be considered in project designs and appropriate strategies developed and resourced to address them.** Important cross-cutting issues include gender equality and social inclusion, child protection, environment protection and 'do no harm' principles. Addressing these would remove barriers to participation, reduce potential harmful impacts on project beneficiaries, and enhance results and sustainability.
- 2. Effective relationship management and stakeholder engagement is essential for timely project and program delivery and ownership of results.** Mapping internal and external stakeholders and managing relationships with power-holders and powerbrokers is an ongoing process. A planned approach to managing relationships helps harness collective strengths and makes best use of resources. For large initiatives like the dairy projects, effective stakeholder engagement has significant influence on adoption rates and impact.
- 3. Market and value chain analysis and development, and business development plans, are essential for future project components that aim to generate profits.** These are foundational activities that should be managed very early during project implementation to guide downstream activities to maximise adoption and results of projects. For example, the scale out of the VBSE program could have benefited from a clear business plan. Milk market and value chain development could have benefited from clearer strategies at the beginning of the projects to ensure greater impact.

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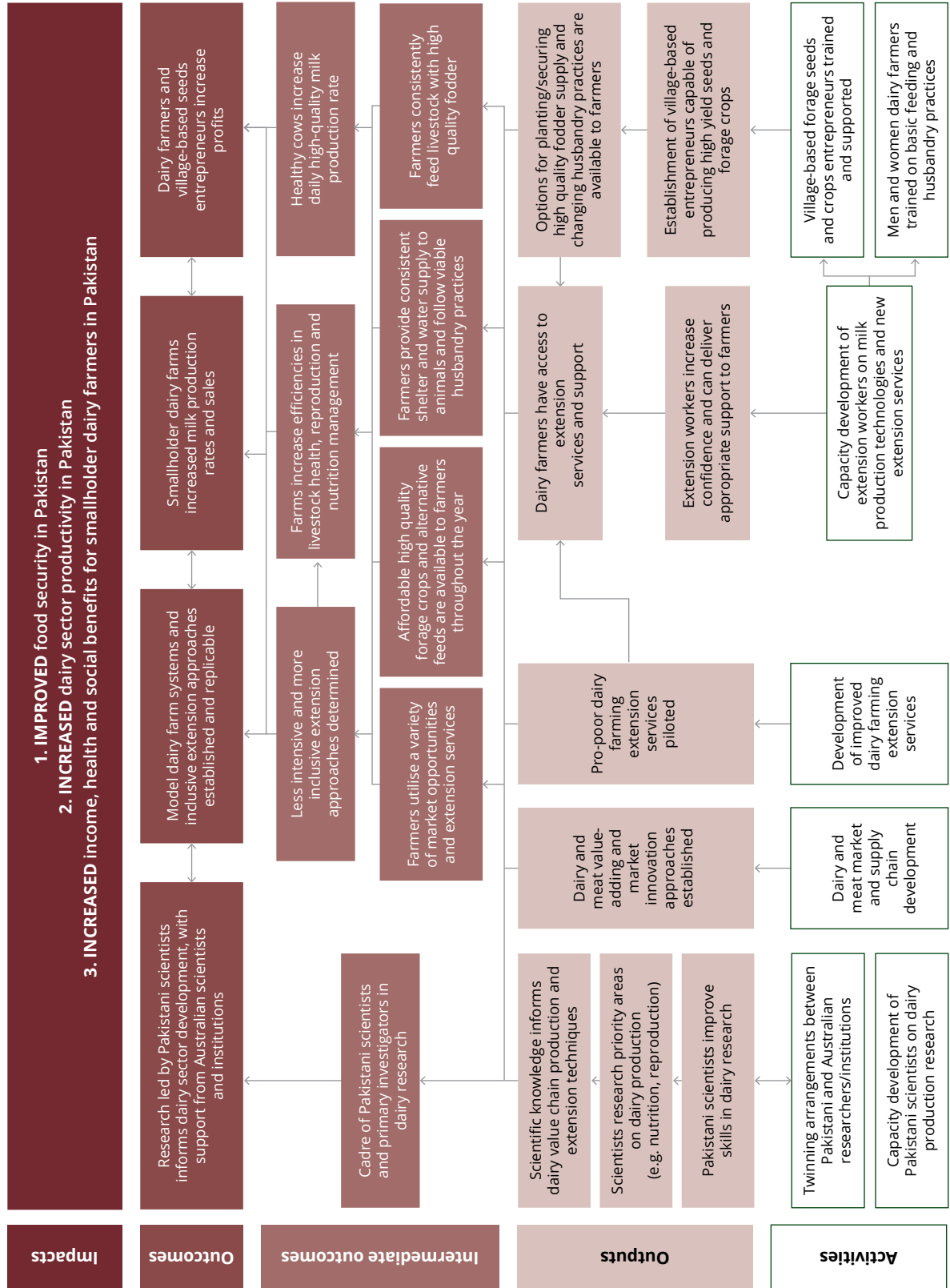
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Appendixes

Appendix 3.1: Theory of change



Appendix 3.2: Stakeholders consulted

Name	Title	Organisation or location
Dr Peter Wynn	Project Leader, ASLP Project	Charles Sturt University, Australia
Dr David McGill	Project Leader, Dairy-Beef Project	University of Melbourne, Australia
Dr Hassan Warriach	Project Manager	ASLP Dairy Project, Pakistan
Dr Muhammad Afzal	Project Leader, ASLP Project	Livestock and Dairy Development Board, Pakistan
Dr Aleem Bhatti	Expert	University of Veterinary and Animal Sciences, Lahore, Pakistan
Ms Sobia Majeed	Area Advisor, Sindh	ASLP Dairy Project, Pakistan
Dr Rukhsana Vighio	Veterinary Officer	Sindh Livestock Department, Pakistan
Dr Kazmi Munawar	Country Manager, Pakistan	ACIAR
Mr Gerard McEvilly	Aik Saath Program Coordinator	ACIAR



Appendix 3.3: Project evaluation framework

The data and process used for addressing each of the key evaluation questions (KEQs) is summarised in the table. Bold questions are high priority and were explored in more depth.

Key Evaluation Question	Evidence/information required	Data sources	Data collection and analysis approach
1. What was the project's theory of change; and how did this evolve during implementation? <ul style="list-style-type: none"> – Was the theory of change appropriate to the project context and desired results? 	<ul style="list-style-type: none"> • Documented theory of change at project commencement • Information on subsequent changes • Information on project context • Perspectives of key stakeholders regarding appropriateness of the theory of change 	<ul style="list-style-type: none"> • Project concept / design documents and variations • Project progress reports, annual plans, etc. • Key stakeholders (project managers and collaborating partners, program manager/ coordinator, government authorities, producers, businesses) 	<ul style="list-style-type: none"> • Desk review of available documents • Interviews with key stakeholders • Triangulation of findings from different sources • Project verification workshops
2. What outcomes (intended and unintended) has the project achieved or contributed to? <ul style="list-style-type: none"> – What was the unique knowledge contribution of the project/cluster that was/is expected to influence practice/policy? – To what extent is there evidence of adoption of new practices based on research process and findings? 	<ul style="list-style-type: none"> • Robust, documented evidence of progress towards planned outputs and outcomes (including progress along adoption pathways), and any unintended consequences • Theory of change assessment from KEQ1 • Perspectives of key stakeholders, to test/validate written reporting, including 'next users' of research outputs 	<ul style="list-style-type: none"> • Annual and/or final reports • Mid-term and/or final reviews • Key stakeholders (as above) 	<ul style="list-style-type: none"> • Desk review of available documents • Interviews with key stakeholders • Triangulation of findings from different sources • Project verification workshops • ACIAR progress assessment and analysis tools (e.g. Table 5 and Table 6)
3. How did project activities and outputs contribute to the outcomes achieved? <ul style="list-style-type: none"> – To what extent and how did they differ from what was planned? 	<ul style="list-style-type: none"> • Theory of change assessment from KEQ1 • Documented evidence of impact pathways, as per KEQ2 • Perspectives of key stakeholders including 'next users' of research outputs 	<ul style="list-style-type: none"> • Annual and/or final reports • Mid-term and/or final reviews • Key stakeholders (as above) 	<ul style="list-style-type: none"> • Documentation review, stakeholder interviews, triangulation, verification workshops • Analysis of adoption and impact pathways, including 'next users' (e.g. Table 5 and Table 6)

Appendix 3.3: Project evaluation framework (cont.)

Key Evaluation Question	Evidence/information required	Data sources	Data collection and analysis approach
<p>4. What strategies were adopted to address gender equity and social inclusion and how effective were these?</p> <ul style="list-style-type: none"> – How did the project impact men and women differently? 	<ul style="list-style-type: none"> • Evidence of analysis/awareness of the potential gender equity issues that may impact on the project • Evidence of steps taken to address the issues identified • Evidence of level of participation of women and men in research activities • Evidence of changes in women's and men's control of assets, resources and decision-making, and gender equity (e.g. through impacts on female researchers; gendered knowledge generation; influence on inclusivity within partner organisations) • Perspectives of key stakeholders 	<ul style="list-style-type: none"> • Documented gender strategy or analysis (if available) • Existing reports providing gender-disaggregated data and/or discussion of gender issues, e.g. annual and/or final reports, mid-term and/or final reviews • Any existing gender audits or inclusion-focused reviews • Key stakeholders (as above) 	<ul style="list-style-type: none"> • Documentation review, stakeholder interviews, triangulation, verification workshops • Gender analysis to explore the level and type of participation of men and women, and influence on positive or harmful gender norms
<p>5. How did management arrangements impact delivery of the project?</p> <ul style="list-style-type: none"> – What other factors influenced project performance? 	<ul style="list-style-type: none"> • Any existing reporting and commentary on management arrangements • Perspectives of key stakeholders • Evidence of contextual factors external to the project that may have impacted performance 	<ul style="list-style-type: none"> • Annual and/or final reports • Mid-term and/or final reviews • Key stakeholders (as above) 	<ul style="list-style-type: none"> • Documentation review, stakeholder interviews, triangulation, verification workshops • ACIAR progress assessment tools
<p>6. How well did the project align with and contribute to the overall goals of its umbrella program?</p> <ul style="list-style-type: none"> – To what extent has the programmatic approach added value at project level? 	<ul style="list-style-type: none"> • Assessment of KEQs 1–5 • Information on program goal and approach • Relevant existing reporting and commentary • Perspectives of key stakeholders 	<ul style="list-style-type: none"> • Annual and/or final reports • Mid-term and/or final reviews • Key stakeholders (as above) 	<ul style="list-style-type: none"> • Assessment of consistency and value-add, based on analysis for KEQs 1–5 and supplementary program-level documentation, stakeholder interviews and verification workshops



Appendix 3.4: ASLP goals

ASLP ran for 2 phases between 2005 and 2015.

The goals of ASLP's first phase (2005–2010) were:

1. To transfer Australian knowledge and expertise to key sectors of Pakistan agribusiness to increase profitability and enhance export potential.
2. To contribute to poverty alleviation of smallholder farmers through collaborative research and development.
3. To enhance the capacity of the Pakistan research, development and extension system to deliver targeted and practical research outputs to agribusiness and farmers.

The goals for the second phase were adapted, but retained a core focus on building value chains to support smallholder farms and building technical capacity in Pakistan. The Phase 2 goals were:

1. Pro-poor value chains: To support 'keystone' interventions to sustainably enhance selected value chains and increase understanding and delivery of benefits to the rural poor through productivity improvements and market and employment opportunities.
2. Agricultural capability: To enhance agriculture capability and sustainably improve agricultural value chains by providing short-term 'smart linkages', scoping studies and other initiatives, as well as longer-term formal training, that are demand-driven and catalytic, and complement the initiatives supported under other components of the program.
3. Enabling policy: To support policy analysis and interventions which improve or enable better economic and natural resource management, particularly where they underpin or strengthen pro-poor value chains and more sustainable farming systems.

Appendix 3.5: Project team members

#	Team member	Gender	International/National researcher
1	Prof Peter Wynn	M	International
2	Dr Russell Bush	M	International
3	Dr David McGill	M	International
4	Dr Muhammad Afzal	M	National
5	Mr Babar Yaqoob	M	National
6	Dr Rifaqat Hussain Raja	M	National
7	Dr Zia Ahmad	M	National
8	Dr Sosheel Solomon	M	International
9	Dr Karl Behrendt	M	International
10	Dr Hassan Warriach	M	National
11	Dr Muhammad Ishaq	M	National
12	Ms Zahra Batool	F	National
13	Prof Talat Pasha	M	National
14	Dr Muhammad Aleem	M	National
15	Dr Imtiaz Nagra	M	National
16	Dr Ghulam Sarwar Shaijh	M	National
17	Mr Hafeez Ullah	M	National



Appendix 3.6: Research outputs

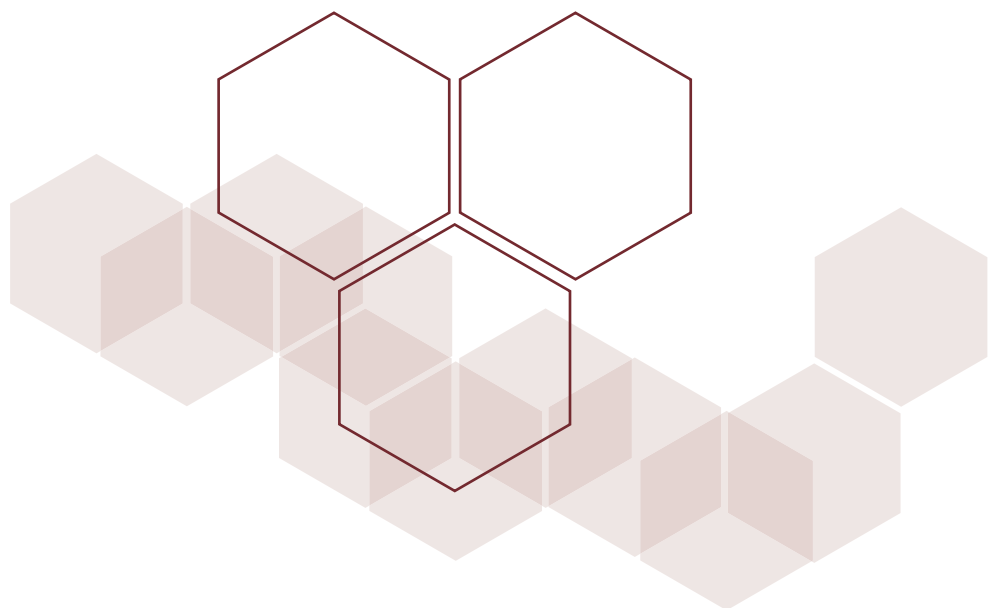
Peer-reviewed journal articles	
Publication	Author (gender, nation)
Aslam N, Iqbal ZM, Warriach HM and Wynn PC (2014) 'Pattern of partitioning of aflatoxins from feed to urine and its effect on serum chemistry in Nili-Ravi buffalo heifers', <i>Animal Production Science</i> , 54(10):1671–1675.	Aslam (Male, Pakistan) Iqbal (Male, Pakistan) Warriach (Male, Pakistan) Wynn (Male, Australia)
Aslam N, Rodrigues I, McGill DM, Warriach HM, Cowling A, Haque A and Wynn PC (2016) 'Transfer of aflatoxins from naturally contaminated feed to milk of Nili-Ravi buffaloes fed a mycotoxin binder', <i>Animal Production Science</i> , 56(10):1637–1642.	Aslam (Male, Pakistan) Rodrigues (Female, Portugal) McGill (Male, Australia) Warriach (Male, Pakistan) Cowling (Female, Australia) Haque (Male, Pakistan) Wynn (Male, Australia)
Aslam N, Tipu MY, Ishaq M, Cowling A, McGill D, Warriach HM and Wynn P (2016) 'Higher levels of aflatoxin M1 contamination and poorer composition of milk supplied by informal milk marketing chains in Pakistan', <i>Toxins</i> , 8(12):347.	Aslam (Male, Pakistan) Tipu (Male, Pakistan) Ishaq (Male, Pakistan) Cowling (Female, Australia) McGill (Male, Australia) Warriach (Male, Pakistan) Wynn (Male, Australia)
Aslam N and Wynn PC (2015) 'Aflatoxin contamination of the milk supply: A Pakistan perspective', <i>Agriculture</i> , 5(4):1172–1182.	Aslam (Male, Pakistan) Wynn (Male, Australia)
Batool Z, Warriach HM, Ishaq M, Latif S, Rashid MA, Bhatti A, Murtaza N, Arif S and Wynn PC (2014) 'Participation of women in dairy farm practices under smallholder production system in Punjab, Pakistan', <i>The Journal of Animal and Plant Sciences</i> , 24(4):1263–1265.	Batool (Female, Pakistan) Warriach (Male, Pakistan) Ishaq (Male, Pakistan) Latif (Male, Pakistan) Rashid (Male, Pakistan) Bhatti (Male, Pakistan) Murtaza (Female, Pakistan) Arif (Female, Pakistan) Wynn (Male, Australia)
Bhatti SA, Ali A, Nawaz H, McGill D, Sarwar M, Afzal M, Khan MS, Amer MA, Bush R, Wynn PC and Warriach HM (2012) 'Effect of pre-weaning feeding regimens on post-weaning growth performance of Sahiwal calves', <i>animal</i> , 6(8):1231–1236.	Bhatti (Male, Pakistan) Ali (Male, Pakistan) Nawaz (Female, Pakistan) McGill (Male, Australia) Sarwar (Male, Pakistan) Afzal (Male, Pakistan) Khan (Male, Pakistan) Amer (Male, Pakistan) Bush (Male, Australia) Wynn (Male, Australia) Warriach (Male, Pakistan)

Appendix 3.6: Research outputs (cont.)

Peer-reviewed journal articles	
Publication	Author (gender, nation)
Bhatti SA, Ahmed MF, Wynn PC, McGill D, Sarwar M, Afzal M, Ullah E, Khan MA, Khan MS, Bush R and Warriach HM and Kahn A (2012) 'Effect of diet on preweaning performance of Sahiwal calves' <i>Tropical Animal Health and Production</i> , 44(4):819–826.	Bhatti (Male, Pakistan) Ahmed (Male, Pakistan) Wynn (Male, Australia) McGill (Male, Australia) Sarwar (Male, Pakistan) Afzal (Male, Pakistan) Ullah (Male, Pakistan) Khan (Male, Pakistan) Bush (Male, Australia) Warriach (Male, Pakistan) Khan (Male, Pakistan)
McGill DM, Mulder HA, Thomson PC and Lievaart JJ (2014) 'Selecting an appropriate genetic evaluation model for selection in a developing dairy sector', <i>animal</i> , 8(10):1577–1585.	McGill (Male, Australia) Mulder (Male, the Netherlands) Thomson (Male, Australia) Lievaart (Male, the Netherlands)
McGill DM, Thomson PC, Mulder HA and Lievaart J (2014) 'Optimal and efficient test-day recording regimes for estimating lactation yield in Sahiwal cattle', <i>Genetics Selection Evolution</i> .	McGill (Male, Australia) Mulder (Male, the Netherlands) Thomson (Male, Australia) Lievaart (Male, the Netherlands)
Warriach HM, McGill DM, Bush RD and Wynn PC (2012) 'Production and reproduction performance of Nili-Ravi buffaloes under field conditions of Pakistan', <i>The Journal of Animal and Plant Sciences</i> , 22(3 Suppl):121–124.	Warriach (Male, Pakistan) McGill (Male, Australia) Bush (Male, Australia) Wynn (Male, Australia)
Warriach HM, McGill DM, Bush RD, Wynn PC and Chohan KR (2015) 'A review of recent developments in buffalo reproduction—a review', <i>Asian-Australasian journal of animal sciences</i> , 28(3):451.	Warriach (Male, Pakistan) McGill (Male, Australia) Bush (Male, Australia) Wynn (Male, Australia) Chohan (Male, Pakistan)
Wynn PC, Warriach HM, Morgan A, McGill DM, Hanif S, Sarwar M, Iqbal A, Sheehy PA and Bush RD (2009) 'Perinatal nutrition of the calf and its consequences for lifelong productivity', <i>Asian-Australasian Journal of Animal Sciences</i> , 22(5):756–764.	Wynn (Male, Australia) Warriach (Male, Pakistan) Morgan (Female, Australia) McGill (Male, Australia) Hanif (Female, Pakistan) Sarwar (Male, Pakistan) Iqbal (Male, Pakistan) Sheehy (Male, Australia) Bush (Male, Australia)



Publications in progress	
Publication	Author (gender, nation)
Batool Z, Warriach HM, McGill D, Thomson PC and Wynn PC (2017) 'Impact of improved extension services on technical knowledge of female farmers and factors affecting their participation in the program'. <i>Resubmitted</i>	Batool (Female, Pakistan) Warriach (Male, Pakistan) McGill (Male, Australia) Thomson (Male, Australia) Wynn (Male, Australia)
McGill DM, Ishaq M, Iqbal J, Thomson PC, Mulder HA and Lievaart, J (n.d.) 'Defining the breeding objective for Sahiwal cattle in Pakistan'. <i>Resubmitted</i>	McGill (Male, Australia) Ishaq (Male, Pakistan) Iqbal (Male, Pakistan) Thomson (Male, Australia) Mulder (Male, the Netherlands) Lievaart (Male, the Netherlands)
Tufail S, Krebs G, Southwell A and Wynn P (2017) 'Village based forage seed enterprises: A sustainable intervention for rural development in the mixed farming systems of Pakistan'.	Tufail (Male, Pakistan) Krebs (Female, Australia) Southwell (Female, Australia) Wynn (Male, Australia)



Appendix 3.6: Research outputs (cont.)

Conference proceedings	
Publication	Author (gender, nation)
Aslam N, Rodrigues I, McGill D, Warriach H, Cowling A, Haque A and Wynn P (8–12 September 2014) 'Transfer of aflatoxins from highly contaminated feed to milk and effect of mycotoxins binder on transfer rate in Nili-Ravi buffaloes', <i>Joint ISNH/ISRP International conference 2014: Harnessing the ecology and physiology of herbivores</i> , Canberra, Australia.	Aslam (Male, Pakistan) Rodrigues (Female, Portugal) McGill (Male, Australia) Warriach (Male, Pakistan) Cowling (Female, Australia) Haque (Male, Pakistan) Wynn (Male, Australia)
Aslam N, Warriach H, McGill D and Wynn P (2–3 December 2013) 'Aflatoxin M1 in milk and milk products in Pakistan: A short review', <i>2nd International Food Safety Conference, Food safety: Critical dimension of feed security in emerging economics</i> , Kuala Lumpur, Malaysia.	Aslam (Male, Pakistan) Warriach (Pakistan) McGill (Male, Australia) Wynn (Male, Australia)
Batool Z, Warriach H, Ishaq M, Latif S, Afzal M, Bhatti A, Murtaza N, Arif S and Wynn P (26–30 November 2012) 'Participation of women in dairy farm practices under small holder production system in Pakistan', <i>15th AAAP Animal Science Congress on Improving Smallholder and Industrial Livestock Production for Enhancing Food Security, Environment and Human Welfare</i> , Thammasat University (Rangsit Campus), Bangkok/Pathum Thani, Thailand.	Batool (Female, Pakistan) Warriach (Male, Pakistan) Ishaq (Male, Pakistan) Latif (Male, Pakistan) Afzal (Male, Pakistan) Bhatti (Male, Pakistan) Murtaza (Male, Pakistan) Arif (Female, Pakistan) Wynn (Male, Australia)
Bush R, Sothoeun S, Khounsy S, Young J, Nampanya S, Warriach H, McGill D, Wynn P and Windsor P (28–31 July 2014) 'Engaging smallholder large ruminant producers to improve food security: lessons from Cambodia, Lao PDR and Pakistan', <i>28th World Buiatrics Congress</i> , Cairns, Australia.	Bush (Male, Australia) Sothoeun (Male, Laos) Khounsy (Male, Cambodia) Young (Male, Australia) Nampanya (Male, Laos) Warriach (Male, Pakistan) McGill (Male, Australia) Wynn (Male, Australia) Windsor (Male, Australia)
Bush R, Warriach H, McGill D and Wynn P (26–30 November 2012) 'Developing a feed calendar for Pakistan's small-holder dairy farmers', <i>The 15th Asian-Australian Association of Animal Production Animal Science Congress</i> , Bangkok.	Bush (Male, Australia) Warriach (Male, Pakistan) McGill (Male, Australia) Wynn (Male, Australia)
Coombes C, Warriach H, McGill D, Latif S, Naqvi Z and Wynn P (26–30 November 2012) 'The Influence of Improved Colostrum Management and Milk Feeding Regimens on Serum Protein and Weight Gain in Sahiwal Calves in Pakistan', <i>15th AAAP Animal Science Congress</i> , Bangkok, Thailand.	Coombes (Female, Australia) Warriach (Male, Pakistan) McGill (Male, Australia) Latif (Male, Pakistan) Naqvi (Female, Pakistan) Wynn (Male, Australia)



Conference proceedings	
Publication	Author (gender, nation)
Godfrey S, Aslam N, Nordblom T, Warriach H, Ishaq M, Wynn P, Ramsay G and Behrendt K (26–30 November 2012) 'Marketing milk from small-holder dairy farmers in Pakistan', <i>15th AAAP Animal Science Congress on Improving Smallholder and Industrial Livestock Production for Enhancing Food Security, Environment and Human Welfare</i> , Thammasat University (Rangsit Campus), Bangkok, Thailand.	Godfrey (Male, Pakistan) Aslam (Male, Pakistan) Nordblom (Male, Australia) Warriach (Male, Pakistan) Ishaq (Male, Pakistan) Wynn (Male, Australia) Ramsay (Male, Australia) Behrendt (Male, Australia)
Godfrey S, Behrendt K, Nordblom T and Wynn P (7–10 February 2012) 'Dairy enterprise and whole farm performance in mixed farming systems in Punjab, Pakistan', <i>56th Annual Conference of the Australian Agricultural & Resource Economics Society</i> , Fremantle, Australia.	Godfrey (Male, Pakistan) Behrendt (Male, Australia) Nordblom (Male, Australia) Wynn (Male, Australia)
Godfrey S, Behrendt K, Ramsay G, Wynn P and Nordblom T (6–8 February 2013) 'Identifying producer, middlemen, retailer and consumer issues from a pro-poor value chain perspective: A dairy case study from Punjab of Pakistan', <i>57th Annual Conference of the Australian Agricultural & Resource Economics Society</i> , Sydney, Australia.	Godfrey (Male, Pakistan) Behrendt (Male, Australia) Ramsay (Male, Australia) Wynn (Male, Australia) Nordblom (Male, Australia)
Ishaq M, Warriach H, McGill D, Bush R, Arif S, Murtaza N and Wynn P (26–29 July 2011) 'Effect of body condition score on milk production and reproductive disorders in buffalo', <i>3rd International Conference on Sustainable Animal Agriculture for Developing Countries</i> , Nakhon Ratchasima, Thailand.	Ishaq (Male, Pakistan) Warriach (Male, Pakistan) McGill (Male, Australia) Bush (Male, Australia) Arif (Female, Pakistan) Murtaza (Male, Pakistan) Wynn (Male, Australia)
Khan M, Lievaart J, Wynn P, McGill D and Warriach H (26–30 November 2012) 'Comparison of Traditional Prostaglandin and CIDR Based Synchronization Protocols on Oestrous and Fertility in Buffaloes in Low Breeding Season in Pakistan', <i>15th AAAP Animal Science Congress</i> , Bangkok, Thailand.	Khan (Male, Pakistan) Lievaart (Male, the Netherlands) Wynn (Male, Australia) McGill (Male, Australia) Warriach (Male, Pakistan)
Khan S, Warriach M, McGill D, Bush R and Wynn P (11–15 July 2010) 'Effectiveness of the Provision of Extension Services for Small-holder Dairy Farmers in Two Regions of the Punjab in Pakistan', <i>28th Biennial Conference of ASAP</i> , University of New England, Armidale, Australia.	Khan (Male, Pakistan) Warriach (Male, Pakistan) McGill (Male, Australia) Bush (Male, Australia) Wynn (Male, Australia)
Latif S, Hand E, Warriach H, McGill D, Ishaq M, Batool Z, Arif S, Bhatti A and Wynn P (26–30 November 2012) 'Relationship of body condition score on ovarian cyclicity and pregnancy rate in Nili-Ravi buffaloes', <i>15th AAAP Animal Science Congress on Improving Smallholder and Industrial Livestock Production for Enhancing Food Security, Environment and Human Welfare</i> , Thammasat University (Rangsit Campus), Bangkok, Thailand.	Latif (Male, Pakistan) Hand (Female, Australia) Warriach (Male, Pakistan) McGill (Male, Australia) Ishaq (Male, Pakistan) Batool (Female, Pakistan) Arif (Female, Pakistan) Bhatti (Male, Pakistan) Wynn (Male, Australia)

Appendix 3.6: Research outputs (cont.)

Conference proceedings	
Publication	Author (gender, nation)
Majeed S, Latif S, Kumbher A, Warriach H and McGill D (16–19 October 2017) 'Cost effectiveness and effect of buffalo and cow milk feeding on growth performance of pre-weaned buffalo calves', <i>Sustainable Animal Agriculture in Developing Countries</i> , Batu, Indonesia.	Majeed (Female, Pakistan) Latif (Male, Pakistan) Kumbher (Male, Pakistan) Warriach (Male, Pakistan) McGill (Male, Australia)
Marsetyo, Tufail M, Mbuku S, Mutimura M, Guo X and Piltz J (15–19 September 2013) 'Utilisation of conserved forage to improve livestock production on smallholder farms in Asia and Africa', <i>22nd International Grassland Congress: Revitalising grasslands to sustain our communities</i> , Sydney, Australia.	Marsetyo (unknown) Tufail (Male, Pakistan) Mbuku (unknown) Mutimura (unknown) Gou (unknown) Piltz (Male, Australia)
McGill D, Thomson P, Mulder H and Lievaart J (20–23 October 2013) 'Modification of lactation yield estimates for improved selection outcomes in developing dairy sectors', <i>Association for the Advancement of Animal Breeding and Genetics</i> , Napier, New Zealand.	McGill (Male, Australia) Thomson (Male, Australia) Mulder (Male, the Netherlands) Lievaart (Male, the Netherlands)
McGill D, Warriach H, Bush R and Wynn P (26–29 July 2011) 'Improving the productivity of dairy cattle and buffalo on small-holder dairy farms in Pakistan', <i>3rd International Conference on Sustainable Animal Agriculture for Developing Countries</i> , Nakhon Ratchasima, Thailand.	McGill (Male, Australia) Warriach (Male, Pakistan) Bush (Male, Australia) Wynn (Male, Australia)
Shafiullah S and Wynn P (21–23 November 2011) 'The development of a simulation model to analyse the productivity and financial viability of dairy farms', <i>International Workshop on Dairy Science Park</i> , Agricultural University Peshawar, Pakistan.	Shafiullah (Male, Pakistan) Wynn (Male, Australian)
Warriach H, McGill D, Ishaq M, Latif S, Bhatti S, Batool Z, Arif S, Murtaza N, Bush R and Wynn P (26–30 November 2012) 'Effect of improved extension services on adoption rates and production of small holder dairy farmers in Pakistan', <i>15th Asian-Australian Association of Animal Production Animal Science Congress</i> , Bangkok.	Warriach (Male, Pakistan) McGill (Male, Australia) Ishaq (Male, Pakistan) Latif (Male, Pakistan) Bhatti (Male, Pakistan) Batool (Female, Pakistan) Arif (Female, Pakistan) Murtaza (Male, Pakistan) Bush (Male, Australia) Wynn (Male, Australia)
Wynn P, Warriach H, Arif S, Bush R and McGill D (25–30 July 2013) 'The evolution of a model for extension services for small-holder dairy farmers in Pakistan', <i>3rd SAADC conference</i> , Lanzhou, China.	Wynn (Male, Australia) Warriach (Male, Pakistan) Arif (Female, Pakistan) Bush (Male, Australia) McGill (Male, Australia)
Wynn P, Warriach H, McGill D, Ishaq M, Godfrey S and Bush R (1–4 October 2012) 'Development of extension programs for the small holder dairy farmers of Pakistan', <i>International Conference on Livestock Production and Veterinary Technology</i> , Bogor, Indonesia.	Wynn (Male, Australia) Warriach (Male, Pakistan) McGill (Male, Australia) Ishaq (Male, Pakistan) Godfrey (Male, Pakistan) Bush (Male, Australia)



University thesis	
Publication	Author (gender, nation)
Abbas W (2015) 'Effect of weaning period and milk feeding regimens on post weaning growth performance of Nili-Ravi Buffalo calves', [MSc thesis], University of Agriculture, Faisalabad.	Abbas (Male, Pakistan)
Ahsan A (2010) 'Effect of early pre-weaning treatment on post-weaning growth performance, in Sahiwal calves', [MSc thesis], Institute of Animal Nutrition and feed Technology, University of Agriculture, Faisalabad.	Ahsan (Male, Pakistan)
Arif S (2018) 'Epidemiology of brucellosis in smallholder farming system in Pakistan', [PhD thesis], School of Animal and Veterinary Sciences, Charles Sturt University, Wagga Wagga.	Arif (Male, Pakistan)
Aslam N (2015) 'Mycotoxins and their effect on milk quality and health related issues in the Pakistan dairy sector', [PhD thesis], School of Animal and Veterinary Sciences, Charles Sturt University, Wagga Wagga.	Aslam (Male, Pakistan)
Batool Z (2020) 'Meat quality characteristics in aged and young beef animals', [PhD thesis], University of Melbourne, Australia.	Batool (Female, Pakistan)
Cheema A (2014) 'Effect of pre-weaning feeding regimens on post-weaning growth performance of Sahiwal calves', [MSc thesis], University of Agriculture, Faisalabad.	Cheema (Male, Pakistan)
Farhan (2017) 'Growth and yield performance of berseem (<i>Trifolium alexandrium</i> L.) under the impact of levels of NPK and irrigation frequencies', [MSc thesis], Sindh Agriculture University, Tandojam.	Farhan (Male, Pakistan)
Godfrey S (2015) 'Milk value chain analysis: industry competitiveness and the dairy policy environment in Pakistan', [PhD thesis], School of Animal and Veterinary Sciences, Charles Sturt University, Wagga Wagga.	Godfrey (Male, Pakistan)
Irfan M (2015) 'Passive transfer of immunity and pre-weaning growth performance, structural development, health, and economic viability in buffalo calves fed fresh and heat treated buffalo colostrum or colostrum replacer', [Master thesis], University of Veterinary and Animal Sciences, Lahore.	Irfan (Male, Pakistan)
Kaka N (2011) 'Effect of buffalo milk vs cow milk on growth performance of Kundi buffalo calves', [MSc thesis], Sindh Agriculture University, Tandojam.	Kaka (Male, Pakistan)
Kashif M (2017) 'Effect of sowing time on fodder quality of rye grass', [MSc thesis], University of Agriculture Faisalabad.	Kashif (Male, Pakistan)
Kashmiri A (2012) 'Comparative study of barseem hay and green barseem on growth performance of post weaned Kundi buffalo calves', [MSc thesis], Sindh Agriculture University, Tandojam.	Kashmiri (Male, Pakistan)
Khan M (2013) 'Comparison between traditional progesterone and CIDR based synchronization protocols on oestrous and fertility in buffaloes in the low breeding season in Pakistan', [Master of Philosophy], School of Animal and Veterinary Sciences, Charles Sturt University, Wagga Wagga.	Khan (Male, Pakistan)
Latif S (2019) 'Mechanism of Photosensitization in <i>Biserrula Pelecenus</i> ', [PhD thesis], School of Animal and Veterinary Sciences, Charles Sturt University, Wagga Wagga.	Latif (Male, Pakistan)

Appendix 3.6: Research outputs (cont.)

University thesis	
Publication	Author (gender, nation)
McGill D (2014) 'Modifying genetic analysis to maximise the effective output from dairy progeny testing programs in Pakistan', [PhD thesis], School of Animal and Veterinary Sciences, Charles Sturt University, Wagga Wagga.	McGill (Male, Australia)
Menghwar D (2012) 'Comparative study of barseem Hay and green barseem on the various blood pictures in post weaned Kundi buffalo calves', [MSc thesis], Sindh Agriculture University, Tandojam.	Menghwar (Male, Pakistan)
Muhammad F (2010) 'Growth performance, health status and hematology of Sahiwal calves fed milk or milk replacer with or without calf starter', [MSc thesis], Institute of Animal Nutrition and feed Technology, University of Agriculture, Faisalabad.	Muhammad (Male, Pakistan)
Shafiullah S (2012) 'The development of an assessment tool to analyse the productivity and financial viability of dairy farms in Pakistan', [Master thesis], Charles Sturt University Wagga Wagga.	Shafiullah (Male, Pakistan)
Shan M (2017) 'Yield performance of Alfalfa under different plant population densities', [MSc thesis], University of Agriculture, Faisalabad.	Shan (Male, Pakistan)
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Part 4: Mango projects

An evaluation of the
ACIAR Agriculture Sector Linkages Program

Abbreviations and acronyms

ACIAR	Australian Centre for International Agricultural Research
ASLP	Agriculture Sector Linkages Program
AUD	Australian Dollar
AusAID	Australian Agency for International Development
AVCCR	Agriculture Value Chain Collaborative Research Program
CABI	Centre for Agriculture and Bioscience International
DFAT	Department of Foreign Affairs and Trade
DPP	Department of Plant Protection (Pakistan)
NARC	National Agricultural Research Council (Pakistan)
PHDEC	Pakistan Horticulture Development and Export Company
PKR	Pakistan Rupee
RPM	Research Program Manager (ACIAR)
SAU	Sindh Agriculture University
SMGE	Sindh Mango Growers and Exporters
SVVCP	Strengthening Vegetable Value Chain in Pakistan Project
TADEP	Transformative Agriculture and Development Enterprise Program
UAF	University of Agriculture Faisalabad
USAID	United States Agency for International Development
USD	United States Dollar
UNIDO/TRTA	United Nations Industrial Development Organisation / Trade Related Technical Assistance

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Summary

From 2005 to 2015, the Australian Centre for International Agricultural Research (ACIAR) oversaw 2 phases of the Agriculture Sector Linkages Program (ASLP) in Pakistan, which was a research-for-development program in Punjab and Sindh provinces of Pakistan, focused on enhancing selected agricultural value chains for the ultimate benefit of the rural poor. The program had 2 phases: Phase 1 ran from 2005 to 2010, and Phase 2 was implemented from 2011 to 2015. The program was funded by the Department of Foreign Affairs and Trade (DFAT)³⁴ and was managed by ACIAR. Both phases included commodity-based projects focused on citrus, dairy and mango. Phase 2 also included a social science research project. The ASLP goals are at Appendix 4.5.

Research projects within the ASLP that focused on improving mango production and mango value chains were:

- Phase 1: Development of integrated crop management practices to increase sustainable yield and quality of mangoes in Pakistan and Australia (HORT/2005/153) and Optimising mango supply chains for more profitable horticultural agri-enterprises in Pakistan and Australia (HORT/2005/157).
- Phase 2: Integrated crop management practices to enhance value chain outcomes for the mango industry in Pakistan and Australia (HORT/2010/006) and Mango value chain improvement (HORT/2010/001).

The 2 mango projects aimed to increase the capacity of a range of industry, research and extension stakeholders in Pakistan.

The mango production projects were led by Queensland Primary Industries and Fisheries, while the value chain projects were led by the University of Queensland. The total ACIAR contribution for the production projects was AUD2,433,515, and for the value chain projects was AUD3,406,479.

This evaluation is Part 4 of a suite of evaluations of the ASLP. It examines the achievements of the mango projects, including project outputs, adoption and outcomes. It is not a comprehensive impact assessment. The evaluation aims to identify lessons that will inform the design and implementation of future ACIAR investments.



34 ASLP was originally funded by the Australian Agency for International Development (AusAID). AusAID was merged with DFAT in 2013.



Key findings

1

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

The evaluation team developed a suggested theory of change that covers the production and value chain projects. A visual representation is at Appendix 4.2 and the key elements are:

- The projects used highly participatory, multidisciplinary approaches that aimed to include relevant stakeholders in research areas. This was expected to lead to new knowledge of mango markets and new scientific knowledge to improve fruit quality, as well as demonstration sites and demonstration value chains. Reflecting the systems approach taken by the projects, these outputs were closely linked and fed into and supported each other.
- The outputs were expected to lead to a number of outcomes. Growers, nurseries and value chain participants directly involved in the demonstration sites were expected to adopt ASLP best practices and increase income as a result. Other actors, particularly research organisations, extension services, and government agencies were expected to increase their understanding of, and capacity to implement, good production practices and value chain approaches.
- In turn, it was expected this would lead to an ongoing, well-targeted mango research program in Pakistan; improved extension services; and the dissemination of project results by a range of stakeholders. Ultimately, it was expected that the disseminated practices would be taken up across the mango industry, leading to better fruit quality, higher yields, increased demand for Pakistani mangoes, and increased incomes for growers and value chain participants.

This theory of change implies there were 3 key assumptions that needed to hold in order for change to come about in the expected way. The assumptions were:

- The projects would be able to reach all important actors in the mango industry, particularly commission agents and contractors, who act as 'middlemen' between growers and markets.
- Dissemination of project results by a range of stakeholders would lead to uptake by other industry stakeholders not directly involved in the projects.
- Appropriate support from Pakistani government agencies would be available in areas such as market access.

Key findings (cont.)

2

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

Outputs

The projects delivered a significant number of outputs that are consistent with this theory of change. For example, **the projects made substantial contributions to increasing scientific knowledge in mango production and value chains** in Pakistan, including research on orchard management practices, disease control and post-harvest fruit management. Research outputs were shared in a variety of ways, such as best practice manuals, pamphlets, and at least 81 scientific papers and conference papers.

The projects also developed new technologies and practical approaches. In particular, they established 8 modern nurseries, 29 integrated research sites, and 4 demonstration value chains:

- Punjab growers focused on fresh exports
- Punjab smallholders focused on fresh domestic sales through direct sales and marketing
- Sindh growers focused on fresh exports by sea freight to the UK/Europe
- Sindh women focused on local mango pickle sales.

In addition, **the projects conducted significant capacity-building work.** This was predominately done through the highly participatory approaches used for all research activities. Such participatory approaches were complemented by formal training in a wide range of pre- and post-harvest management and value chain approaches, both for direct project participants and the broader sector. A particular highlight in this area was the value chain projects' support to establish a world-class post-harvest research and teaching laboratory at the University of Agriculture Faisalabad (UAF).

Outcomes – immediate beneficiaries

The projects achieved strong outcomes for immediate beneficiaries – the nurseries, growers and value chain participants who were directly involved in project demonstration sites. The final report to ACIAR for the production projects (Bally 2019) states that one nursery has produced 35,000 high health trees. It also notes that, for growers using ASLP best practices, mango yields increased by 59% in 2009–10 and 65% in 2010–11, while orchard values increased between 2 and 6 times over 5 years from 2009 (Bally 2019). An important caveat here is that this data is for only a small number of farmers and may not have been collected in a systematic way.

Similarly, **outcomes for value chain participants are strong.** For Sindh growers focused on fresh exports, the projects facilitated export by sea freight of 330 tonnes of fresh mangoes to the UK, achieving an average price of USD2.72 per kilogram compared with an industry average of less than USD1 per kilogram for exports. Punjab smallholders were able to sell 43 tonnes of mangoes with a 20% net income increase for growers. In 2015, women from 2 villages were able to produce and sell more than 2,000 kilograms of pickles with a net profit of USD1,060.



Outcomes – broader mango sector

As noted in the theory of change section, the projects aimed to influence broader change in Pakistan's mango sector. It is clear that the **projects demonstrated that value chain principles and approaches can work in Pakistan**. However, **when it comes to capacity outcomes, the picture is more mixed**. For example:

- A large number of Pakistani people have increased their individual capacity. At least 65 higher degrees (Masters and above) were achieved through the project, and the evaluation team received numerous examples of project collaborators who were building strong careers in horticulture.
- There is good evidence that the capacity of the post-harvest research and teaching laboratory at UAF – that was built during the project – has continued to improve. The laboratory has been able to attract additional funding and continues to conduct industry-focused, multidisciplinary research.
- The capacity of research institutions hosting modern nurseries has been built, but not to the desired extent. The final independent review of the production project found that the nurseries had not fully adopted best practices due to inadequate support and training (McEvelly and Laghari 2015a).
- There is insufficient data available to assess whether the capacity of extension services and the National Agricultural Research Council (NARC) was built, as no systematic monitoring data was collected.

It is challenging to draw conclusions on whether higher-level outcomes – dissemination of project results and adoption by the broader industry – have been achieved. On the positive side, training was conducted for a large number of industry stakeholders, and the ASLP projects were able to leverage other programs, such as the United Nations Industrial Development Organisation / Trade Related Technical Assistance (UNIDO/TRTA II) program to disseminate best practices. However, the projects' monitoring and evaluation was not designed to systematically collect data on such higher-level outcomes, making it difficult to draw robust conclusions.

Key findings (cont.)

3

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

There were 4 factors that ensured the activities and outputs contributed to the outcomes achieved.

First, the participatory research approaches previously described were key to ensuring all work responded to the needs of mango industry stakeholders and built their capacity. Second, interviewees identified that high quality scientific research was undertaken and this, combined with the participatory approach, ensured research outputs were relevant and useful to the sector. Third, the projects' systems-based approach was central to project success, as it ensured that project components were well-integrated and reinforced each other. Finally, the projects were able to leverage funding from other sources to support their outcomes. In particular, the UAF post-harvest laboratory was able to use the start provided by the ASLP project to secure funding from other sources, and so further strengthen its capacity and influence.

At the same time, **there were a number of barriers to the projects achieving more, particularly higher-level, outcomes related to sector-wide change.** Specifically, it appears that the theory of change assumptions did not hold. For example, despite good intentions, **the projects struggled to engage commercial agents and contractors from the mango industry.** These groups are powerful players in the system and, if projects are not able to change their behaviour in production practices and value chains, it is difficult to achieve widespread change in the mango industry.

It is also questionable whether the projects did enough to support dissemination of project results to support industry take-up. Basic enablers were not in place for details such as a communications plan for results and post-2015 maintenance of key knowledge documents. The value chain project also acknowledged that more research was needed to understand how to scale demonstration value chains.

Finally, **the projects struggled to get support from Pakistani government agencies** in areas such as market access and exports. This challenge is particularly difficult to overcome without ongoing resources and engagement with such government partners.




4

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

The projects started during a period when addressing gender equity and social inclusion was not an explicit priority of Australia's overseas aid programs. This is reflected in the mango projects, **which did not have a strategy for addressing gender issues, or for considering marginalised groups such as people with disability or disadvantaged youth.**

Despite the lack of a gender equity strategy, **the projects were able to engage women in meaningful ways.** For example, the projects worked with women researchers and students, actively supporting their participation in training and conferences. The production project encouraged the strengthening of women's roles in production (such as, packing and weeding), including pay parity with male labourers. The value chain projects supported a value chain for women to produce and sell mango pickles.

The projects, particularly in the second phase, were also appropriately pro-poor. The production projects worked with medium-sized growers on demonstration sites, but used small plot sizes to show best practices could work on smallholder farms. Production project results were made available to smallholder growers through farmer field schools, and extension materials that were translated into local languages and used visual aids for growers with low literacy. The value chain projects also had one value chain specifically focused on smallholder farmers. Note, some interviewees felt the value chain projects could have had a greater focus on smallholder growers and reduced work with larger, export-focused growers.



5

How did management arrangements impact delivery of the project?

The management arrangements were viewed positively by interviewees. Strong aspects of the management arrangements which facilitated project success were:

- **Strong relationships within and between mango projects.** Interviewees highlighted that there was clear communication and trust between project staff, particularly between the teams based in Australia and Pakistan, and this led to strong commitment to the projects. Strong in-country coordination by the Pakistan team was also in place.
- **Context-appropriate budget management arrangements.** Project funding was held by an international organisation to ensure the projects were not subject to inflexible Pakistan government funding systems. Project funding was also flexible, with budgets being re-allocated during annual planning processes and carefully overseen to avoid waste.

There are 2 areas where management arrangements inhibited project performance. First, **there were continual management changes** at the Pakistan Horticulture Development and Export Company (PHDEC), meaning oversight and support from this organisation was not as strong as expected of a key partner. Second, **the projects did not have strong monitoring and evaluation arrangements.** It is positive that the value chain project conducted its own impact assessment. But apart from this, data collection was not systematic or designed to understand higher-level outcomes, and no comparison groups were used, making it challenging to draw conclusions on project success (or otherwise).

Key findings (cont.)

6

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

The mango projects aligned well with the ASLP's 3 key objectives:

- enhancing the capacity of research and extension systems
- supporting poverty alleviation for smallholder farmers
- supporting value chains.

This evaluation also examined whether ASLP's 'programmatic' approach added value for the mango projects. **The projects benefited from being part of a larger program.** In particular, ASLP (and ACIAR) were able to create an enabling environment for the different mango projects to work together closely. This enabling environment, together with strong relationships and alignment of goals between the production and value chain projects, allowed the projects to successfully coordinate and collaborate.

In its second phase, ASLP introduced the social science project, which aimed to increase the engagement of the rural poor in the commodity-based projects (mango, citrus and dairy). **Collaboration between the mango projects and the social science projects was not as strong as anticipated**, with interviewees noting that the projects were not able to add significant value to each other's work. Reasons for this include that the purpose of the social science project was not clear or well-aligned with the commodity-based projects; that the different projects struggled to find common ground to work on; and that the different projects used very different methods and this added to the complexity when trying to collaborate.



Conclusions and lessons learned

Overall, the mango projects achieved a significant number of outputs. They generated new scientific and market knowledge, and created multiple demonstration sites. This led to strong outcomes for direct participants in demonstration sites, and increased capacity for project collaborators and the UAF's post-harvest laboratory. However, it is difficult to assess the capacity changes for some organisations, as well as whether higher outcomes around dissemination and broad adoption by the industry have been achieved, due to the limits of projects' monitoring and evaluation systems.

The projects' achievements were supported by their participatory and systems-based approaches, and high-quality science. Strong relationships within and between project teams, as well as good budget management, also facilitated project success.

Lessons learned

This evaluation highlights some general lessons for ACIAR projects and programs:

- **Projects need monitoring systems that systematically collect data on changes in capacity and broad uptake by industry.** This would allow projects and ACIAR to understand if the projects are making progress towards higher-level outcomes, and adjust approaches if needed.
- **ACIAR and project teams should design and implement projects with long-term sustainability in mind.** This includes conducting early thinking about what research, partners and systems are needed post-project, and a possible commitment to very long-term (for instance, 10-plus year) projects. This may increase the chances of adoption and use of project results by the broader industry.
- **The importance of appropriate project team membership cannot be underestimated.** Project teams require appropriate expertise, but also require like-minded team players who are open to interdisciplinary ways of working, are collaborative, and are able to build strong relationships across countries and projects. Consideration should also be given to integrating social science expertise into commodity-based teams.
- **Gender analysis and social inclusion analysis, and the development of gender and social inclusion strategies, should be undertaken at the start of project planning.** This will assist projects to develop a more strategic approach to influencing gender equity, to ensuring people with disability and other marginalised groups can benefit from projects, and to developing clear strategies that maximise poverty-reduction outcomes for smallholders. This holds true regardless of the research focus: even projects with an apparently narrow focus (for example, commodity production) can have potential consequences and opportunities related to gender and social inclusion.

Introduction

Purpose, scope and audience

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

From 2005 to 2015, ACIAR managed the Agriculture Sector Linkages Program (ASLP)³⁵, a research-for-development program funded by DFAT³⁶, in the Punjab and Sindh provinces of Pakistan. The program focused on enhancing selected agricultural value chains for the ultimate benefit of the rural poor. There were 2 phases of the program: Phase 1 from 2005 to 2010, and Phase 2 from 2011 to 2015. Both phases included commodity-based projects focused on citrus, dairy and mango. Phase 2 also included a social science research project. The ASLP goals are at Appendix 4.5.

ACIAR commissioned a program-level evaluation to identify lessons that will inform the design and implementation of future ACIAR investments and improve the quality of outcomes.

Purpose

The program-level evaluation has 5 key purposes:

1. Compile performance information from each project under a program and investigate the contribution to specific project outcomes, with a particular focus on differential effects for women and men.
2. Generate project-level case studies for use in a qualitative cross-case analysis.
3. Summarise the contribution to outcomes of each program, with a particular focus on differential effects for women and men.
4. Establish how the different approaches to programmatic management adopted by each program influenced the achievement of outcomes.
5. Identify lessons related to programmatic management of agricultural research-for-development to inform future ACIAR investments.

Scope

The program-level evaluation focuses on the whole ASLP and its constituent projects. Individual evaluations have been conducted on the citrus, mango and dairy projects under ASLP.

This project-level evaluation assesses the 4 ASLP projects that focused on the mango industry:

- the 2 projects that focused on mango production (HORT/2005/153 and HORT/2010/006)
- the 2 projects that focused on mango value chains (HORT/2005/157 and HORT/2010/001).

35 The third phase of the Pakistan program that began in 2015 is known as the Agriculture Value Chain Collaborative Research Program (AVCCR). However, the projects to be evaluated all started under the earlier phase, known as ASLP. For simplicity, this program is referred to as ASLP in the remainder of this document.

36 ASLP was originally funded by the Australian Agency for International Development (AusAID). AusAID was merged with DFAT in 2013.

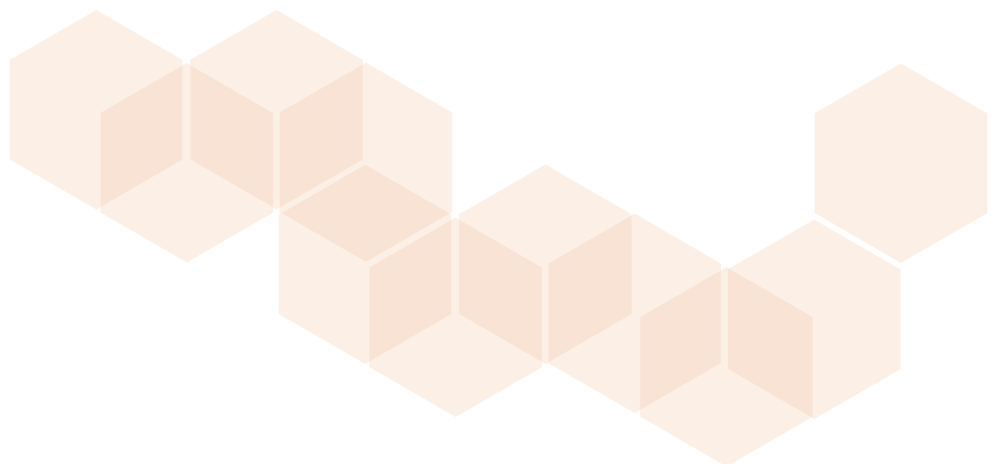


The evaluation provides an assessment against the following key evaluation questions:

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

Audience

The primary audience for this evaluation is ACIAR staff with direct responsibilities for programs and/or their constituent projects. This includes Canberra-based research program managers (RPMs), and field-based program managers and coordinators. The ACIAR Executive and senior managers, and DFAT fund managers, are also important audiences particularly for the program-level assessments and synthesis report.



Methodology

Data collection and analysis

Data was collected through a thematic analysis of the key project documents, particularly project annual and final reports, and the mid-term and final project reviews. Semi-structured interviews were also undertaken with 8 project stakeholders³⁷ and ACIAR staff. Stakeholders were intentionally selected in consultation with ACIAR. Interviews were conducted using Zoom and WhatsApp.

Systematic analysis of data collected through these processes was undertaken using NVivo qualitative data analysis software to distil findings. ACIAR working definitions and assessment frameworks for project outputs, outcomes and 'next users' were used to analyse, categorise and summarise findings (Table 9).

Preliminary findings were shared and tested in a project validation workshop involving the stakeholders previously consulted. Stakeholders were also given the opportunity to provide written comments on a draft executive summary. These activities provided the opportunity to 'ground-truth' the assessments, identify any key issues not addressed, clarify any areas of uncertainty, and correct any misinterpretations. A draft evaluation report was then prepared for review by ACIAR and finalised in accordance with feedback received.

Table 9 ACIAR project outcome assessment terminology

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

37 The list of stakeholders consulted is at Appendix 4.3.



Limitations

The evaluation team relied heavily on pre-existing documentation provided by ACIAR and the project team. These documents were of varying quality. Unfortunately, there were insufficient evaluation resources to explore third-party data or reporting that may have provided additional useful information.

There were limitations on stakeholder consultations. Direct consultations mostly focused on ACIAR staff and implementing partners, and only a very small number of program beneficiaries could be interviewed. As primary data collection was restricted to online interviews, the evaluators had limited ability to build rapport with participants and interpret non-verbal communication. In addition, the length of time since projects were completed in 2015 may have made it challenging for interviewees to provide accurate data. In some cases, phone lines were poor and unclear, and English language skills of interviewees was limited.

Interviewees for the project were intentionally chosen by ACIAR and the evaluation team. This means they were not a representative sample of project participants. Given the selection process, and the length of time since the project ended, it is also likely that respondent experiences fall at the positive end of the spectrum, meaning data from interviews is likely positively biased.

Ethical considerations

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

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

Overview of projects

Project number	Production projects		Value chain projects	
	HORT/2005/153	HORT/2010/006	HORT/2005/157	HORT/2010/001
Project title	Development of integrated crop management practices to increase sustainable yield and quality of mangoes in Pakistan and Australia	Integrated crop management practices to enhance value chain outcomes for the mango industry in Pakistan and Australia	Optimising mango supply chains for more profitable horticultural agri-enterprises in Pakistan and Australia	Mango value chain improvement
Collaborating institutions	Queensland Department of Primary Industries and Fisheries National Agricultural Research Council Ayub Agricultural Research Institute Agricultural Research Sindh Pakistan Horticulture Development and Export Board Directorates of Extension Services of Punjab and Sindh provinces	Queensland Department of Primary Industries and Fisheries National Agricultural Research Council Ayub Agricultural Research Institute Agricultural Research Sindh Pakistan Horticulture Development and Export Board Directorates of Extension Services of Punjab and Sindh provinces	The University of Queensland The Queensland Department of Primary Industries and Fisheries The Western Australia Department of Agriculture and Food The University of Agriculture Faisalabad Pakistan Horticulture Development and Export Board	The University of Queensland The Queensland Department of Agriculture Fisheries and Forestry The Western Australia Department of Agriculture and Food The University of Agriculture Faisalabad Pakistan Horticulture Development and Export Board
Project leaders	Dr Chrys Akem, Queensland Department of Primary Industries and Fisheries Dr Iftikhar Ahmad, National Agricultural Research Council	Dr Chrys Akem and Dr Ian Bally, Queensland Department of Primary Industries and Fisheries Dr Iftikhar Ahmad, National Agricultural Research Council	Associate Professor Ray Collins, University of Queensland Mr Muhammad Iqbal, Pakistan Horticulture Development Export Board	Professor Ray Collins, University of Queensland Mr Razzaq Malkana, Pakistan Horticulture Development and Export Company
Duration	January 2007 to September 2010	October 2010 to September 2015	December 2006 to September 2010	December 2010 to November 2015
Funding	AUD1,132,044	AUD1,301,468	AUD1,452,929	AUD1,953,550
Countries	Australia and Pakistan			
Commodities	Mango			
Related projects	Mango value chain projects (see next column)		Mango production projects (see previous column)	



Context

Mangoes are one of Pakistan's more important fruit crops. Mango orchards have almost doubled over the last 2 decades to 170,700 hectares in 2014–15 (Mangan and Ruthbah 2018). In 2013–14, Pakistan produced 1.65 million tonnes of mangoes and exported around 5% of these, at a value of USD50million (Collins, Sun and Ayyaz 2015). The main mango growing areas are Punjab and Sindh provinces (Mangan and Ruthbah 2018).

The Pakistan mango industry faces a number of challenges. The average price received per kilogram for exports is one of the lowest in the world. This is largely due to the combination of poor-quality fruit, poor post-harvest technologies and ineffective marketing practices (Collins, Sun and Ayyaz 2015). Factors that contribute to this situation include significant losses due to disease and pests, poor handling and storage, variable productivity due to different orchard management practices, and market access challenges. In addition, a survey of mango farmers in Sindh found that the majority of farmers sell their fruit to contractors or commission agents at the flowering stage. These contractors are then responsible for orchard management, harvesting and sales. As a result, growers have few incentives to invest in good orchard management and disease control, contributing to poor quality fruit (Mangan and Ruthbah 2018).

The projects

Consistent with the importance of the mango industry in Pakistan, each ASLP phase supported 2 mango projects focused on mango production and value chains:

- Phase 1: Development of integrated crop management practices to increase sustainable yield and quality of mangoes in Pakistan and Australia (HORT/2005/153) and Optimising mango supply chains for more profitable horticultural agri-enterprises in Pakistan and Australia (HORT/2005/157).
- Phase 2: Integrated crop management practices to enhance value chain outcomes for the mango industry in Pakistan and Australia (HORT/2010/006) and Mango value chain improvement (HORT/2010/001).

The projects aimed to improve the quality of mangoes and demonstrate value chain principles in Pakistan.

For Phases 1 and 2, the **production** projects' aims were:

- To facilitate the establishment and spread of 'clean' mango nurseries to ensure high quality planting materials were available.
- To develop improved orchard management practices (pre-harvest).
- To develop improved strategies for the detection and management of field diseases and pests.

For Phases 1 and 2, the **value chain** projects' aims were:

- To improve the quality of mangoes (this project focused on post-harvest practices to avoid duplication with the production projects).
- To research and develop Pakistani domestic markets and selected export markets, and use the findings to inform fruit quality, value chain development and *capacity-building* activities.
- To work with value chain participants (including smallholders) to demonstrate the benefits of value chain approaches.

These objectives were underpinned by 2 key ways of working. **Both projects had a strong emphasis on capacity building.** Participatory approaches (in which a variety of stakeholders were involved in research and implementation of research practices) and formal training were used to build capacity.

The projects, and particularly the value chain projects, also had a strong systems-based approach.

In this approach, all parts of the project were seen as an integrated system in which different activities supported and reinforced each other. This systems-based approach was represented by a project concept shown at Appendix 4.1.

Findings

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

Projects' theory of change

In 2005, when the mango projects were first designed, the use of theory of change was limited in Australia's aid program. Consequently, it is not surprising that the **documentation of the mango projects' does not include a theory of change** to articulate how the projects expected change to happen, or how activities would lead to outputs and outcomes. To its credit, the value chain projects had a 'project concept', outlining how different components of the project were linked in a systems-based approach (see Appendix 4.1).

Drawing on documents and discussion with stakeholders, **the evaluation team developed a suggested theory of change**. This covers both the production and value chain projects, given how closely they were linked. A visual representation of the theory of change is at Appendix 4.2.

The projects' theory was that project success was dependent on highly participatory, multidisciplinary research. This research should include a variety of stakeholders, including growers, researchers, and extension services. It should cover a vast range of topics (for example, pre-harvest orchard and nursery management, post-harvest disease control, markets, and mango value-added products) and be complemented by more formal training where necessary.

If this participatory research was successful, then a number of outputs were expected to flow. These outputs included new knowledge of mango markets and new scientific knowledge to improve fruit quality, as well as demonstration sites and demonstration value chains. Reflecting the systems approach taken by the projects, these outputs were expected to be closely linked and support each other.

If these outputs were relevant to, and successfully supported, the mango industry, then a number of outcomes were expected as a result. Growers, nurseries and value chain participants directly involved in the demonstration sites were expected to adopt ASLP best practices and increase yields and/or incomes as a result. Other actors, particularly research organisations, extension services, and government agencies were expected to increase their understanding of and capacity to implement good production practices and value chain approaches.

If such actors did increase their understanding and capacity, it was expected that a number of changes would take place. These included implementation of a well-targeted mango research program in Pakistan; improved extension services grounded in participatory approaches; and the dissemination of project results by a wide variety of stakeholders. Ultimately, it was expected that the practices disseminated would be taken up across the mango industry, leading to better fruit quality, higher yields, increased domestic demand for high quality Pakistani mangoes, increased international market share for Pakistani mangoes, and increased incomes for growers and value chain participants.

Appropriateness of the theory of change

There was some evolution of the theory of change over the course of the mango projects. For example, **the projects had an increasingly pro-poor focus over time.** For example, the documents from the Phase 2 project were more explicit in describing the projects' focus on small to medium growers.

The theory of change was **underpinned by a number of assumptions that needed to hold true in order for change to happen as anticipated.** These assumptions included:

- The projects would be able to reach all significant players in the mango industry, including the commission agents and contractors who are powerful 'middlemen'. Project proposals for both the production and value chain projects outlined a need to include these commission agents and contractors in project activities, given their significant role in orchard management, harvesting, and linking produce to markets.
- The dissemination of project results by Pakistani project stakeholders (for example, growers, extension services, researchers, and government organisations) would lead to uptake of the ASLP practices by other industry stakeholders not directly involved in the project. Project documentation appears to assume that this dissemination would continue after the projects were completed.
- Appropriate support from Pakistan government agencies would be available. This was particularly important for long-term impacts around exports, where government agencies play a key role in market access and biosecurity.



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

This section discusses the outputs and outcomes the projects achieved using the theory of change as a framework. To summarise, **it is clear that the projects achieved significant outputs**, making substantial contributions to increasing scientific knowledge in mango production and markets, developing new technologies and approaches through demonstration sites and demonstration value chains, and implementing significant *capacity-building* work.

This led to strong outcomes – such as increased yields and incomes – for immediate beneficiaries who were involved in demonstration sites and demonstration value chains. **Outcomes for other stakeholders were more mixed.** Individual Pakistani project collaborators increased their capacity, as did the post-harvest laboratory at the University of Agriculture Faisalabad (UAF). Nursery institutions increased their capacity, but not to the extent preferred. A lack of systematic monitoring data makes it difficult to draw robust conclusions on whether the capacity of extension services improved, and whether project results were disseminated and taken up by other industry stakeholders.

Outputs

Based on the participatory approach taken, the projects achieved a number of outputs in the areas of scientific knowledge, technologies/practices, and capacity building. Although different outputs have been categorised under different headings, in reality the systems-based nature of the projects means many of the outputs were closely linked to each other and are not easily placed in a single category.

Scientific knowledge

The projects made substantial contributions to increasing scientific knowledge in mango production and value chains in Pakistan. Key examples include:

- Nursery management: Recommendations for suitable potting mix were developed.
- Germplasm: A germplasm repository at the mango research station in Punjab was established; new rootstock was tested to determine its suitability for Pakistan; and rootstock and cultivar resistance to salinity and diseases was tested.
- Orchard management: Significant research was conducted on pruning, nutrition, disease and pest management, orchard floor management, and integration of management techniques.
- Field and post-harvest diseases and pests: A large amount of research was conducted on diseases and pests, and management options for them. These included, mango sudden death syndrome³⁸, mango malformation disease, gall midge, dendritic spots, and mango stem end rots.
- Post-harvest management: Research was conducted in areas such as skin colour development; the role of orchard management on post-harvest disease development; low temperature chilling injury; the effects of ethylene on ripening³⁹; fungicides for controlling post-harvest diseases; fruit fly management; and the effects of extended hot water treatment.

The **scientific knowledge developed was shared through a variety of physical outputs**, such as:

- A nursery best practice manual, produced together with the ASLP citrus projects.
- A best practice orchard management manual titled, 'Recommendations for Good Orchard Management in Pakistan', which was translated into Urdu.
- Incorporation of project best practices into the UNIDO/TRTA II Code of Practice, covering farm management, mango production, post-harvest management and processing (noting that miscommunication meant the ASLP project teams were not able to review the Code and were not acknowledged in it).
- Eight nursery pamphlets, 8 disease management pamphlets, 9 orchard management pamphlets, and 12 technical guides covering value chain issues (such as, pre- and post-harvest management; mango skin colour guides; mango defects guide; and market research reports).
- Scientific papers. For the mango production project, this included 22 journal articles, 6 conference proceedings, 4 conference posters, 7 articles for local language journals, and 9 published abstracts. For the value chains project, this included 13 published research papers and 20 papers presented at international conferences.

38 The Phase 1 production project determined the causal agent for mango sudden death syndrome; a significant achievement given researchers previously had diverse views on the disease's cause.

39 Pakistani growers commonly used calcium carbide for ripening, which can cause severe health problems, making the research and adoption of ethylene ripening a very notable achievement.

New technologies or practical approaches

To demonstrate new technologies or practical approaches, the projects established multiple demonstration and best practice sites and value chains. These sites were used to both conduct and implement findings from much of the research. The key demonstration activities included:

- Eight modern nurseries at 6 major mango institutions.
- Twenty-four integrated research sites in Punjab and 5 integrated research sites in Sindh to study and test orchard management practices.
- Four value chains. As per the value chains projects' systems approach, the formation of these value chains drew heavily on many other project outputs, such as research conducted on markets and value-add products, implementation of good practice in orchard and post-harvest management, and training of stakeholders. The 4 value chains were:
 - Punjab growers focused on fresh exports: Growers in Punjab were supported to export mangoes to Europe and Asia (China and Malaysia).
 - Punjab smallholders focused on fresh domestic sales: In this value chain, a cluster of 6 smallholder farmers (each with less than 5 hectares of land) worked cooperatively to improve the quality of their fruit. The farmers jointly marketed and sold their fruit directly to consumers, using e-commerce (for example, Facebook), home delivery, and a promotional and sale stall.
 - Sindh growers focused on fresh exports to the UK/Europe⁴⁰: Sindh Mango Growers and Exporters (SMGE) was supported to directly export fresh mangoes to the UK and Europe. Considerable work on sea freight exporting was undertaken.
 - Sindh women focused on local mango pickle sales: Drawing on research conducted by the Sindh Agriculture University, this value chain project trained and supported women from 2 villages to process and sell mango pickles.

The value chain projects developed new technologies and practices to enable exports.

These included:

- Sea freight technology and protocols for sea freight shipment of Pakistani mangoes to the UK/Europe (conducted as part of the SMGE demonstration value chain). The project successfully developed approaches that enable transit times of up to 40 days, with 5- to 7-day shelf life in stores, which is considered global best practice.
- Technical guidance for establishing and accrediting hot water treatment facilities in Punjab.
- Export protocols for the China market.

The value chain project also supported significant research on mango value-add products. Sindh Agriculture University (SAU) developed 21 different value-add products and identified 3 products (pickle, dried mango slices, and mango powder) that have potential for village-level production. SAU also conducted supply chain analysis of the mango pickle industry to build a marketing plan for this product. These research outputs were directly linked to the demonstration value chain of Sindh women developing mango pickle.

The value chain project also deepened understanding of mango markets and consumers.

Outputs included:

- Market research on domestic (for example, Karachi, Faisalabad) and export markets (for example, UK, Europe, China and Malaysia).
- Market development undertaken, evaluated and documented for Chinese and Malaysian markets.

Capacity building

The projects took a highly participatory approach to all research and implementation of activities with a view to increasing the capacity of all stakeholders involved. **These participatory approaches were supplemented by formal training, specific capacity support for some organisations, and support for Pakistani students to complete higher degrees.**

Specific outputs included:

- Establishment of a world-class post-harvest research and teaching laboratory at UAF. In particular, the mango projects provided basic equipment, training for staff and students, and support for research related to the mango projects.
- Twenty training sessions on nursery management covering 1,500 participants.
- More than 100 training events on orchard best management practices for 6,233 participants.

⁴⁰ These growers formed and operated under a company known as the Sindh Mango Growers and Exporters (SMGE).

- In Phase 2 of the value chain projects, 1,919 males and 146 females were trained in a variety of areas, including post-harvest skills and technologies, market research, and producing value-added products. The participants included growers, contractors, commission agents, exporters, importers, government research and extension staff.
- Training on mango market research for 29 participants from universities, provincial extension and market services, Pakistan Horticulture Development and Export Company (PHDEC) and industry.
- ‘Walking the Chain’ value chain training conducted for 40 undergraduate students.
- A sea freight technology workshop for 150 participants.
- A large number of university degrees were obtained by students associated with the project. For the mango production projects, this included 8 PhDs; 6 MPhils; 21 MScs; 20 BSc (Hons) and 27 BScs. The value chains projects supported 4 PhDs and 26 MScs.

Adoption and outcomes – immediate beneficiaries

As outlined in the theory of change, the projects sought to achieve adoption and outcomes for 2 main groups. The first group were the growers, nurseries and value chain participants directly involved in the projects, for example, as growers on demonstration sites or participants in a demonstration value chain. Adoption and economic/social outcomes for this group are discussed in this section. The second group was the broader mango industry, including extension services, researchers, growers, nurseries and value chain participants not directly involved in the project.

The participatory approaches used in the mango projects meant nurseries, growers and value chain participants were closely involved in research and in testing new approaches. This means that **participation and adoption were generally the same thing, ensuring high adoption rates.** In other words, participants in demonstration activities adopted the approaches because they were being trialled at their farms, nurseries, or businesses.

There is also **evidence that production best practices were adopted by growers surrounding demonstration farms.** A study conducted in 2013 by the mango production project randomly selected 50 farmers located within a 5-kilometre radius of demonstration sites. The study found that, for the 12 ASLP best practices, half had been adopted by at least 60% of farmers, and 2 of those had been adopted by over 90% of farmers (Fateh n.d.).

For the farmers, nurseries and value chain participants directly involved in the projects, **the outcomes achieved are significant, with some being sustained beyond 2015.**

An outcome from the establishment of the **8 modern nurseries** has been increased availability of high health trees. The production project final report notes that the oldest commercial nursery has produced 35,000 high health plants over 5 seasons, while another nursery exported 35,000 high health plants to the Middle East (Bally 2019).

Mango production project reports also note **good outcomes for growers involved in the production projects.** The production projects’ final report states that, for farmers using ASLP production best practices, mango yields increased by 59% in 2009–10 and 65% in 2010–11. The final report also includes data stating that farmers’ orchard values increased between 2 and 6 times over 5 years (Bally 2019). An important caveat is that the data presented in the reports appears to be based on only a small number of farmers with relatively large farms (at least 55 acres). In addition, interviewees reflected that such data was collected by field staff through informal approaches, rather than in a systematic or rigorous manner. Consequently, such results should be treated with a degree of caution.

It also appears that **the outcomes for participants in the demonstration value chains up to 2015 were strong.** Results for these participants largely come from an impact assessment conducted by the value chain project, meaning the findings are likely to be reliable (Ayyaz et al. 2016).⁴¹ Post-2015, interview data and document review suggest some outcomes have been sustained while others have not.

41 One caveat is that the impact assessment did not have a comparison or control group. This means that we cannot say with certainty that any outcomes were due to the value chain projects, as it is possible that other growers who did not participate in the projects may have experienced similar changes.

For the **growers focused on fresh exports**, the project facilitated the SMGE to export 330 tonnes of mangoes by sea freight to the UK from 2012 to 2015. These exports used on-farm and post-harvest systems developed and supported by the value chain projects. The impact assessment reported that the mangoes achieved an average price of USD2.72 per kilogram, compared with an industry average for exports of less than USD1 per kilogram. The overall export earnings were reported as USD900,000. Interviews demonstrated that the SMGE company continues to operate up to 2021, noting that some interviewees highlighted ongoing challenges and that sea freight transporting may have reduced.

The value chain projects facilitated 5 trial shipments to China and one trial shipment to Malaysia. The value chain projects experienced challenges in expanding exports to China because Chinese regulations required mangoes to undergo hot water treatments. There was only one hot water treatment plant in Pakistan and so the project designed micro on-farm hot water treatment plants. At the time the value chain project was wrapping up in 2015, these hot water treatment plants were being registered by Pakistan's Department of Plant Protection (DPP) for export and it was hoped that this would lead to increased exports to China. Interviewees noted that air freight exports to China were continuing up to 2021, with the mango value chain project being key to initiating this market.

For the **Punjab smallholders focused on fresh domestic sales**, the growers were able to sell 43 tonnes of mangoes across 2014 and 2015 at an average price of PKR96 per kilogram, compared with PKR52 per kilogram for similar mangoes in traditional markets. This resulted in a gross return of more than USD20,000 and a 20% net increase in income for the farmers involved. Interviews indicate that this value chain has not continued to operate post-2015 as the key grower leading the value chain left the area.

For the **Sindh women focused on local mango pickle sales**, in 2014, 12 women from one village produced more than 500 kilograms in pickles, generating USD350 in income. In 2015, across 2 villages, women produced more than 2000 kilograms of pickles with a net profit of USD1,060. The women also received repeat orders from 40–50 customers in 2015. In 2018, CABI conducted a follow-up study and found the women's pickle business in one village was continuing to operate effectively. Women had used their profits to re-invest in the business and to buy other assets such as a sewing machine and a computer. The CABI report indicated the second village was not successfully continuing with the pickle business due to multiple challenges such as internal coordination and finances.

The value chain projects also **contributed to positive outcomes for workers in the mango industry**. The impact assessment report highlights that mango growers hired more agricultural graduates as farm managers, while workers trained in improved packing practices charged 20% higher wages. One grower also reported increasing the number of labourers hired for seasonal work (Ayyaz et al. 2016).

Adoption and outcomes – broader mango sector

As outlined in the projects' theory of change, the projects not only aimed to achieve outcomes for the growers, nurseries and value chain participants directly involved in the projects, they also aimed to influence change in the broader mango sector in Pakistan. This section of the report discusses whether these broader outcomes were achieved.

In the ACIAR outcome area of 'innovation enabled', it is clear the projects **demonstrated that value chain principles could work in Pakistan** and provided the foundations for value chain thinking in Pakistan. One interviewee highlighted that the projects resulted in a cohort of Pakistanis who understood the multidisciplinary, value chain oriented way of thinking. The good results achieved for value chain participants are evidence of this.

In the ACIAR **outcome area of 'capacity built', the projects achieved mixed results**. It is clear that the capacity of a number of individual Pakistanis has been increased. For example, a large number of Pakistanis achieved higher degrees with the projects' support. There were multiple examples of Pakistani researchers involved in the project who are building strong careers in horticulture, both within and outside Pakistan. In addition, the final independent review for the value chain projects found that the projects led to a handful of highly competent Pakistani nationals who could be leaders in value chain projects (McEvelly and Laghari 2015b).

For institutions, it is a more mixed picture on whether institutional capacity has been built. **In some cases, it is very difficult to assess changes in institutional capacity**. For example, the final independent review for the value chain project found that, although NARC understood the importance of value chain research and development, the independent team was unable to assess whether this translated into increased capacity to deliver value chain projects (McEvelly and Laghari, 2015b).



The projects also sought to increase the capacity of Pakistan's extension services, aiming for an outcome of improved extension services grounded in participatory approaches. Unfortunately, **this review has not been able to access data or interview representatives of Pakistan's extension services to inform a judgement on whether their capacity has increased.** Other interviewees indicated that quality extension services are a gap in the mango sector and that it is difficult to access specialist extension advice on horticulture. However, given the diverse government partners that provide extension services, and the limited data available for this review, there is insufficient evidence to conclude whether the capacity of extension services changed as a result of the projects.

For some institutions, **capacity appears to have been built, but not to the desired extent.** The production projects established 8 modern nurseries at 6 mango research institutions, with these nurseries producing high health plants at the time of project completion. At the same time, the final independent review for the production project found that 'several of the demonstration nurseries at research institutions had neither fully adopted best practices nor fully understood the principles of managing potting media' (McEvilly and Laghari 2015:5), due to inadequate training and support for Pakistani personnel.

On the positive side, **there is good evidence that capacity of the post-harvest laboratory research and teaching laboratory at UAF was enhanced during the projects, and has likely improved further after the projects.** During the ASLP projects, the laboratory was able to benefit from ASLP equipment and training. From this basis, both during and after the ASLP projects, the laboratory has been able to:

- attract additional funding and research projects from the Government of Punjab and international donors
- continue to collaborate with the mango industry, other researchers, marketers, and the extension system on post-harvest research
- expand its research to other horticulture commodities.

Based on the strong capacity of the laboratory, the ASLP projects have made a substantial contribution to an outcome of an ongoing, well-targeted mango research program that has continued after 2015.

In the long-term, the mango projects aimed to use the increased capacity of a range of partner organisations, an improved research program, and an improved extension system to disseminate the projects' best practices and value chain approaches. This could contribute to sector-wide change in the mango industry, with greater adoption of better production practices and value chain approaches and resulting improved mango quality, sales and exports.

Given the limited resources for this review, **it is challenging to draw robust conclusions on whether these higher-level outcomes have been achieved.**

Some work was done to share the project results with a wide audience. Training was held with large groups to share project results, and multiple conference papers were delivered. The projects were also able to leverage other programs to disseminate best practices. For example, the production projects worked with the Punjab Fruit and Vegetable Project's Farmer Field Schools to disseminate best practices. UNIDO/TRTA II, USAID and Nestlé also used project outputs in manuals and training. A small number of interviewees reflected that the ASLP production and post-harvest practices continued to be used and have spread in Pakistan, while others felt that, while there was a good knowledge basis in the country, there had not been significant widespread change. Given this mixed interview data and the lack of systematic monitoring data on higher-level outcomes, this evaluation has not been able to reach defensible conclusions on the achievement (or otherwise) of such outcomes.

Table 10 summarises adoption of project outputs, while Table 11 summarises capacity built through the projects.

Table 10 Levels of adoption of key project outputs

Project	New technologies or practical approaches	New scientific knowledge	Knowledge or models for policy and policymakers
ASLP mango production and value chain projects	Nf – Value chain approaches (applies to growers, nurseries, and value chain participants) NF – Participatory, multidisciplinary research (applies to mango research community)	Nf – Best practice production and post-harvest management (applies to growers, nurseries, and value chain participants)	O – Value chain approaches ^a

Notes:

O No uptake by either initial or final users

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

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

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

(a) The value chain projects demonstrated that value chain approaches can be successful in Pakistan. This could be very useful for policymakers, but influencing policy was not part of the projects' design or implementation.

Table 11 Capacity built relevant to project outcomes

Who	Skills and knowledge
Nursery-hosting institutions	<ul style="list-style-type: none"> • Best practice nursery management • Improved potting media Note, findings that capacity was built but likely not to the extent desired
Growers on production project demonstration sites	<ul style="list-style-type: none"> • Best practice orchard management in areas such as pruning, nutrition, and orchard floor management • Disease and pest management, particularly for mango sudden death syndrome and mango malformation disease
Demonstration value chain participants	<ul style="list-style-type: none"> • Production best practices, where relevant • Post-harvest management in areas such as skin colour, ripening, and post-harvest disease and fruit fly control • Market research and market development • Value-added mango products • Export protocols, for example, in sea freight
Research / academic community in Pakistan	<ul style="list-style-type: none"> • Market research and market development • Value chain thinking and approaches • Nursery management • Orchard management • Disease and pest management • Post-harvest management
Key project stakeholders – PHDEC and NARC	<ul style="list-style-type: none"> • Understanding of value chain principles and approaches

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

Based on interviews and document reviews, 4 factors have been identified that ensured activities and outputs contributed to the projects' outcomes. These factors were:

- the participatory research approaches
- high quality science
- the systems-based approach
- the leveraging of other projects and funding.

The projects also experienced factors that hindered its achievements, particularly in terms of higher-level outcomes. Specifically, it appears that the assumptions underpinning the projects' theory of change did not hold.

Factors contributing to success

One of the key factors contributing to the projects' success was the **participatory approach used for research**. The projects were highly participatory, involving a wide range of stakeholders in research and implementation. This ensured that the projects responded to the needs of the industry and built the capacity of all the stakeholders involved. For the participants in demonstration sites and demonstration value chains, the participatory approach also ensured high adoption rates for ASLP best practices and value chain principles.

A second factor in project success was the **high quality of research conducted**. It is clear from document review and interviews that the projects completed significant scientific research which responded directly to key issues in the Pakistan mango sector. These research outputs underpinned many of the projects' outcomes and so were central to overall project success.

A third factor was the **systems-based approach** implemented by the projects. This approach, which looked at the whole mango system from production to sales, differentiated the mango projects from other ASLP commodity-based projects. The production and value chain projects were well-integrated and linked directly to one another, ensuring each project facilitated the others' success. The systems-based approach also created incentives for project participants to adopt ASLP best practices. For example, by linking growers to markets, growers could see the direct benefits of changing their production and post-harvest practices. This contributed to high adoption rates and the outcomes achieved for project participants.

Finally, the projects were able to **leverage other funding and projects to support their outcomes**.

A good example is the UAF post-harvest laboratory. Following the start provided by ASLP, it was able to secure funding from other sources, and so further strengthen its capacity and influence. The projects were also able to share the ASLP best practices more widely through other projects, such as the UNIDO/TRTA II program.

Barriers to success

At the same time, **there were a number of barriers to the projects achieving more, particularly higher-level outcomes related to sector-wide change**. Specifically, it appears that the theory of change assumptions did not hold.

For example, despite good intentions, **the projects struggled to engage commercial agents and contractors from the mango industry**. These 'middlemen' are powerful agents in the mango industry in Pakistan who buy fruit from growers at the orchard flowering stage. Post-purchase, they are generally responsible for orchard management, harvesting and sales. As project documents outline, many of these agents and contractors benefit from the existing system and so have a vested interest in resisting change to it. At the design phase, the mango projects aspired to work with commercial agents and contractors but ultimately struggled to do so, and were only able to reach a small number of such 'middlemen' who were interested in disrupting existing systems. Changing the behaviour of such entrenched actors is very challenging and likely a long-term endeavour. At the same time, without working with these actors it is very difficult for growers to engage with the market signals that would incentivise them to change the pre- and post-harvest practices, and for the projects to contribute to sector-wide change.

It is also **questionable whether the projects did enough to support dissemination of project results to support industry take-up**. As noted in the final independent reviews of the projects, there was no communication strategy to inform the dissemination of results, or a plan for the ongoing maintenance and distribution of the projects' guidelines, manuals and protocols after 2015. This review could also not identify attempts to influence governments or policymakers about the successful value chain approaches. In its reporting, the value chain project also acknowledged that more research was needed to understand how to scale demonstration value chains. This knowledge would be needed to underpin any genuine attempts to scale-up project results to the broader mango sector.

Finally, **the projects struggled to get support from Pakistan government agencies** in areas such as market access and exports. For example, the projects needed Pakistan government assistance to certify hot water treatment plants, which would then enable mangoes treated in these plants to be exported to the UK/Europe. It was challenging to obtain this support, noting this challenge is particularly difficult to overcome without ongoing resources to engage with such government partners.

A key lesson for ACIAR is that projects should be **designed and implemented with long-term sustainability in mind**. The projects may have more successfully achieved higher-level outcomes if a number of factors were in place.

These include:

- early research on how successful scale-up might be implemented
- identification of partners to be the long-term ‘home’ of project outputs
- systems for the ongoing maintenance and dissemination of project outputs
- project engagement with government agencies and sector actors needed for long-term success.

Further, ACIAR could also consider whether longer projects (such as 10-plus years) may be beneficial, given the long-term timeframes needed to change the behaviour of some industry actors and to achieve scale-up.⁴²

A summary of factors that influenced adoption of project outputs is provided in Table 12.

Table 12 Factors influencing adoption and impact

	Factor	Key findings
Knowledge	Do potential users know about the outputs?	Immediate users knew about the outputs. It is questionable whether the broader sector is aware of or can access the outputs.
	Is there continuity of staff in organisations associated with adoption?	PHDEC experienced staff turnover, which may influence long-term sustainability.
	Are outputs complex in comparison with the capability of users?	Best practice production techniques are not complex and should be achievable for many growers. Value chain approaches are complex and strong leadership is required for them (noting the projects developed a cadre of potential leaders in value chain thinking).
Incentives	Are there sufficient incentives to adopt the outputs?	The value chain approach provided direct incentives to adopt production and post-harvest outputs. However, the involvement of contractors/commission agents can prevent growers from accessing market signals, meaning incentives to change are not clear to growers. There was insufficient demand from growers for high health trees, reducing incentives for nurseries to adopt best practices.
	Does adoption increase risk or uncertainty?	Adopting a value chain approach creates risk for participants given it is outside normal practice in Pakistan.
	Is adoption compulsory or effectively prohibited?	Not identified as a constraint for these projects.
Barriers	Do potential users face capital or infrastructure constraints?	Government agency cooperation is needed for export-focused value chains, and there may be significant constraints if such cooperation cannot be obtained. Some smallholder growers may experience capital constraints to implementing best practices (for example, fertiliser, start-up costs for value chains).
	Are there cultural or social barriers to adoption?	The production and value chain approaches are new and there may be resistance from older family members who control family farms and nursery businesses.

⁴² Note, ACIAR, as an Australian Government agency, is subject to the funding strategy determined by the government of the day. Such government strategy is not within ACIAR control and may constrain the ability of ACIAR to commit to long-term projects.



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

It is important to note that the ASLP mango projects were developed in 2005. At the time, there was much less focus on gender, marginalised groups or social aspects of research in research-for-development programs. This is reflected in the mango projects, which did not have strategies for addressing gender issues, or for considering marginalised groups such as people with disability or people facing disadvantage.

However, **despite the lack of strategies in these areas, the projects engaged meaningfully with women and included poorer smallholder farmers.**

The projects employed appropriate approaches to link with these groups. For future projects, more deliberate and thorough gender analysis and social inclusion analysis could further increase project effectiveness by identifying appropriate entry points and possible barriers to adoption that might need to be overcome.

A key development for ASLP was the addition of the social science project in Phase 2. This project worked on gender and social inclusion issues.

Gender equality

Generally speaking, women play a limited role in the mango industry in Pakistan. Interviews noted that women's engagement with nurseries and orchards was limited, and that reaching women was challenging – particularly in Punjab – due to cultural practices.

The ASLP mango projects did not have a documented gender equity strategy. Project documentation is 'gender blind'; it does not address gender issues, power dynamics or the roles of women in the mango industry, noting that ACIAR project documentation at the time did not request this information from projects.

Despite the lack of recognition of gender issues, **the mango projects did involve women in meaningful ways:**

- The projects worked with female researchers and students by supporting their participation in training and conferences. Project documents for the value chain projects state the projects will 'positively discriminate in favor of women on project team activities such as postharvest and market research [and] highlight the existing role of women in the project team at seminars and conferences' (Collins 2014:22).
- Interviewees highlighted that the production projects considered the key roles of women in mango production (for example, packing, weeding, collecting dropped fruit) and encouraged the strengthening of these roles. This included encouraging growers to pay female and male labourers equal rates – noting it is not clear if this parity was achieved, with the value chain impact assessment report stating that female labour was considered by growers to be 'cheap'.
- The value chain projects specifically worked with women to develop the pickles value chain. This resulted in considerable benefits for the women involved, some of which appear to have been sustained beyond 2015.

The projects also faced barriers to involving women in deeper ways. Women's relatively limited roles in the mango industry meant there were fewer opportunities to engage with them. Interviewees also highlighted that it is expected that training for village women be conducted by female trainers. However, finding female trainers with appropriate skills was challenging and this further limited opportunities available for women. A small number of interviewees also expressed the view that, as agricultural scientists, project teams were not well-placed to engage with or attempt to change social structures in Pakistan.

Social inclusion

This section of the report focuses on the extent to which the mango projects were 'pro-poor', or inclusive of poorer smallholder farmers. The review did not identify any mango project activities that addressed the needs of marginalised groups, such as people with disability, ethnic or religious minorities, or disadvantaged youth.

The first phase of the mango projects had a greater focus on medium to large mango growers. This changed in the second phase after the projects' mid-term reviews, which recommended that more attention should be paid to smallholder farmers.

The mango production projects aimed to work directly with medium to large growers while ensuring that the project results were available to smallholders. This strategy appears to have been suitable and effective. For example, the production projects undertook research and demonstration work on medium to large farms. This was appropriate, as such farmers had more resources and were able to take on the risks associated with research. At the same time, the demonstration sites on these farms were also relatively small – for example, around one acre – so that it could be shown that the production methods could work on smallholder farms. The production projects' planning also highlighted that increased productivity in commercial orchards would likely benefit rural labourers through increased employment opportunities. This appears to have been the case.

The production projects aimed to ensure project results were available to smallholder farmers. The results were included in farmer field schools and recorded in extension materials, which were translated into local languages, and made use of visual aids to assist growers with low literacy.

A number of interviewees highlighted that, although project results were shared with smallholder farmers, **many faced resource constraints to adopting new practices.** This is supported by a study conducted by the production project team (Fateh n.d.). It showed that, for farmers surrounding demonstration plots, adoption of practices increased as education level increased, and that wealthier farmers adopted more practices than poorer farmers. While it is clear that project results were available to smallholder farmers, there is a lack of project data to inform a judgement on whether broader groups of smallholder farmers (for example, those who participated in farmer field schools) actually benefited from the projects.

The value chain projects also increased their focus on smallholder farmers over time. In the Phase 2 project, a 'pro-poor' approach was seen as a key enabler for project success. The value chain projects put the propoor approach into practice by supporting a demonstration value chain focused on direct marketing by smallholders, and on value-addition by women.

The value chain projects also worked with larger, more sophisticated growers. The project's initial focus was on international markets and larger producers, which was required to develop the production and quality protocols to reach distant markets, open up new export opportunities and generate increased foreign exchange. Some of the value chain projects' greatest successes appear to be with this type of grower.

It is interesting to reflect on whether the value chain projects struck the right balance between supporting smallholders and working with larger, export-focused growers. Some interviewees felt that more could have been done to support more smallholders. Continually reflecting on the right balance will be important for other future value chain projects.

The successes and challenges in gender and social inclusion highlight lessons for future ACIAR projects. Although women and poorer smallholders were reached in the mango projects, **projects can be more effective by conducting gender and social inclusion analysis at project commencement.** In addition, where projects have explicit poverty reduction objectives and seek to engage smallholders, clear strategies need to be built to maximise outcomes for this target group. This is true regardless of project focus, as even projects with an apparently narrow commodity-based focus can have opportunities and consequences related to gender, social inclusion and poverty reduction. Such analysis can identify appropriate entry points and potential barriers for adoption, and consider early strategies to overcome such barriers.



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

Overall, **the management arrangements for the mango projects were effective and enabled the smooth functioning of the projects**. Particularly strong aspects of the management arrangements that facilitated project success included the strong relationships within the mango projects, and the appropriate budget management arrangements. The projects experienced challenges related to staff turnover at a key Pakistani partner, and would have benefited from improved monitoring and evaluation arrangements.

Relationships within the mango projects

The majority of interviewees highlighted that **strong relationships were key to the mango projects' success**. Within the individual projects, project staff members noted that there was very good communication and trust between the teams based in Australia and Pakistan. In the production projects, for example, the team leader based in Australia would speak to the Pakistan-based project coordinator every 2 weeks. These project staff would engage in joint planning, and the Pakistani coordinator was also given autonomy to implement broad strategies as needed. Interviewees also reflected that this strong communication and trust led to mutual respect, close relationships and a sense that all team members were valued. This, in turn, contributed to excellent team commitment to the projects.

The strong relationships between the teams based in Australia and Pakistan were also **supported by strong coordination by team members based in Pakistan**. Interviewees noted that having in-country coordinators with continuous oversight of the projects was vital for project success. These in-country coordinators were able to implement strong project oversight when Australian team members were unable to travel to Pakistan for security reasons. They also implemented strong communication with other Pakistan-based team members (for example, researchers and extension workers). The mid-term review for ASLP Phase 2 highlighted good project management by the project teams, with interviews also highlighting strong communication between project coordinators and other Pakistani team members (for example, researchers and extension workers).

Budget management arrangements

Interviews highlighted that the **projects' budget management arrangements were vital to the projects' success**. Key features included:

- Funds were held in Pakistan by an international organisation, rather than by a Pakistan government entity. This ensured that funds were easily accessible and not subject to restrictive government processes (for example, needing to procure goods from registered government suppliers). The projects paid a fee to the international organisation, but this was considered worthwhile due to the flexibility provided.
- The projects used context-appropriate budget management systems. For example, value chain projects would develop an annual work plan and a budget for this workplan, which provided annual flexibility in activity budget allocations. The project leader would review activity budgets to ensure unnecessary items were not included and value-for-money principles were adhered to. The projects also asked partner institutions to agree to budgets so that it was clear how much funding would flow to research teams. This led to effective budget management as well as savings that were re-directed to the projects' impact assessment activity.

Management challenges

There were 2 areas where management arrangements inhibited project performance. **There were continual senior management changes at one of the key partner organisations** – the PHDEC. Interviewees reflected that this slowed project progress, as it could take time for PHDEC to appoint replacement staff. Continual changes also meant PHDEC was not as strong as expected providing oversight and support to the projects.

The projects did not have strong monitoring and evaluation arrangements. This is not surprising. Similar to the gender and social inclusion, monitoring and evaluation was not a clear focus for ACIAR projects when the mango projects commenced. It is positive that the value chain project conducted its own impact assessment, and this contributed to our current understanding of project success. Apart from this, data collection was not systematic or designed to understand higher-level outcomes, and no comparison groups were used. This makes it difficult for project leaders to understand progress during projects and adjust accordingly; for projects and ACIAR to report results to funders for accountability purposes; and for projects and ACIAR to draw conclusions on project success, in areas such as capacity and industry adoption. A lesson is that future ACIAR projects should collect such data to inform program improvements and accountability.

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

The ASLP goals, while slightly different between Phases 1 and 2, focused on 3 key areas:

- enhancing the capacity of research and extension systems
- supporting poverty alleviation for smallholder farmers
- supporting value chains.

The ASLP mango projects demonstrate good alignment with each of these goals, noting the lack of systematic monitoring data makes it difficult to assess project contributions to achieving these goals.

This review also examined the extent to which the ASLP 'programmatic' approach added value to the mango projects. **The value chain and production projects benefited from being part of ASLP**, as the program enabled close collaboration between the 2 project areas. At the same time, **collaboration between the mango and social science projects was not as strong as anticipated** – likely to the detriment of all projects.

Capacity of research and extension systems

There is good alignment between the mango projects and the goal of enhancing the capacity of Pakistan's research and extension systems. The projects contributed to a better research capacity, particularly through support to the UAF post-harvest research laboratory. While efforts were made to increase extension capacity, the lack of systematic data precludes a robust assessment of whether this was achieved.

Poverty alleviation for smallholder farmers

The mango projects were appropriately pro-poor and were well-aligned with the ASLP goal of supporting smallholder farmers. The production projects had appropriate strategies in place to ensure project results were available to smallholder farmers, while the value chain projects implemented one demonstration value chain specifically focused on smallholders.

Given it was not possible for the value chain projects to scale-up value chains, and the lack of data on the adoption of ASLP best practices by smallholders outside the demonstration sites, it is challenging to make a robust assessment of whether the projects resulted in wider adoption or outcomes for smallholder farmers. Greater poverty alleviation may have been achieved with more targeted gender and social inclusion analysis for the projects.

Supporting value chains

It is clear that the projects explicitly supported value chains, given the focus of the value chain projects and the links between the production and value chain projects. The projects also achieved outcomes in this area by demonstrating that value chain approaches could function in Pakistan.

One area where perhaps more value chain work could have been undertaken was for nurseries in the production projects. The production projects' final independent review highlighted that more work was needed to convince farmers of the benefits of high health trees, and through this, create greater incentives for more nurseries to adopt ASLP nursery management practices.

Programmatic level value-add

ASLP put in place a small number of processes to facilitate a 'programmatic' approach. In both phases, a key approach was an annual meeting of project teams in Australia. These annual meetings were designed to help build relationships and foster collaboration between the different project teams. Joint trainings were also conducted with all project teams in areas such as communication skills, and extension theory and methods.

A further approach was added for ASLP's second phase, when the social science project (ASEM/2010/003) was added to the program. This project, which was run by a team from the University of Canberra, aimed to:

- increase the engagement of rural poor who may benefit from the commodity-based projects (citrus, dairy and mango)
- increase collaboration between project teams
- foster effective collaborative development in rural Pakistan.

Based on interviews, **it is clear that the 2 mango projects collaborated well with each other.** One project team member stated that 'all the achievements in the value chain project were really supported by the production project'. Interviewees described how the projects:

- had joint meetings in Australia and Pakistan
- worked together to jointly determine what each project should focus on to avoid duplication
- referred any problems that were identified to the project best placed to address them
- used some of the same farms and growers in Phase 2, where appropriate.

It is also clear **that this collaboration was enabled by the projects coming under the ASLP umbrella.**

There were clearly natural linkages and goal alignment between the projects. However, the ASLP/ACIAR teams also drove collaboration to ensure it actually took place, for example, by facilitating the annual ASLP meetings. In some interviewee views, the close interaction between the production and value chain projects would not have taken place without ASLP, given the projects had different partners in Pakistan and that production and value chain projects have not traditionally worked together.

Unfortunately, **collaboration between the mango projects and the Phase 2 social science project was not as strong as anticipated.** The mango projects' Phase 2 proposals outlined strong aspirations for working with the social science project, for example, to seek their assistance to engage smallholders, women and commission agents, and ensure project benefits extended to the poor and marginalised.

There is some evidence of the social and mango projects working together. For example:

- The final report for the value chain projects mentions that value chain projects worked with the social science project to facilitate training of village women in pickle production and marketing.
- Some community centres established by the social science project appear to have been linked with value chain and production initiatives in the same villages.

However, both project documents and interviews outlined **that collaboration between the social science and mango projects was less than ideal.** The general view from interviewees was that the mango and social science projects were not able to add significant value to each other's work. A number of explanations for this were provided, including:

- The purpose of the social science project was unclear and it was 'tacked on' to ASLP. There were also different views and expectations on entry points and what success might look like for the social project.
- The objectives of the mango and social science projects were not well aligned. Mango project members felt the data collected by the social science project was too general to be helpful.
- The projects struggled to find common ground where they could work easily together. This was likely exacerbated by the social science project starting in Phase 2 after the mango projects had established partners and sites. The social science project also required some time to come to grips with the program and be in a position to support other projects.

- The social science and mango projects had different research approaches and this made collaboration more challenging, as illustrated by this quote from the final report for the mango value chain project: 'The value chain research approach was more active and interventionist while the social project's approach emphasised observation, description and reflection, with a tendency to avoid direct involvement in actions to improve situations being studied. This reliance on two different methodologies, while entirely defensible for each project, added a further layer of complexity in terms of working to mutually agreeable timetables' (Collins, Sun and Ayyaz 2015:38).
- A small number of interviewees felt that the relationships between mango and social science projects were not open or trusting, as the social science project was overly critical and not supportive of the mango projects.

A key lesson from the strong relationships within projects, the strong relationships between projects, and the challenges between the mango and social science projects is that the **importance of appropriate team membership cannot be underestimated.** This is particularly true for multidisciplinary and/or systems-based approaches that require close cooperation across many disciplines. Such teams require appropriate expertise, but also require like-minded team players who are open to interdisciplinary ways of working, are collaborative, and are able to build strong relationships across countries and projects. Project team members also stated a strong preference for having all expertise – including in social sciences – integrated into a single team to ensure all team members are working towards the same goals.

Conclusions and lessons learned

Overall, the mango projects achieved a significant number of outputs. They generated new scientific and market knowledge, and created multiple demonstration sites. This led to strong outcomes for direct participants in demonstration sites, and increased capacity for project collaborators and the University of Agriculture Faisalabad (UAF) post-harvest laboratory. However, it is difficult to assess the capacity changes for some organisations, as well as whether higher outcomes around dissemination and broad adoption by the industry have been achieved, due to the limits of the projects' monitoring and evaluation systems.

The projects' achievements were supported by participatory and systems-based approaches, and high-quality science. Strong relationships within and between project teams, as well as good budget management, also facilitated project success.

Lessons learned

This evaluation highlights some general lessons for ACIAR projects and programs:

- 1. Projects need monitoring systems that systematically collect data on changes in capacity and broad uptake by industry.** This would allow projects and ACIAR to understand if, during their lifetime, the projects are making progress towards higher-level outcomes. If progress is not being made as desired, adjustments could be made as required. Systematic monitoring systems would also ensure more data was available to make a case for whether outcomes have been achieved in the long-term.
- 2. ACIAR and project teams should design and implement projects with long-term sustainability in mind.** This could include early research on how successful scale-up might be implemented; identification of partners to be the long-term 'home' of project outputs; systems for the ongoing maintenance and dissemination of project outputs; and project engagement with government agencies and sector actors who are needed for long-term success. Further, ACIAR could also consider whether longer projects (for instance, 10-plus years) may be beneficial, given the long-term timeframes needed to change the behaviour of some industry actors and to achieve scale-up.
- 3. Gender analysis and social inclusion analysis, and the development of gender and social inclusion strategies, should be undertaken at the start of project planning.** This will assist projects to develop a more strategic approach to influencing gender equity, to ensuring people with disability and other marginalised groups can benefit from projects, and to developing clear strategies which maximise poverty-reduction outcomes for smallholders. This holds true regardless of the research focus: even projects with an apparently narrow focus (for example, commodity production) can have potential consequences and opportunities related to gender and social inclusion.
- 4. The importance of appropriate project team membership cannot be underestimated.** This is particularly true for multidisciplinary and/or systems-based approaches that require close cooperation across many disciplines. Such teams require appropriate expertise, but also require like-minded team players who are open to interdisciplinary ways of working, are collaborative, and are able to build strong relationships across countries and projects. Consideration should also be given to integrating social science expertise into commodity-based teams.



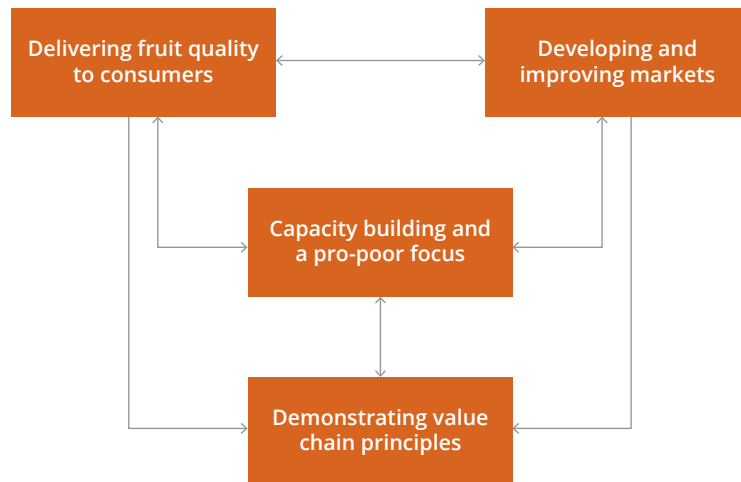
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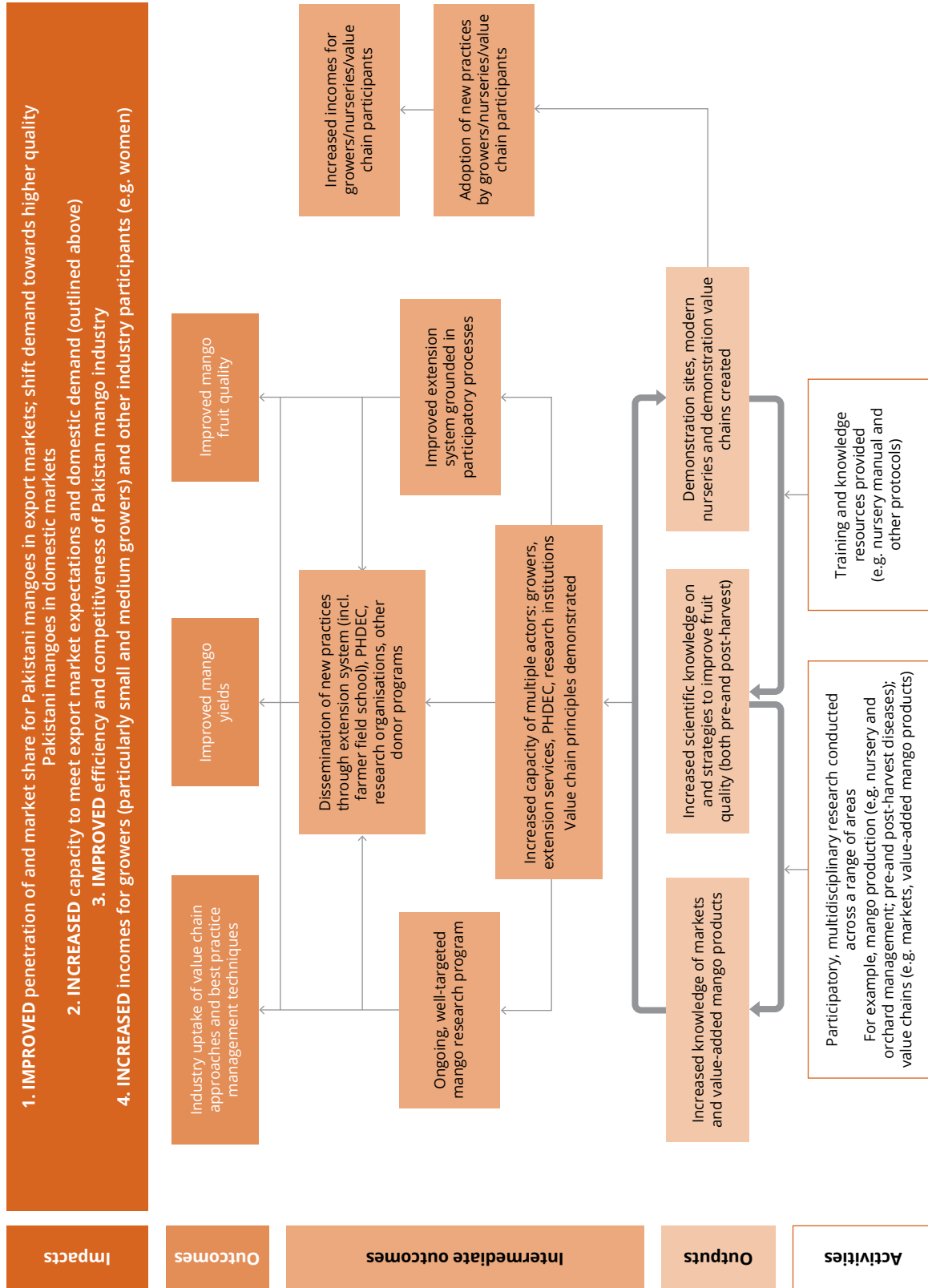
Appendixes

Appendix 4.1: Value chain projects' concept



Source: Collins R (2014) *Project proposal: Mango value chain improvement (variation July 2014)*.

Appendix 4.2: Theory of change



Appendix 4.3: Stakeholders consulted

Name	Title	Organisation or location
Dr Ian Bally	Project Leader – Production	Queensland Department of Primary Industries
Mr Tariq Khan	President	Mango Grower Association Multan
Mr Hadi Leghari (written inputs only)	Project collaborator	Asim Farm Sindh
Professor Ray Collins	Project Leader – Value Chains	University of Queensland
Dr Aman Malik	Head of Post-harvest Laboratory	University of Agriculture Faisalabad
Mr Sohail Ayaz	Project Coordinator – Value Chains	Based in NARC for the projects
Mr Mohmmod Shad	Grower	Sindh Mango Growers and Exporters
Dr Greg Johnson	Consultant and Program Coordinator (Phase 1)	ACIAR (formerly)
Dr Kazmi Munawar	Project Coordinator – Production (Phase 1) ACIAR Country Manager, Pakistan (Phase 2)	ACIAR



Appendix 4.4: Project evaluation framework

The data and process used for addressing each of the key evaluation questions (KEQs) is summarised in the table. Bold questions are high priority and were explored in more depth.

Key Evaluation Question	Evidence/information required	Data sources	Data collection and analysis approach
<p>1. What was the project's theory of change; and how did this evolve during implementation?</p> <ul style="list-style-type: none"> - Was the theory of change appropriate to the project context and desired results? 	<ul style="list-style-type: none"> Documented theory of change at project commencement Information on subsequent changes Information on project context Perspectives of key stakeholders regarding appropriateness of the theory of change 	<ul style="list-style-type: none"> Project concept / design documents and variations Project progress reports, annual plans etc Key stakeholders (project managers and collaborating partners, program manager/ coordinator, government authorities, producers, businesses) 	<ul style="list-style-type: none"> Desk review of available documents Interviews with key stakeholders Triangulation of findings from different sources Project verification workshops
<p>2. What outcomes (intended and unintended) has the project achieved or contributed to?</p> <ul style="list-style-type: none"> - What was the unique knowledge contribution of the project/cluster that was/is expected to influence practice/policy? - To what extent is there evidence of adoption of new practices based on research process and findings? 	<ul style="list-style-type: none"> Robust, documented evidence of progress towards planned outputs and outcomes (including progress along adoption pathways), and any unintended consequences Theory of change assessment from KEQ1 Perspectives of key stakeholders, to test/validate written reporting, including 'next users' of research outputs 	<ul style="list-style-type: none"> Annual and/or final reports Mid-term and/or final reviews Key stakeholders (as above) 	<ul style="list-style-type: none"> Desk review of available documents Interviews with key stakeholders Triangulation of findings from different sources Project verification workshops ACIAR progress assessment and analysis tools (e.g. Table 9 and Table 10)
<p>3. How did project activities and outputs contribute to the outcomes achieved?</p> <ul style="list-style-type: none"> - To what extent and how did they differ from what was planned? 	<ul style="list-style-type: none"> Theory of change assessment from KEQ1 Documented evidence of impact pathways, as per KEQ2 Perspectives of key stakeholders including 'next users' of research outputs 	<ul style="list-style-type: none"> Annual and/or final reports Mid-term and/or final reviews Key stakeholders (as above) 	<ul style="list-style-type: none"> Documentation review, stakeholder interviews, triangulation, verification workshops Analysis of adoption and impact pathways, including 'next users' (e.g. Table 9 and Table 10)

Appendix 4.4: Project evaluation framework (cont.)

Key Evaluation Question	Evidence/Information required	Data sources	Data collection and analysis approach
<p>4. What strategies were adopted to address gender equity and social inclusion and how effective were these?</p> <ul style="list-style-type: none"> – How did the project impact men and women differently? 	<ul style="list-style-type: none"> • Evidence of analysis/awareness of the potential gender equity issues that may impact on the project • Evidence of steps taken to address the issues identified • Evidence of level of participation of women and men in research activities • Evidence on changes in women's and men's control of assets, resources and decision-making, and gender equity (e.g. through impacts on female researchers; gendered knowledge generation; influence on inclusivity within partner organisations) • Perspectives of key stakeholders 	<ul style="list-style-type: none"> • Documented gender strategy or analysis (if available) • Existing reports providing gender-disaggregated data and/or discussion of gender issues, e.g. annual and/or final reports, mid-term and/or final reviews • Any existing gender audits or inclusion-focused reviews • Key stakeholders (as above) 	<ul style="list-style-type: none"> • Documentation review, stakeholder interviews, triangulation, verification workshops • Gender analysis to explore the level and type of participation of men and women, and influence on positive or harmful gender norms
<p>5. How did management arrangements impact delivery of the project?</p> <ul style="list-style-type: none"> – What other factors influenced project performance? 	<ul style="list-style-type: none"> • Any existing reporting and commentary on management arrangements • Perspectives of key stakeholders • Evidence of contextual factors external to the project that may have impacted performance 	<ul style="list-style-type: none"> • Annual and/or final reports • Mid-term and/or final reviews • Key stakeholders (as above) 	<ul style="list-style-type: none"> • Documentation review, stakeholder interviews, triangulation, verification workshops • ACIAR progress assessment tools (e.g. Table 11)
<p>6. How well did the project align with and contribute to the overall goals of its umbrella program?</p> <ul style="list-style-type: none"> – To what extent has the programmatic approach added value at project level? 	<ul style="list-style-type: none"> • Assessment of KEQs 1–5 • Information on program goal and approach • Relevant existing reporting and commentary • Perspectives of key stakeholders 	<ul style="list-style-type: none"> • Annual and/or final reports • Mid-term and/or final reviews • Key stakeholders (as above) 	<ul style="list-style-type: none"> • Assessment of consistency and value-add, based on analysis for KEQs 1–5 and supplementary program-level documentation, stakeholder interviews and verification workshops



Appendix 4.5: ASLP goals

ASLP ran for 2 phases between 2005 and 2015.

The goals of ASLP's first phase (2005–2010) were:

1. To transfer Australian knowledge and expertise to key sectors of Pakistan agribusiness to increase profitability and enhance export potential.
2. To contribute to poverty alleviation of smallholder farmers through collaborative research and development.
3. To enhance the capacity of the Pakistan research, development and extension system to deliver targeted and practical research outputs to agribusiness and farmers.

The goals for the second phase were adapted, but retained a core focus on building value chains to support smallholder farms, and building technical capacity in Pakistan. The Phase 2 goals were:

1. Pro-poor value chains: To support 'keystone' interventions to sustainably enhance selected value chains, and increase understanding and delivery of benefits to the rural poor through productivity improvements and market and employment opportunities.
2. Agricultural capability: To enhance agriculture capability and sustainably improve agricultural value chains by providing short-term 'smart linkages', scoping studies and other initiatives, as well as longer-term formal training, that are demand driven and catalytic, and complement the initiatives supported under other components of the program.
3. Enabling policy: To support policy analysis and interventions which improve or enable better economic and natural resource management, particularly where they underpin or strengthen pro-poor value chains and more sustainable farming systems.

Appendix 4.6: Project team members

#	Team member	Gender	International/National researcher
Production projects – HORT/2005/153 and HORT/2010/006			
1	Dr Chrys Akem	M	International
2	Bob Williams	M	International
3	Tony Cooke	M	International
4	Ian Bally	M	International
5	Rowland Holmes	M	International
6	Lisa Still	F	International
7	Kerry-Lee Stockdale	F	International
8	Jan Dean	F	International
9	Dr Iftikhar Ahmad	M	National
10	Munawar Kazmi	M	National
11	Tariq Malik	M	National
12	Muhammad Ikhlaq	M	National
13	Dr Atta Soomro	M	National
14	Igrar A Khan	M	National
15	Abdul Buriro	M	National
16	Ahmad Mubarik	M	National
17	Hadi Leghari	M	National
18	Lindy Coates*	F	International
19	Tony Cooke*	M	International
20	Dr Ian Newton	M	International
21	Paula Boccalatte	F	International
22	Faisal Sohail Fateh	M	National
23	Khalid Mahmood	M	National
24	Dr Saeed Shafqat	M	National
25	Dr Kazi Memon	M	National
26	Yousif Channa	M	National
27	Asif Iqbal	M	National
Value chain projects – HORT/2005/157 and HORT/2010/001			
28	Ray Collins	M	International
29	Tony Dunne	M	International
30	Jodie Campbell	F	International
31	Dr Peter Hofman	M	International
32	Terry Campbell	M	International
33	Lee Barker	M	International



Appendix 4.6: Project team members (cont.)

#	Team member	Gender	International/National researcher
34	Rod Jordan	M	International
35	Peter Johnson	M	International
36	Muhammad Iqbal	M	National
37	Dr Aman Ullah Malik	M	National
38	Dr Khalid Mustafa	M	National
39	Majid	M	National
40	Asif	M	National
41	Mr Nizamani	M	National
42	Mahmood Shah	M	National
43	Tim Sun	M	International
44	Peter Hofman	M	International
45	Leigh Barker	M	International
46	Lindy Coates*	F	International
47	Tony Cook*	M	International
48	Greg Johnson	M	International
49	Dr Barbar Ehsan Bajwa	M	National

* Part of both value chain and production project series.

Appendix 4.7: Research outputs

Peer-reviewed journal articles	
Publication	Author (gender, nation)
Abdul J, Malik AU, Anwar R, Ayub M, Rajwana IA, Amin M, Khan AS and Saeed M (2011) 'Effect of combined application of fungicides and hot water quarantine treatment on postharvest diseases and quality of mango fruit', <i>Pakistan Journal of Botany</i> , 43(1):65–73. Impact factor: 0.947	Abdul (Male, Pakistan) Malik (Male, Pakistan) Anwar (Male, Pakistan) Ayub (Male, Pakistan) Rajwana (Male, Pakistan) Amin (Male, Pakistan) Khan (Male, Pakistan) Saeed (Male, Pakistan)
Abro MA, Marri SA, Kumar L, Pussio GB, Jatoi GH (2014) 'Behaviour of <i>Fusarium nivale</i> causal agent of mango malformation against different culture media and range of different temperatures and in-vitro control', <i>European Academic Research Journal</i> , 2(8):10089–10113.	Abro (Male, Pakistan) Marri (Male, Pakistan) Kumar (Male, Pakistan) Pussio (Male, Pakistan) Jatoi (Male, Pakistan)
Amin M, Malik A, Khalid MS and Anwar R (2013) 'Fruit harvest maturity indicators for mango cultivars 'Sindhri' and 'Samar Bahisht Chaunsa'', <i>Acta Horticulturae</i> , 992:561–567.	Amin (Male, Pakistan) Malik (Male, Pakistan) Khalid (Male, Pakistan) Anwar (Male, Pakistan)
Amin M, Malik AU, Khan AS and Javed N (2011) 'Potential of fungicides and plant activator for postharvest disease management in mangoes', <i>International Journal of Agriculture and Biology</i> , 13:671–676. Impact factor: 0.940	Amin (Male, Pakistan) Malik (Male, Pakistan) Khan (Male, Pakistan) Javed (Male, Pakistan)
Arif AM, Malik MT, Hussain N, Ahmad I and Bally ISE (2015) 'Management of Mango Decline using Thiophanate Methyl and Plant Activators through a Macro Infusion System', <i>Acta Horticulturae</i> , 1105:35–38.	Arif (Male, Pakistan) Malik (Male, Pakistan) Hussain (Male, Pakistan) Ahmad (Male, Pakistan) Bally (Male, Australia)
Asif I, Fateh FS, Munawar KR, Chrys AN, Bhar PG and Nazim LH (2011) 'Trend of mango sudden death syndrome (MSDS) in relation to fungal microflora and nematodes fauna in Punjab, Pakistan', <i>Pakistan Journal of Nematology</i> , 29(1):45–51.	Asif (Male, Pakistan) Fateh (Male, Pakistan) Munawar (Male, Pakistan) Chrys (Male, Australia) Bhar (Male, Pakistan) Nazim (Male, Pakistan)
Asma R, Shazia I and Ahmad I (2013) 'Study on incidence, molecular characterization and pathogenesis of different fungi associated with sudden death of mango', <i>International Journal of Agronomy and Plant Production</i> , 4(Special Issue):3485–3488.	Asma (Female, Pakistan) Shazia (Female, Pakistan) Ahmad (Male, Pakistan)
Collins R and Iqbal M (2011) 'Integrating postharvest, marketing and supply chain systems for sustainable industry development: the Pakistan mango industry as work-in-progress', <i>Acta Horticulturae</i> , 895:91–97.	Collins (Male, Australia) Iqbal (Male, Pakistan)
Dunne A and Johnson P (2011) 'The rapid supply chain appraisal approach: A case study of Pakistan mangoes to the United Kingdom', <i>Acta Horticulturae</i> , 895:107–112.	Dunne (Male, Australia) Johnson (Male, Australia)



Peer-reviewed journal articles	
Publication	Author (gender, nation)
Fateh FS, Kazmi MR, Ahmed I and Ashraf M (2006) 'Ceratozystis Frimbriata isolated from Vascular Bundles of Declining Mango Trees in Sindh, Pakistan', <i>Pakistan Journal of Botany</i> , 38(4):1257–1259.	Fateh (Male, Pakistan) Kazmi (Male, Pakistan) Ahmad (Male, Pakistan) Ashraf (Male, Pakistan)
Hafeez O, Malik AU, Khan AS, Rehman A and Javaid QA (n.d.) 'Impact of different packaging types and low temperature shipping durations on fruit quality and marketability of Pakistani mangoes', <i>International Journal of Agriculture and Biology</i> , 14:47–54.	Hafeez (Male, Pakistan) Malik (Male, Pakistan) Khan (Male, Pakistan) Rehman (Male, Pakistan) Javaid (Male, Pakistan)
Hainzer K, Best T and Brown P (2019) 'Local value chain interventions: a systematic review', <i>Journal of Agribusiness in Developing and Emerging Economies</i> , 9(4):369–390.	Hainzer (Male, Australia) Best (Female, Australia) Brown (Male, Australia)
Iqbal N and Shafqat S (2012) 'Isolation of mango quick decline fungi from mango bark beetle, <i>Hypocryphalus mangiferae</i> S.(Coleoptera: Scolytidae)', <i>The Journal of Animal Science</i> , 22:644–648.	Iqbal (Male, Pakistan) Shafqat (Male, Pakistan)
Iram S and Abrar S (2014) 'Isolation and Molecular Characterization of <i>Lasiodiplodia theobromae</i> by SSR Markers', <i>International Journal of Agronomy and Plant Production</i> , 5(1):31–36. Impact factor: 0.467	Iram (Female, Pakistan) Abrar (Female, Pakistan)
Iram S and Abrar S (2015) 'Pathological and molecular characterization of post harvest fungal pathogens of mango', <i>International Journal of Agronomy and Plant Production</i> . Impact factor: 0.467	Iram (Female, Pakistan) Abrar (Female, Pakistan)
Iram S and Ahmad I (2013) 'Major post-harvest diseases of mango and their management', <i>International Journal of Agronomy and Plant Production</i> , 4(12):3470–3484. Impact factor: 0.467	Iram (Female, Pakistan) Ahmad (Male, Pakistan)
Iram S, Rasool A and Ahmad I (2014) 'Comparison of Incidence, Prevalence and Severity of Post-Harvest Fungal Diseases in Pakistan improved integrated management orchards and conventional practices blocks', <i>International Journal of Science and Engineering Research</i> , 5(10):1274–1284. Impact factor: 3.2	Iram (Female, Pakistan) Rasool (Male, Pakistan) Ahmad (Male, Pakistan)
Jabbar A, Malik AU, Maqbool M, Amin M, Saeed M and Hameed R (2012) 'Anti-sap chemicals and hot water quarantine treatment effects on storage life and fruit quality of mango cv. Samar Bahisht Chaunsa', <i>Pakistan Journal of Botany</i> , 44(2):757–64. Impact factor: 0.907	Jabbar (Male, Pakistan) Malik (Male, Pakistan) Maqbool (Male, Pakistan) Amin (Male, Pakistan) Saeed (Female, Pakistan) Hameed (Female, Pakistan)

Appendix 4.7: Research outputs (cont.)

Peer-reviewed journal articles	
Publication	Author (gender, nation)
Jabbar A, Malik AU, Saeed M, Malik OH, Amin M, Khan AS, Rajwana IA, Saleem BA, Hameed R and Mazhar MS (2011) 'Performance of hot water phytosanitary treated mangoes for intended export from Pakistan to Iran and China', <i>International Journal of Agriculture and Biology</i> , 13:645–651. Impact factor: 0.940	Jabbar (Male, Pakistan) Malik AU (Male, Pakistan) Saeed (Female, Pakistan) Malik OH (Male, Pakistan) Amin (Male, Pakistan) Khan (Male, Pakistan) Rajwana (Male, Pakistan) Saleem (Male, Pakistan) Hameed (Female, Pakistan) Mazhar (Male, Pakistan)
Johnson P, Malik AU, Malik OH and Campbell J (2013) 'Issues and advances in commercializing sea-freight technology of mangoes', <i>Acta Horticulturae</i> , 992:75–85.	Johnson (Male, Australia) Malik AU (Male, Pakistan) Malik OH (Male, Pakistan) Campbell (Female, Australia)
Kazmi MR, Fateh FS and Jabeen A (2008) 'Role of general mango-orchard management in disease development', <i>Science Technology and Development</i> , 27(3&4):42–44.	Kazmi (Male, Pakistan) Fateh (Male, Pakistan) Jabeen (Female, Pakistan)
Kazmi MR, Fateh FS, Majeed K, Kashkhely AM, Hussain I and Jabeen A (2005) 'Incidence and etiology of mango sudden death phenomenon in Pakistan', <i>Pakistan Journal of Phytopathology</i> , 17(2):154–458.	Kazmi (Male, Pakistan) Fateh (Male, Pakistan) Majeed (Male, Pakistan) Kashkhely (Male, Pakistan) Hussain (Male, Pakistan). Jabeen (Female, Pakistan)
Khan AS, Malik AU, Raza SA, Asad HU, Amin M and Razzaq K (2014) 'Locality and orchard management influence fruit quality of low temperature stored mangoes', <i>International Journal of Fruit Science</i> , 14(3):327–340.	Khan (Male, Pakistan) Malik (Male, Pakistan) Raza (Male, Pakistan) Asad (Male, Pakistan) Amin (Male, Pakistan) Razzaq (Male, Pakistan)
Khaskheli MI, Jiskani MM, Soomro MH, Talpur MA and Poussio GB (2011) 'Prevalence of mango sudden decline/death syndrome (MSDS) on various varieties at the orchards of different age in the vicinity of Tando Qaiser, Hyderabad, Sindh', <i>Pakistan Journal of Agriculture, Agricultural Engineering and Veterinary Sciences</i> , 27(2):160–167.	Khaskheli (Male, Pakistan) Jiskani (Male, Pakistan) Soomro (Male, Pakistan) Talpur (Male, Pakistan) Poussio (Male, Pakistan)



Peer-reviewed journal articles	
Publication	Author (gender, nation)
Malik AU, Hafeez O, Johnson P, Campbell JA, Amin M, Saeed M, Mazhar MS, Schouten S and Adeel J (2010) 'Toward developing a sea-freight supply chain for delivering Pakistani mangoes to European supermarket: a private-public sector model', <i>Acta Horticulturae</i> , 880:83–89.	Malik (Male, Pakistan) Hafeez (Male, Pakistan) Johnson (Male, Australia) Campbell (Female, Australia) Amin (Male, Pakistan) Saeed (Female, Pakistan) Mazhar (Male, Pakistan) Schouten (Male, the Netherlands) Adeel (Male, Pakistan)
Malik MT, Khan SM, Khan MA, Dasti AA, Kazmi, Grewal AG and Awan MZ (2010) 'Confirmation of the capability of <i>Ceratocystis fimbriata</i> to cause mango sudden death syndrome in Pakistan', <i>Pakistan Journal of Phytopathology</i> , 22(2):120–125.	Malik (Male, Pakistan) Khan SM (Male, Pakistan) Khan MA (unknown) Dasti (unknown) Kazmi (Male, Pakistan) Grewal (Male, Pakistan) Awan (Male, Pakistan)
Malik MT, Munaza R, Atiq-ur-Rehman, Bally I and Amae M (2014) 'Chemical and cultural management of dieback disease of mango in Pakistan', <i>Acta Horticulturae</i> , 1111:363–368.	Malik (Male, Pakistan) Munaza (unknown) Atiq-ur-Rehman (Male, Pakistan) Bally (Male, Australia) Amae (Male, Pakistan)
Malik AU, Umar M, Hameed R, Amin M, Asad HU, Hafeez O and Hofman PJ (2013) 'Phytosanitary irradiation treatments in relation to desapping and processing types affect mango fruit quality', <i>Acta Horticulturae</i> , 1012:681–692.	Malik (Male, Pakistan) Umar (Male, Pakistan) Hameed (Female, Pakistan) Amin (Male, Pakistan) Asad (Male, Pakistan) Hafeez (Male, Pakistan) Hofman (Male, Australia)
Masood A, Saeed S, Erbilgin N and Jung Kwon Y (2010) 'Role of stressed mango host conditions in attraction of and colonization by the mango bark beetle <i>Hypocryphalus mangiferae</i> Stebbing (Coleoptera: Curculionidae: Scolytinae) and in the symptom development of quick decline of mango trees in Pakistan', <i>Entomological Research</i> , 40(6):316–327.	Masood (Male, Pakistan) Saeed (Male, Pakistan) Erbilgin (Male, Pakistan) Jung Kwon (unknown)
Masood A, Saeed S, Iqbal N, Malik MT and Kazmi MR (2010) 'Methodology for the evaluation of symptoms severity of mango sudden death syndrome in Pakistan', <i>Pakistan Journal of Botany</i> , 42(2):1289–1299.	Masood (Male, Pakistan) Saeed (Male, Pakistan) Iqbal (Male, Pakistan) Malik (Male, Pakistan) Kazmi (Male, Pakistan)

Appendix 4.7: Research outputs (cont.)

Peer-reviewed journal articles	
Publication	Author (gender, nation)
Masood A, Saeed S, Mahmood A, Malik SA and Hussain N (2012) 'Role of nutrients in management of mango sudden death disease in Punjab, Pakistan', <i>Pakistan Journal of Zoology</i> , 44(3):675–83.	Masood (Male, Pakistan) Saeed (Male, Pakistan) Mahmood (Male, Pakistan) Malik (Male, Pakistan) Hussain (Male, Pakistan)
Masood A, Saeed S, Silveira SF, Akem CN, Hussain N and Farooq M (2011) 'Quick decline of mango in Pakistan: survey and pathogenicity of fungi isolated from mango tree and bark beetle', <i>Pakistan Journal of Botany</i> , 43(3)1793–1798.	Masood (Male, Pakistan) Saeed (Male, Pakistan) Silveira (Male, Brazil) Akem (Male, Australia) Hussain (Male, Pakistan) Farooq (Male, Pakistan)
Mazhar MS, Amin M, Malik AU, Campbell J and Johnson P (2011) 'Improved harvest and desapping practices affect mango fruit quality along the supply chains', <i>International Journal of Agriculture and Biology</i> , 13(5):776–780. Impact factor: 0.940	Mazhar (Male, Pakistan) Amin (Male, Pakistan) Malik (Male, Pakistan) Campbell (Female, Australia) Johnson (Male, Australia)
Mazhar MS, Collins R, Campbell JA, Malik AU, Johnson P, Dunne A, Sun X and Amin M (2010) 'Managing mango fruit quality through the supply chain: a Pakistan case study', <i>Acta Horticulturae</i> , 880:117–124.	Mazhar (Male, Pakistan) Collins (Male, Australia) Campbell (Female, Australia) Malik (Male, Pakistan) Johnson (Male, Australia) Dunne (Male, Australia) Sun (Male, Australia) Amin (Male, Pakistan)
Meer H, Iram S, Ahmad I, Fateh FS and Kazmi MR (2013) 'Identification and characterization of post harvest fungal pathogens of mango from domestic markets of Punjab', <i>International Journal of Agronomy and Plant Production</i> , 4(4):650–658. Impact factor: 0.467	Meer (Male, Pakistan) Iram (Female, Pakistan) Ahmad (Male, Pakistan) Fateh (Male, Pakistan) Kazmi (Male, Pakistan)
Memon N, Bally ISE, Fateh FS, Memon M and Kumar L (2017) 'Raising healthy seedling rootstocks of mango', <i>Acta Horticulturae</i> 1183:139–144.	Memon N (Female, Pakistan) Bally (Male, Australia) Fateh (Male, Pakistan) Memon M (Female, Pakistan) Kumar (Male, Pakistan)



Peer-reviewed journal articles

Publication	Author (gender, nation)
<p>Memon M, Dalwani MB, Memon KS, Fateh FS, Bally ISE, Memon N, Akhtar MS, Sheikh SA, Pusio GB and Chachar Q (2017) 'Sulphur stocks in 'Sindhri' mango soils in Sindh, Pakistan, in relation to leaf tissue analysis', <i>Acta Horticulturae</i>, 1183:167-174.</p>	<p>Memon M (Female, Pakistan) Dalwani (unknown) Memon KS (Male, Pakistan). Fateh (Male, Pakistan) Bally (Male, Australia) Memon N (Female, Pakistan) Akhtar (unknown) Sheikh (unknown) Pusio (Male, Pakistan) Chachar (unknown)</p>
<p>Memon M, Goraya AA, Memon KS, Fateh FS, Bally ISE, Kazmi MR, Sheikh SA, Channa MY and Sial TA (2017) 'Nutrient evaluation of 'Sindhri' mango orchards at two growth stages', <i>Acta Horticulturae</i> 1183:213-220.</p>	<p>Memon M (Female, Pakistan) Goraya (unknown) Memon, K. S. (Male, Pakistan) Fateh (Male, Pakistan) Bally (Male, Australian) Kazmi (Male, Pakistan) Sheikh (Female, Pakistan) Channa (Male, Pakistan) Sial (unknown)</p>
<p>Naqvi SAH, Perveen R, Malik MT, Malik O, Umer UD, Wazeer MS, Rehman A, Majid T and Abbas Z (2014) 'Characterization of symptoms severity on various mango cultivars to quick decline of mango in district Multan', <i>International Journal of Bioscience</i>, 4(11):157-163.</p>	<p>Naqvi (Male, Pakistan) Perveen (Female, Pakistan) Malik MT (Male, Pakistan) Malik O (Male, Pakistan) Umer (Male, Pakistan) Wazeer (Male, Pakistan) Rehman (Male, Pakistan) Majid (Male, Pakistan) Abbas (Male, Pakistan)</p>
<p>Poussio GB, Kazmi MR, Akem C and Fateh FS (2010) 'First record of <i>Ceratocystis fimbriata</i> associated with shisham (<i>Dalbergia sissoo</i>) decline in Pakistan', <i>Australasian Plant Disease Notes</i>, 5(1):63-65.</p>	<p>Poussio (Male, Pakistan) Kazmi (Male, Pakistan) Akem (Male, Australia) Fateh (Male, Pakistan)</p>
<p>Rajwana I, Amin M, Khan A and Saeed M (2011) 'Effect of combined application of fungicides and hot water quarantine treatment on postharvest diseases and quality of mango fruit', <i>Pakistan Journal of Botany</i>, 43(1):65-73. Impact factor: 0.907</p>	<p>Rajwana (Male, Pakistan) Amin (Male, Pakistan) Khan (Male, Pakistan) Saeed (Female, Pakistan)</p>

Appendix 4.7: Research outputs (cont.)

Peer-reviewed journal articles	
Publication	Author (gender, nation)
Rajwana LA, Malik AU, Bally ISE, Kazmi MR, Kham MI, Rajawana EA and Mahmood K (2013) 'Trends and challenges in mango nursery production in Pakistan', <i>Acta Horticulturae</i> , 992:63–68.	Rajwana (Male, Pakistan) Malik (Male, Pakistan) Bally (Male, Australia) Kazmi (Male, Pakistan) Kham (Male, Pakistan) Rajawana (Male, Pakistan) Mahmood (Male, Pakistan)
Rashid A, Iram S and Ahmad I (2014) 'Molecular characterization of <i>Ceratocystis manginecans</i> sp. from mango in Pakistan', <i>Pakistan Journal of Agricultural Sciences</i> , 51(4):901–905. Impact factor: 1.054	Rashid (Male, Pakistan) Iram (Female, Pakistan) Ahmad (Male, Pakistan)
Raza SA, Khan AS, Malik AU, Amin M, Asad HU and Razzaq K (2013) 'Respiration rate, physico-chemical fruit quality and consumer acceptability for Fajri mango under different storage temperatures', <i>Pakistan Journal of Agricultural Sciences</i> , 50(4):585–590. Impact factor: 1.240	Raza (Male, Pakistan) Khan (Male, Pakistan) Malik (Male, Pakistan) Amin (Male, Pakistan) Asad (Male, Pakistan) Razzaq (Male, Pakistan)
Shafqat S, Khan MI and Masood A (2011) 'Symptom development after artificial inoculation of <i>Botryodiplodia theobromae</i> , a possible causal organism to quick decline in mango trees', <i>Pakistan Journal of Agricultural Science</i> , 48(4):289–294.	Shafqat (Male, Pakistan) Khan (Male, Pakistan) Masood (Male, Pakistan)
Shafqat S, Masood A and Khan SM (2012) 'Diseased plants as a source of dissemination of mango sudden death disease in healthy mango plants', <i>Pakistan Journal of Phytopathol</i> , 24(1):21–25.	Shafqat (Male, Pakistan) Masood (Male, Pakistan) Khan (Male, Pakistan)
Sun X, Collins R, Dunne A, Bajwa B, Mazhar S and Iqbal M (2011) 'A whole of supply chain approach to developing a new market for Pakistan mangoes: The case of China', <i>Acta Horticulturae</i> , 895:277–282.	Sun (Male, Australia) Collins (Male, Australia) Dunne (Male, Australia) Bajwa (Male, Pakistan) Mazhar (Male, Pakistan) Iqbal (Male, Pakistan)
Syed RN, Mansha N, Khaskheli MA, Khanzada MA and Lodhi AM (2014) 'Chemical control of stem end rot of mango caused by <i>Lasiodiplodia theobromae</i> ', <i>Pakistan Journal of Phytopathology</i> , 26(2):201–206.	Syed (Male, Pakistan) Mansha (Male, Pakistan) Khaskheli (Male, Pakistan) Khanzada (Male, Pakistan) Lodhi (Male, Pakistan)



Conference proceedings	
Publication	Author (gender, nation)
Ali Z (28 September – 2 October 2015) 'Evaluation of acoustic firmness technology for non-destructive maturity and ripeness assessment of mangoes', <i>International Mango Symposium</i> , Darwin, Australia.	Ali (Male, Pakistan)
Amin A, Malik A, Razzaq K, Ullah S, Raza S, Khan A and Naseer M (2014) 'Influence of low temperature storage and exogenous ethylene treatment on physico-chemical fruit quality of Sindhri and Samar Bahisht Chaunsa mangoes', <i>4th International and 13th National Conference of Plant Scientists</i> , Saheed Benazir Bhutto University, KPK, Pakistan. (peer-reviewed)	Amin (Male, Pakistan) Malik (Male, Pakistan) Razzaq (Male, Pakistan) Ullah (Male, Pakistan) Raza (Male, Pakistan) Khan (Male, Pakistan) Naseer (Male, Pakistan)
Amin M (28 September – 2 October 2015) 'Dynamics of under skin browning and management prospects under low temperature stored mangoes', <i>International Mango Symposium</i> , Darwin, Australia.	Amin (Male, Pakistan)
Amin M (28 September – 2 October 2015) 'Orchard practices and fruit peel mineral contents influence postharvest disease development and severity of stem end rot in mangoes', <i>International Mango Symposium</i> , Darwin, Australia.	Amin (Male, Pakistan)
Amin M (28 September – 2 October 2015) 'Pre-cooling duration significantly affects post-storage skin colour development, enzymatic activities and organoleptic properties of S.B. Chaunsa mango', <i>International Mango Symposium</i> , Darwin, Australia.	Amin (Male, Pakistan)
Amin M, Malik AU, Asad H, Azeem F, Khalid MS and Khalid S (2014) 'Tree and fruit biological factors associated with mango fruit maturation', <i>XXIX International Horticultural Congress on Horticulture: Sustaining Lives, Livelihoods and Landscapes (IHC2014)</i> , Brisbane, Australia.	Amin (Male, Pakistan) Malik (Male, Pakistan) Asad (Male, Pakistan) Azeem (Male, Pakistan) Khalid (Male, Pakistan) Khalid (Female, Pakistan)
Ayyaz S (28 September – 2 October 2015) 'Direct marketing of fresh mango: a case study of mango smallholder in Pakistan', <i>International Mango Symposium</i> , Darwin, Australia.	Ayyaz (Male, Pakistan)
Collins R (28 September – 2 October 2015) 'An integrated approach for developing value added horticultural products at village level in developing countries: a case study of producing and marketing mango pickle by women in a poor village in Pakistan', <i>International Mango Symposium</i> , Darwin, Australia.	Collins (Male, Australia)
Dunne T (28 September – 2 October 2015) 'New market segment development—the challenges facing exporters from developing countries', <i>International Mango Symposium</i> , Darwin, Australia.	Dunne (Male, Australia)
Fateh F, Ahmed I, Malik T, Bally ISE, Mehmood A and Kazmi, MR (2014) 'Factors affecting the adoption of good mango orchard management practices in Pakistan', <i>IHC2014</i> , Brisbane, Australia.	Fateh (Male, Pakistan) Ahmed (Male, Pakistan) Malik (Male, Pakistan) Bally (Male, Australia) Mehmood (Male, Pakistan) Kazmi (Male, Pakistan)

Appendix 4.7: Research outputs (cont.)

Conference proceedings	
Publication	Author (gender, nation)
Fetah FS, Ahmad I, Mallik MT and Bally I (17–22 August 2014) 'Factors affecting adoption of good orchard management practices in Pakistan', <i>29th International Horticultural Congress</i> , Brisbane, Australia.	Fetah (Male, Pakistan) Ahmad (Male, Pakistan) Mallik (Male, Pakistan) Bally (Male, Australia) Arif, A. M. (Male, Pakistan) Kazmi, M. R. (Male, Pakistan)
Fateh F, Kazmi M, Akem C, Iqbal A and Bhar G (29 September – 1 October 2009) 'Mango Sudden Death Syndrome Assessment in Various Mango Growing Districts of Punjab, Pakistan', <i>17th Australasian Plant Pathology Society Conference</i> , Newcastle, Australia.	Fateh (Male, Pakistan) Kazmi (Male, Pakistan) Akem (Male, Australia) Iqbal (Male, Pakistan) Bhar (Male, Pakistan)
Fiaz M, Malik A, Amin M, Khan A, Rehman A, Alam M, Hofman P and Johnson P (2014) 'Production locality influences postharvest disease development and quality in mangoes', <i>XXIX International Horticultural Congress on Horticulture: Sustaining Lives, Livelihoods and Landscapes (IHC2014)</i> , Brisbane, Australia.	Fiaz (Male, Pakistan) Malik (Male, Pakistan) Amin (Male, Pakistan) Khan (Male, Pakistan) Rehman (Male, Pakistan) Alam (Male, Pakistan) Hofman (Male, Australia) Johnson (Male, Australia)
Ibell P, Bally I, Wright C and Maddox C (28 September – 2 October 2015) 'Does soil applications of fulvic acid applied with potassium sulphate influence mango fruit quality?', <i>XI International Mango Symposium</i> , Darwin, Australia.	Ibell (Female, Australia) Bally (Male, Australia) Wright (Female, Australia) Maddox (Female, Australia)
Ibell P, Bally I, Wright C and Maddox C (28 September – 2 October 2015) 'When is the best time to apply postharvest Nitrogen fertiliser?' <i>XI International Mango Symposium</i> , Darwin, Australia.	Ibell (Female, Australia) Bally (Male, Australia) Wright (Female, Australia) Maddox (Female, Australia)
Khan A (28 September – 2 October 2015) 'Exogenous application of PUT, SA, OA and CaCl ₂ delayed fruit ripening and maintaining fruit quality of 'Samar Bahisht Chaunsa' mango', <i>International Mango Symposium</i> , Darwin, Australia.	Khan (Male, Pakistan)
Kumbhar M (28 September – 2 October 2015) 'Impact of mango preservation technology training on knowledge and adoption of rural women in Sindh Pakistan', <i>International Mango Symposium</i> , Darwin, Australia.	Kumbhar (Male, Pakistan)
Kumbhar M (28 September – 2 October 2015) 'Study of mango marketing system in selected districts of Sindh Province, Pakistan', <i>International Mango Symposium</i> , Darwin, Australia.	Kumbhar (Male, Pakistan)
Lodhi A (28 September – 2 October 2015) 'Influence of fungicide treatments on mango stem end rot development in commercial export consignments and colony growth of <i>Lasiodiplodia theobromae</i> ', <i>International Mango Symposium</i> , Darwin, Australia.	Lodhi (Male, Pakistan)
Lodhi A (28 September – 2 October 2015), 'Monitoring of postharvest diseases and pathogens in mango export farms of Sindh, Pakistan', <i>International Mango Symposium</i> , Darwin, Australia.	Lodhi (Male, Pakistan)



Conference proceedings	
Publication	Author (gender, nation)
Malik A (28 September – 2 October 2015) 'Mango value chain development through postharvest research and development—a developing country case study', <i>International Mango Symposium</i> , Darwin, Australia.	Malik (Male, Pakistan)
Malia A, Amin M and Asad U (2014) 'Advances and challenges in value chain development in 'Kinnow' mandarin and mango industries of Pakistan', <i>XXIX International Horticultural Congress on Horticulture: Sustaining Lives, Livelihoods and Landscapes</i> (IHC2014), Brisbane, Australia.	Malik (Male, Pakistan) Amin (Male, Pakistan) Asad (Male, Pakistan)
Malik A, Javed H, Amin M, Hofman P, Khan A and Amjad A (2014) 'Impact of pre-cooling and cold storage on post-storage peel colour development & other physico-chemical and physiological attributes of mango cv. Samar Bahisht Chaunsa', <i>4th International and 13th National Conference of Plant Scientists</i> , Saheed Benazir Bhutto University, KPK, Pakistan. (peer-reviewed)	Malik (Male, Pakistan) Javed (Hafiz, Pakistan) Amin (Male, Pakistan) Hofman (Male, Australia) Khan (Male, Pakistan) Amjad (Female, Pakistan)
Mallik M, Rana M, Rehman A, Ammar M and Bally I (17–22 August 2014) 'Cultural and chemical management of dieback disease in mango in Pakistan', <i>29th International Horticultural Congress</i> , Brisbane, Australia.	Mallik (Male, Pakistan) Rana (Male, Pakistan) Rehman (Male, Pakistan) Ammar (Male, Pakistan) Bally (Male, Australia)
Mehdi M (28 September – 2 October 2015) 'Opportunities and constraints in building improved domestic mango value chains in Pakistan', <i>International Mango Symposium</i> , Darwin, Australia.	Mehdi (Male, Pakistan)
Poussio GB, Baloch NM, Kumar L, Bally I, Fateh FS, Soomro MA, Kazmi MR and Channa MY (2016) 'Effect of integrated management practices on the yield of mango in ASLP – demonstration block', <i>Acta Horticultrae</i> – proceedings of Darwin International Mango Symposium.	Poussio (Male, Pakistan) Baloch (Male, Pakistan) Kumar (Male, Pakistan) Bally (Male, Pakistan) Fateh (Male, Pakistan) Soomro (Male, Pakistan) Kazmi (Male, Pakistan) Channa (unknown)
Poussio GB, Bally I, Kumar L, Fateh FS, Kazmi M, Jiskani MM, Channa MY and Memon AJ (2013) 'Culture sensitivity test of <i>Ceratocystis fimbriata</i> associated with mango sudden decline (MSD) (poster)', ICPP, China.	Poussio (Male, Pakistan) Bally (Male, Australia) Kumar (Male, Pakistan) Fateh (Male, Pakistan) Kazmi (Male, Pakistan) Jiskani (Unknown, Pakistan) Channa (Male, Pakistan) Memon (Female, Pakistan)
Quershi A, Galea V, Akem C, Atkin E and Bally I (25–28 November 2013) 'The effect of postharvest hot fungicide dip and exogenous ethylene gas application on the incidence of dendritic spot and stem end rot in Kensington Pride (KP) mangoes', <i>19th Australian Plant Pathology Conference</i> , Auckland, New Zealand.	Quershi (Female, Pakistan) Galea (Male, Australia) Akem (Male, Australia) Atkin (Female, Australia) Bally (Male, Australia)

Appendix 4.7: Research outputs (cont.)

Conference proceedings	
Publication	Author (gender, nation)
Quershī A, Galea V, Akem C, Atkin E and Bally I (25–28 November 2013) 'The effect of bagging on the incidence of dendritic spot and stem end rot in Kensington Pride (KP) mangoes', <i>19th Australian Plant Pathology Conference</i> , Auckland, New Zealand.	Quershī (Female, Pakistan) Galea (Male, Australia) Akem (Male, Australia) Atkin (Female, Australia) Bally (Male, Australia)
Rajwana IA, Malik AU, Bally I, Kazmi M, Ikhlaq M and Rajwana EA (2013) 'Trends and Challenges in Mango Nursery Production in Pakistan', <i>Acta Horticulturae</i> 992:63–68 (conference proceedings). (peer-reviewed)	Rajwana (Male, Pakistan) Malik (Male, Pakistan) Bally (Male, Australia) Kazmi (Male, Pakistan) Ikhlaq (Male, Pakistan) Rajwana (Male, Pakistan)
Rehman A (28 September – 2 October 2015) 'Research and development in mango postharvest disease management in Pakistan', <i>International Mango Symposium</i> , Darwin, Australia.	Rehman (Male, Pakistan)
Ul Haq I, Ghaffar A and Umar H (28 September – 2 October 2015) 'Standardization of potting media for the rapid growth of mango nursery plants', <i>XI International Mango Symposium</i> , Darwin, Australia.	Ul Haq (Male, Pakistan) Ghaffar (Male, Pakistan) Umar (Male, Pakistan)



University theses	
Publication	Author (gender, nation)
Abrar S (2014) 'Genetic variability among post-harvest fungal pathogens of <i>Mangifera indica</i> L. by molecular marker' [Master thesis], Jinnah Women University, Rawalpindi.	Abrar (Female, Pakistan)
Amin M (2012) 'Integrated approaches for improving fruit quality and shelf life of two commercial mango cultivars of Pakistan', [Master thesis], Faisalabad University of Agriculture, Pakistan.	Amin (Male, Pakistan)
Amin MA (2013) 'Effectiveness of different traps as a monitoring tools for mango blossom and leaf gall midges', [MSc thesis], Bahauddin Zakariya University, Multan.	Amin (Male, Pakistan)
Arain RH (n.d.) 'Evaluation of fertilizer practices on NPK nutrition of mango', [MSc thesis], Sindh Agricultural University, Tandojam.	Arain (Male, Pakistan)
Babbar SH (2014) 'Macronutrient evaluation in mango orchards of Kotri', [MSc thesis], Sindh Agricultural University, Tandojam.	Babbar (Male, Pakistan)
Badar H (2015) 'Value chain performance improvement for sustainable mango industry development in Pakistan', [Master thesis], UQ Gatton, Australia.	Badar (Male, Pakistan)
Bux M (2004) 'Sulphur status in soil and plant tissue of mango orchards in some districts of Sindh', [MSc thesis], Sindh Agricultural University, Tandojam.	Bux (Male, Pakistan)
Dahar GY (n.d.) 'Physiological studies of <i>Ceratocystis frimbriata</i> causal agent of MSD and its in-vitro control', [MSc thesis], Plant pathology, Sindh Agricultural University, Tandojam.	Dahar (Male, Pakistan)
Dalwani M (2014) 'Sulphur in soil and plant tissue of mango orchards in Sindh', [MSc thesis], Sindh Agricultural University, Tandojam.	Dalwani (Male, Pakistan)
Faiz H (n.d.) 'Management of mango diseases anthracnose and blossom blight by ecofriendly methods', [PhD thesis], Fatima Jinnah Women University, Rawalpindi.	Faiz (Female, Pakistan)
Feroze F (n.d.) 'Raising productive seedling rootstocks and grafts of Mango', [PhD thesis], Sindh Agricultural University, Tandojam.	Feroze (Female, Pakistan)
Fida S (2014) 'Isozymes and biocontrol analysis of <i>Collectotrichum</i> isolates from diseased mangoes', [Master thesis], Fatima Jinnah Women University, Rawalpindi.	Fida (Female, Pakistan)
Goraya AH (2013) 'NPK nutrition of mango at pre & post harvest stages', [MSc thesis], Sindh Agricultural University, Tandojam.	Goraya (Male, Pakistan)
Gullai S (2014), 'Analysis of Protein and Biocontrol Agent of Stem End Rot Fungi of <i>Mangifera indica</i> L', [Master thesis], Fatima Jinnah Women University, Rawalpindi.	Gullai (Female, Pakistan)
Jatoi SA (n.d.) 'Macronutrients in mango orchards of Khairpur Mir's Sindh', [MSc thesis], Sindh Agricultural University, Tandojam.	Jatoi (Male, Pakistan)
Kakar N (2014), 'Boron status in soil and plant tissue of mango orchards in Sindh', [MSc thesis], Sindh Agricultural University, Tandojam.	Kakar (Male, Pakistan)
Kausar R (2014) 'Genetic diversity among isolates of <i>Colletotrichum</i> species of <i>Mangifera indica</i> L. by molecular marker', [Master thesis], Fatima Jinnah Women University, Rawalpindi.	Kausar (Female, Pakistan)
Khaliq H (2014) 'Survey for damage assessment of Cecid flies on mango in Southern Punjab. Department of Plant and Environment Protection', [Master thesis], The University of Agriculture, Peshawar.	Khaliq (Male, Pakistan)
Kumar M (2014) 'Macronutrients in mango orchards of lower Sindh', [MSc thesis], Sindh Agricultural University, Tandojam.	Kumar (Male, Pakistan)
Majeed F (2015) 'Management of mango midges through irrigation schedule', [MSc thesis], Bahauddin Zakariya University, Multan.	Majeed (Male, Pakistan)

Appendix 4.7: Research outputs (cont.)

University theses	
Publication	Author (gender, nation)
Malik A (n.d.) 'Current status of mango pre-harvest diseases with respect to environmental factors', [PhD thesis], Fatima Jinnah Women University, Rawalpindi.	Malik (Female, Pakistan)
Malik H (2014) 'Evaluation of controlled atmosphere and modified atmosphere conditions for the transport of mangoes to distant markets', [PhD thesis], Punjab Agricultural Research Board, Punjab.	Malik (Male, Pakistan)
Mansoor AA (2014) 'Primary macronutrients in mango orchards of lower Sindh', [MSc thesis], Sindh Agricultural University, Hyderabad.	Ansari (Male, Pakistan)
Mari SA (n.d.) 'Internship, Behaviour of <i>Fusarium nivale</i> at different temperature, nutrient media in vitro and their control, Plant Pathology', [Master thesis], Sindh Agricultural University, Tandojam.	Mari (Male, Pakistan)
Meer H (2012) 'Post harvest fungal spoilage in local Markets of Punjab', [Master thesis], Fatima Jinnah Women University, Rawalpindi.	Meer (Male, Pakistan)
Mehdi M (2012) 'Evaluating the effectiveness of a whole of chain approach in rural industry development in developing countries: A case of Pakistan mango industry', [Master thesis], UQ Gatton, Australia.	Mehdi (Male, Pakistan)
Muhammad W (2011) 'Monitoring and management of mango gall midges through sticky coloured traps', [MSc thesis], Bahauddin Zakariya University, Multan.	Muhammad (Male, Pakistan)
Naeem G (2012) 'Efficacy of Different Fungicides on Post Harvest Fungal Disease (StemEnd Rot) Pathogen of Mango', [Master thesis], Fatima Jinnah Women University, Rawalpindi.	Naeem (Female, Pakistan)
Quershi A (2014) 'The Epidermology of Dendritic spot and Stem-end-rot of mango', [Master thesis], University of Queensland, Brisbane, Australia.	Quershi (Female, Pakistan)
Rajpar IR (2014), 'Evaluation of boron in mango orchards of lower Sindh', [Master thesis], Department of Soil Science, Sindh Agricultural University.	Raipar (Male, Pakistan)
Rana M (2012) 'Studies on die back disease of mango', [MSc thesis], Bahauddin Zakariya University, Multan.	Rana (Female, Pakistan)
Rasheed A (n.d.) 'Pathogenic and genetic characterization of strains of Ceratocystics affecting mangoes in Pakistan', [PhD thesis], Fatima Jinnah Women University, Rawalpindi.	Rasheed (Female, Pakistan)
Rashid O (2013) 'Pathological and Molecular Characterization of Post-Harvest Fungal Pathogens of Mango', [Master thesis], Fatima Jinnah Women University, Rawalpindi.	Rashid (Female, Pakistan)
Rizwan M (2013) 'Assessment of economic losses incurred by mango gall Midges', [MSc thesis], Bahauddin Zakariya University, Multan.	Rizwan (Male, Pakistan)
Solangi Y (n.d.) 'Survey and identification of different fungi associated with decline plants in Sindh', [MSc thesis], Plant Pathology, Sindh Agricultural University, Tandojam.	Solangi (Male, Pakistan)
Tahir M (n.d.) 'Detection, Quantification and Molecular Characterization of <i>Fusarium</i> spp. associated with malformation in mango orchards of Punjab and Sindh', [PhD thesis], Fatima Jinnah Women University, Rawalpindi.	Tahir (Female, Pakistan)
Talha (2012) 'Studies on mango malformation disease in Multan', [Master thesis], Bahauddin Zakariya University, Multan.	Talha (Male, Pakistan)
Ullah AH (n.d.) 'Improving the efficiency of mango breeding', [Master thesis], James Cook University, Cairns, Australia.	Ullah (Male, Pakistan)
Zubair (2012) 'Monitoring of inoculum load of <i>Fusarium mangiferae</i> in improved and traditional mango orchard', [MSc thesis], Bahauddin Zakariya University, Multan.	Zubair (Male, Pakistan)



Associated publications and seminars	
Publication	Author (gender, nation)
Akem C, Holmes R, Pinese B, Bally I, Cooke A, Johnson G and Morton J (2006) <i>Assessment of mango diseases, pest and production problems in Pakistan</i> , Queensland Department of Primary Industries and Fisheries, Brisbane, Australia.	Akem (Male, Australia) Holmes (Male, Australia) Pinese (Male, Australia) Bally (Male, Australia) Cooke (Male, Australia) Johnson (Male, Australia) Morton (Male, Australia)
Anon (2014) <i>Codes of Practice of Mango Farming and Processing – A guide book to help address the critical control points along the supply chain</i> , UNIDO - TRTA II, Faisalabad, Pakistan.	Various
Bally ISE (2007) <i>Training Award mentors report – Ijaz Rajawana</i> , Crawford Foundation, Canberra.	Bally (Male, Australia)
Bally ISE (2008) Dr. Ian Bally at Mango Research Station, Shujubad, Multan (Part-1), <i>ASLP Activities</i> , F. a. V. project, Multan, Pakistan, YouTube 9:11 min.	Bally (Male, Australia)
Bally I, Donovan N, Kurshid T and Falvine S (2013) <i>Training of Pakistani Nurserymen in Australia</i> , report to Agriculture Sector Linkage program, Agricultural Capability Fund.	Bally (Male, Australia) Donovan (Female, Australia) Kushid (Male, Australia) Falvine (Male, Australia)
Bally ISE and Kazmi MR (2009) <i>An experiment on the right time for pruning Chuansa variety</i> , Islamabad, Pakistan, NARC.	Bally (Male, Australia) Kazmi (Male, Pakistan)
Bally ISE, Kazmi MR, Iqbal A and Fateh FS (22 April 2008) 'Guidelines for Developing Modern Nursery, Mango Nursery Management', <i>ASLP mango orchard management project update seminar</i> , Sindh Horticultural Research Institute, Mirpurkhas, Pakistan, ASLP 1–7.	Bally (Male, Australia) Kazmi (Male, Pakistan) Iqbal (Male, Pakistan) Fateh (Male, Pakistan)
Holmes R (2007) <i>ASLP Australian Mango Industry Familiarisation Tour for Pakistan Delegates</i> , Canberra, Australian Centre for International Agricultural Research.	Holmes (Male, Australia)
Jabeen A, Kazmi MR and Akem C (2009) <i>Review: Sudden Death Phenomenon in Mango</i> .	Jabeen (Female, Pakistan) Kazmi (Male, Pakistan) Akem (Male, Australia)
Johnson GI, Akem C, Weinert M, Kazmi MR, Fateh FS, Abdul R, Iftikhar S and Cooke AW (2012) <i>Handbook for a Workshop on Diagnosis & Control of Mango Postharvest Diseases</i> , NARC, Islamabad, Pakistan, ACIAR.	Johnson (Male, Australia) Akem (Male, Australia) Weinert (Male, Australia) Kazmi (Male, Pakistan) Fateh (Male, Pakistan) Abdul (Male, Pakistan) Iftikhar (Female, Pakistan) Cooke (Male, Australia)
Khan MI (2012) <i>Catalogue of mango germplasm</i> , Mango Research Station, Shujubad, Pakistan.	Khan (Male, Pakistan)
Kazmi MR (2009) <i>Key for early detection of Mango Sudden Death Syndrome (MSDS) and its Management</i> , ASLP, Mango Project, National IPM Programme, NARC, Islamabad.	Kazmi (Male, Pakistan)
Kumar L (2012) 'Mango sudden death and their management after rain flood in Sindh', <i>National Mango Souvenir</i> .	Kumar (Male, Pakistan)

Appendix 4.7: Research outputs (cont.)

Associated publications and seminars	
Publication	Author (gender, nation)
Malik AU, Khan MA and Chan K (2014) <i>Codes of practice for mango farming & processing</i> , Trade Related Technical Assistance programme (TRTA II) United Nations Industrial Development Organisation (UNIDO).	Malik (Male, Pakistan) Khan (Male, Pakistan) Chan (Male, Japan)
Poussio G (2012) 'January and February activities in mango orchards', <i>Monthly Sindh Zraiat</i> , January:32.	Poussio (Male, Pakistan)
Poussio G (2012) 'Intercropping and uses of irrigation in mango orchard', <i>Monthly Sindh Zraiat</i> , November:24.	Poussio (Male, Pakistan)
Poussio G (2012) 'December activities in mango orchards', <i>Monthly Sindh Zraiat</i> , December:24.	Poussio (Male, Pakistan)
Poussio G (2013) 'December activities in mango orchards', <i>Monthly Sindh Zarait Magazine</i> , December.	Poussio (Male, Pakistan)
Poussio G (2013) 'The role of irrigation and intercropping in mango orchards', <i>Monthly Sindh Zarait Magazine</i> , January.	Poussio (Male, Pakistan)
Poussio G (2014) 'February activities in mango orchards', <i>Monthly Sindh Zarait Magazine</i> , January.	Poussio (Male, Pakistan)
Poussio GB et al. (2015) 'Influence of different fungicides and Plant extracts against <i>Ceratocystis fimbriata</i> associated with mango sudden decline (MSD)', accepted in Indian Journal.	Poussio (Male, Pakistan)
Rajpur I and Khaskhely (2015) <i>Evaluating salinity tolerance of mango rootstocks</i> , Project Brief, Centre for Biosaline Agriculture, Department of Soil Science, Faculty of Crop Production, Sindh Agricultural University.	Rajpur (Male, Pakistan) Khaskhely (Male, Pakistan)
Rajwana IA (2007) <i>Training Award Awardees end-of-training report – Ijaz Rajwana</i> , Crawford Foundation, Canberra.	Rajwana (Male, Pakistan)
Saeed S, Saeed Q, Amin MA and Rizwan M (2012) <i>Identification, monitoring and damage assessment of cecid flies of mango</i> , Department of Entomology, Faculty of Agricultural Science and Technology, Bahauddin Zakariya University.	Saeed, S (Male, Pakistan) Saeed, Q (Male, Pakistan) Amin (Male, Pakistan) Rizwan (Male, Pakistan)

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