

# **INNOVATION for INCLUSIVE VALUE-CHAIN DEVELOPMENT**

**Successes and Challenges**

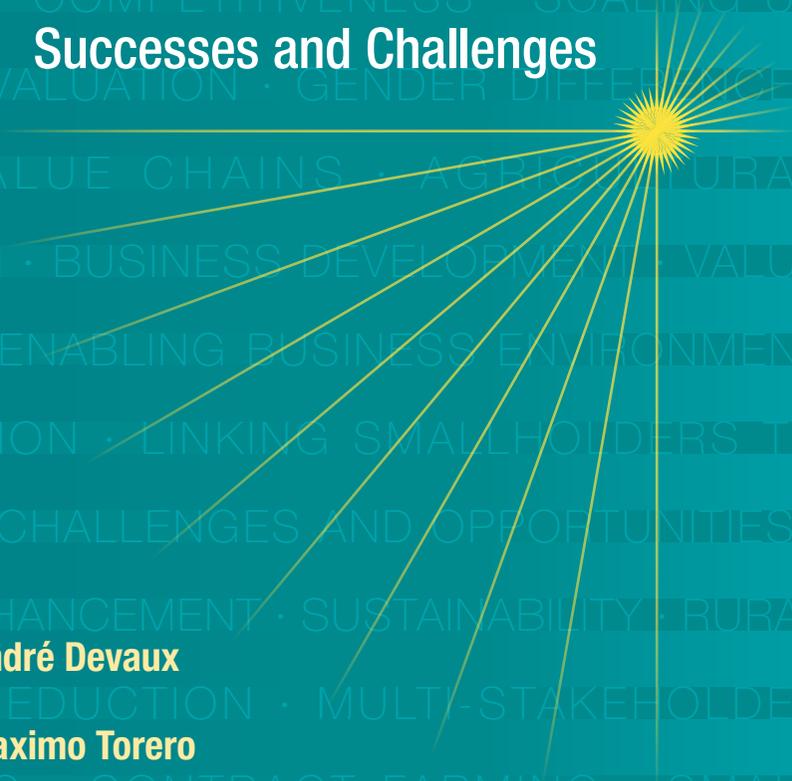
**EDITORS**

**André Devaux**

**Maximo Torero**

**Jason Donovan**

**Douglas Horton**





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# Innovation for Inclusive Value-Chain Development

Successes and Challenges

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Edited by André Devaux, Maximo Torero,  
Jason Donovan, and Douglas Horton



A peer-reviewed publication

International Food Policy Research Institute  
Washington, DC

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International Food Policy Research Institute  
2033 K Street, NW  
Washington, DC 20006-1002, USA  
Telephone: +1-202-862-5600  
[www.ifpri.org](http://www.ifpri.org)

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## **Acronyms and Abbreviations**

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AAACP	All ACP Agricultural Commodities Programme
ABS-TCM	African Breeders Services Total Cattle Management Limited
ACIAR	Australian Centre for International Agricultural Research
ADB	Asian Development Bank
ADERS	Asociación para el Desarrollo Sostenible
AI	artificial insemination
AIS	agricultural innovation-systems
AISP	artificial insemination service provider
ANDIBOL	Andino Boliviana
APEPA	Asociación de Productores Ecológicos de la Provincial Aroma
AR4D	agricultural research for development
ATE	average treatment effects
ATT	average treatment effect on the treated
BASED	Broadening Agricultural Service and Extension Delivery
BOP	base of the pyramid
CAD	Center for Agricultural Development
CAPAC	Cadenas Agrícolas Productivas de Calidad (Peru)
CAPAC-PERU	Coordinadora de Activistas del Patrimonio Ambiental y Cultural

CATIE	Tropical Agricultural Research and Higher Education Center (Costa Rica)
CENTAD	Centre for Trade and Development (India)
CEPAL	Comisión Económica para América Latina y el Caribe
CESA	Central Ecuatoriana de Servicios Agropecuarios (Ecuador)
CESP	community extension-service provider
CGIAR	Consultative Group for International Agricultural Research
CIAL	local research committee / comité de investigación agrícola local
CIAT	International Center for Tropical Agriculture
CIDE	Centro de Investigación y Docencia Económicas (Mexico City)
CIP	International Potato Center
COLNODO	Asociación Colombiana de Organizaciones no Gubernamentales para la Comunicación Vía Correo Electrónico
CONPAPA	Consortium of Small Potato Producers / Consorcio de Pequeños Productores de Papa
COS-SIS	Convergence of Sciences— Strengthening Agricultural Innovation Systems
COSUDE-INIAP	Consortium of Small Potato Producers (Ecuador)
CP	chilling plant
CRS	Catholic Relief Services
CSV	creating shared value
DCED	Donor Committee for Enterprise Development
DEO	District Extension Office
DESCO	Centro de estudios y Promoción del desarrollo (Centre for Studies and Development Promotion)
DFBA	Dairy Farmer Business Association
DFID	Department for International Development (United Kingdom)
DMG	dairy-management group

DONATA	Dissemination of New Agricultural Technologies in Africa
EADD	East Africa Dairy Development program (Kenya)
EIQ	environmental impact quotient
EPFL	Ecole polytechnique fédérale de Lausanne
ESPOCH	Escuela Superior Politécnica del Chimborazo
FAO	Food and Agriculture Organization of the United Nations
FAP	Fodder Adoption Project (Ethiopia, Syria, and Vietnam)
FARA	Forum for Agricultural Research in Africa
FFS	Farmer Field School
FIML	full-information maximum likelihood
FORTIPAPA	Fortalecimiento de la Investigación y Producción de Semilla de Papa project
FOVIDA	Asociación Fomento de la Vida
FSP	Forages for Smallholders Project
GDN	Global Development Network
IAAE	International Association of Agricultural Economists
IAD	Institutional Analysis and Development framework
IADB	Inter-American Development Bank
ICARDA	International Centre for Agricultural Research in the Dry Areas
ICO	International Coffee Organization (United Kingdom)
ICRAF	World Agroforestry Centre
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
ICT	information and communications technology
IDRC	International Development Research Centre (Canada)
IEDECA	Instituto de Ecología y Desarrollo de las Comunidades Andinas (Ecuador)
IESE	Instituto de Estudios Sociales y Económicos, Universidad Mayor de San Simon (Bolivia)
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute

IICA	Inter-American Institute for Cooperation on Agriculture / Instituto Interamericano de Cooperación para la Agricultura
ILRI	International Livestock Research Institute
INCOPA	Innovation and Competitiveness for the Potato Crop project (Peru) / Innovación y Competitividad de la Papa
INIAP	National Autonomous Institute for Agricultural Research (Ecuador) / Instituto Nacional Autónomo de Investigaciones Agropecuarias
IP	innovation platform
IPM	integrated pest management
IPMS	Improving Productivity and Market Success
ITT	intention to treat analysis
IV	instrumental variable
KARI	Kenya Agricultural Research Institute
KCC	Kenya Co-operative Creameries
KTDA	Kenya Tea Development Agency
KTI	Knowledge, Technology and Innovation group (Wageningen University)
LATE	local average treatment effects
LILI MARKETS	Livestock Livelihood and Markets project
LLSP	Livelihood and Livestock Systems project
LWR	Lutheran World Relief
M&E	monitoring and evaluation
MAAR	Ministry of Agriculture and Agrarian Reform (Syria)
MARCO	Minga para la Acción Rural y la Cooperación (Ecuador)
MCA	market-chain actor
MCC	milk-collection center
MEDA	Mennonite Economic Development Associates
NBDC	Nile Basin Development Challenge
NGO	nongovernmental organization
NIAH	National Institute of Animal Husbandry (Vietnam)

NIAS	National Institute of Animal Science
NTAE	nontraditional agricultural exports
ODI	Overseas Development Institute (United Kingdom)
OLS	ordinary least squares
OSSUP	Ugandan Oilseed Sub-sector Platform
PEA	Participatory Extension Approach
PIM	Policies, Institutions, and Markets (CGIAR research program)
PLM	Building Livelihoods Resilience to Alleviate Poverty in Semiarid Areas of West Africa
PMCA	Participatory Market Chain Approach
PPP	public–private partnership
PREVAL	Regional Platform for Evaluation Capacity Building in Latin America and the Caribbean / Programa para el Fortalecimiento de los Sistemas Gubernamentales de Seguimiento y Evaluación de Proyectos y Programas de Desarrollo Rural en América Latina y el Caribe
PROGEBE	Regional Project on Sustainable Management of Endemic Ruminant Livestock in West Africa Project / Projet Régional de Gestion Durable du Bétail Ruminant Endémique en Afrique de l'Ouest
PROINPA	Foundation for Promotion and Research of Andean Products (Bolivia) / Fundación para la Promoción e Investigación de Productos Andinos
PROLINNOVA	Promoting Local Innovation (Philippines)
PSM	propensity-score matching
RAAKS	Rapid Appraisal of Agricultural Knowledge Systems
RCT	randomized controlled trial
RDD	regression discontinuity design
RIMISP	Latin American Center for Rural Development
RIU	Research Into Use program
RMA	Rapid Market Appraisal
SDC	Swiss Agency for Development and Cooperation

SEDERA	Fundación de Servicios para el Desarrollo Rural Agropecuario (Bolivia)
SOAS	School of Oriental and African Studies (United Kingdom)
SSA CP	Sub-Saharan Africa Challenge Program
TEI	total environmental impact quotient
TNS	Technoserve
TNU	Tay Nguyen University
UNIDO	United Nations Industrial Development Organization
VBDC	Volta Basin Development Challenge
VCD	value-chain development
WLS	weighted least squares

## **Foreword:**

# **Inclusive Value-Chain Development through the Lens of *Direction*, *Distribution*, and *Diversity***

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In order to stimulate critical thinking on innovation, sustainability, and development, in 2010 the STEPS Centre (Social, Technological and Environmental Pathways to Sustainability) at the University of Sussex published its *New Manifesto*.<sup>1</sup> The main objectives of this manifesto were to introduce the ‘3D Agenda’—a new way of thinking about inclusive innovation and development—and to suggest ways for enacting this agenda. The three Ds stand for

- *direction* (what is innovation for development for, what goals should it serve?),
- *distribution* (who benefits from innovation and how can innovation become more inclusive for marginal people?), and
- *diversity* (how can a portfolio of innovation pathways be fostered to develop a range of resilient production systems and value chains?).

While not composed having the 3D Agenda explicitly in mind, the empirical research on inclusive value-chain development reported in the chapters of this book shows how the 3D Agenda can be implemented in practice. It does so by looking at experiences with technological, institutional, and social innovations to foster inclusive value-chain development. It presents a variety of

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<sup>1</sup> STEPS Centre. 2010. *Innovation, Sustainability, Development: A New Manifesto*. Brighton, UK: STEPS Centre. [http://steps-centre.org/aneumanifesto/wp-content/uploads/steps-manifesto\\_small-file.pdf](http://steps-centre.org/aneumanifesto/wp-content/uploads/steps-manifesto_small-file.pdf)

discussions of different ways to approach inclusive value-chain development; lessons from interventions to support combined technological, social, and institutional innovation to support value-chain development (through such approaches as multistakeholder platforms); and ways of monitoring and evaluating value-chain development interventions and their impacts on specific elements of value chains (for example, contract forms and gender issues). By presenting this range of approaches to understanding inclusive value-chain development, the chapters in the book touch in several elements of the 3D Agenda (*direction*, *diversity*, and *distribution*), as well as how the *New Manifesto* proposes to enact the 3D Agenda.

This being a foreword and not an overall summary of the book, I will not enter into the details of how inclusive value-chain development is being captured in different ways, as readers can discover for themselves in the book's overview (Part 1), the introductions to Parts 2, 3, and 4, and the individual chapters that present empirical research. Instead, I will briefly discuss the book's (probably unplanned and unintended) contributions in terms of the different elements of the 3D Agenda.

In Part 2 of the book, the issue of *direction* is dealt with in terms of how to shape inclusive value chains, and what form these can have. This part also touches on the issue of *diversity* of value-chain development pathways. The chapters critically discuss such questions as what real inclusion is, and to what extent such real inclusion can be sustainably realized given the web of relationships in value chains and the many interlocking factors that determine the scope for change and the effort this takes from interventions. This discussion also relates to issues of *distribution*.

Part 3 of the book, which focuses on different examples of inclusive value-chain development interventions, connects to several important elements for enacting the 3D Agenda—or, put another way, how to organize collective processes that support democratic articulation and implementation of an agenda for technological, social, and institutional innovation. Such an agenda would include capacity building for and proper organization of inclusive innovation and value-chain development processes. Part 3 also provides many examples of multistakeholder platforms, which are analyzed from different angles. Though multistakeholder platforms—which include learning alliances and innovation platforms—have been characterized as “wheelbarrows full of frogs” and their facilitation has sometimes been denoted as “herding cats,” they are key in coordinating many stakeholders in addressing complex problems and challenges. The chapters in Part 3 of the book show how multistakeholder

platforms provide *direction* to inclusive value-chain development processes and enable more democratic decisionmaking and collective action. The cases also touch on issues of *distribution*, as they empower those in weaker positions and achieve outcomes that ideally benefit all the different stakeholder groups represented on the platform. The chapters in Part 3 identify critical factors that impact on the performance of multistakeholder platforms and reflect on what could be called the dark side of multistakeholder platforms, which should by no means be seen as a development panacea. The element of *distribution* is also scrutinized and de-romanticized, in line with thinking in the *New Manifesto* on being aware of the political side of innovation for development.

Part 4 of the book focuses on issues of monitoring and evaluating inclusive value-chain development interventions, issues that are seen as highly important in the *New Manifesto*, to increase transparency and accountability in innovation for development processes, and also to enable benchmarking. The chapters show that, in order to assess the extent to which the 3 Ds have been enacted, it is essential to develop reliable metrics as well as qualitative indicators to monitor progress and evaluate impacts of inclusive value-chain development interventions. This can provide a reality check for program progress and impacts, which may also lead to reassessment of development pathways and adaptation of inclusive value-chain development interventions. Monitoring and impact evaluation of inclusive value-chain interventions are needed to determine whether intended *distribution* of benefits is realized, and can also help prioritize within a *diversity* of intervention approaches and development pathways. Ultimately, this may help determine the most fruitful *direction* for inclusive value-chain development. Part 4 shows that, whereas current monitoring and evaluation methods have been useful, there is still much to be done to become better at whole value-chain assessment and at measuring welfare impacts.

To conclude this foreword, I wish to congratulate the authors and editors of this book on the result of their work. In coherent parts, the book provides a collection of robust peer-reviewed research, which is rich in methodological diversity as well as in its variety of geographical foci. On the basis of the cases and different perspectives on inclusive value-chain development, an agenda for future research is provided. Thus, by taking stock of what we have learned so far about inclusive value-chain development, this well-timed book is likely to be a valuable reference for those working in inclusive value-chain development and also for those researching this topic. To stay in line with the terminology of the 3D Agenda, I hope the book will have a wide *distribution* among

scholars and practitioners of inclusive value-chain development, will give them *direction* to orient their work, and will help them to appropriately address the *diversity* of situations they may encounter in supporting or researching innovation for inclusive value-chain development.

Laurens Klerkx  
Associate Professor  
Knowledge, Technology and Innovation Group  
Wageningen University  
The Netherlands

## Preface

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This book—*Innovation for Inclusive Value-Chain Development: Successes and Challenges*—presents concepts and frameworks for designing, implementing, and evaluating strategies for promoting pro-poor innovation in value chains. Based on 14 case studies, the editors formulate a number of general propositions, present lessons about interventions that work well under various circumstances, and identify key areas for future research. The latter include developing methods for implementing asset-based approaches; improving the application of a “gender lens” in value-chain interventions; constructing practical approaches for evaluating action and change models and measuring impacts of complex value-chain interventions; clarifying principles underlying platform membership, management, and facilitation; and formulating approaches for upscaling successful interventions.

This publication is one of the important outputs of the CGIAR Research Program on Policies, Institutions, and Markets (PIM). The Program provides targeted analysis to strengthen the evidence for better policies, stronger institutions, and well functioning markets. The Program’s Inclusive Value Chains and Efficient Trade flagship analyzes the changing international, regional, and local contexts of agricultural markets; identifies interventions in value chains that increase efficiency and inclusion, particularly of poor and marginalized groups; and studies successful approaches to scaling up improvements in value chains.

This book will be a valuable reference for all those working to improve policies and strengthen institutions, helping them to introduce and facilitate innovation in value chains for inclusive agricultural growth.

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International Food Policy Research Institute

Barbara Wells, Director General  
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CGIAR Research Program on Policies, Institutions, and Markets

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## **PART 1**

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# **Innovation for Inclusive Value-Chain Development: Highlights**



## **INNOVATION FOR INCLUSIVE VALUE-CHAIN DEVELOPMENT: HIGHLIGHTS**

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**Douglas Horton, Jason Donovan, André Devaux, and Maximo Torero**

### **Summary**

Despite increasing use of innovation-system and value-chain approaches to promote rural income growth, poverty reduction, and greater gender equity, there is little systematic knowledge about how to operationalize value-chain approaches in different contexts and how best to evaluate innovation and value-chain development. In this book, we bring together 14 papers (chapters)—of which 12 were previously published as journal articles—that present results of recent work associated with CGIAR and its partners in Africa, Asia, and Latin America. The papers assess the opportunities emerging from new and expanding markets for agricultural produce and identify challenges to smallholder participation in these markets and the resulting benefits. They illustrate how interventions have fostered agricultural innovation and inclusive value-chain development, and the extent of their impacts. Methods for evaluating complex interventions that involve innovation and value-chain development are presented, along with empirical results of evaluation studies. From an analysis of the cases presented, we discuss emerging issues and policy implications, and identify knowledge gaps and priorities for future applied research and evaluation.

### **Introduction**

For agricultural research to benefit the rural poor, it needs to complement other efforts that improve the policy environment, alleviate resource constraints, and build local capacity for responding to changing technological and economic challenges and opportunities. Action may also be needed to influence the incentives and constraints faced by large-scale retailers and buyers, for them to engage more effectively with smallholder producers and build mutually beneficial business relationships that are able to stand the test of time. Together, such efforts can lead to tangible improvements in smallholders' production and marketing practices, which benefit smallholders as well as other

market participants. The Inclusive Value Chains concept developed in this book shows by practical examples that it is possible to link smallholder producers, including a gender and minorities focus, to modern integrated markets.

This book has been prepared by a Value Chains Flagship team of the CGIAR Research Program on Policies, Institutions, and Markets (PIM), to take stock and learn from current knowledge on linking international agricultural research, innovation, and value-chain development (VCD) to benefit the rural poor. It brings together 14 papers that grapple with the complexity of VCD in developing countries and the potential to link agricultural research more effectively with development processes through joint learning and shared approaches to fostering innovation among stakeholders. The chapters present applied research carried out by professionals in centers affiliated with CGIAR and partner organizations in Africa, Asia, and Latin America. The book identifies emerging themes and offers recommendations for policymakers and decisionmakers, and identifies priorities for future research and development (R&D) work in this area.

Value-chain researchers from throughout CGIAR were invited to propose papers for inclusion in this book. More than 30 submissions were received and reviewed for their relevance to current debates on how agricultural research, innovation, and VCD can benefit smallholders, and for their scientific quality. After careful review, 14 papers were selected for the book, of which 12 were previously published as journal articles. The primary intended users of the book are researchers, policymakers, and development professionals working in the spheres of agricultural research, innovation systems, and VCD, who are often isolated from one another and have limited access to state-of-the-art knowledge on these subjects. The book is linked to the ValueChains Knowledge Clearinghouse website ([tools4valuechains.org](http://tools4valuechains.org)) as part of the Value Chain Flagship integrative strategy to reach a network of practitioners, researchers, and policymakers.

The book has four parts.

*Part 1, Highlights*, outlines the context and purpose of the publication and identifies the intended audiences. It sets the stage for the work reviewed and presents an overview of each chapter in Parts 2–4. It then identifies themes and policy implications that emerge from the chapters, and identifies priorities for future R&D work to advance inclusive VCD.

*Part 2, Challenges and approaches for inclusive value-chain development*, contains four chapters that discuss approaches for implementing VCD with the rural poor and the various issues and challenges that can arise in the process. The first chapter reviews well-known guides for value-chain analysis,

often the first step in the implementation of VCD interventions. It compares the assumptions underpinning their design, the recommended methods for data collection and analysis, and their effectiveness across different contexts in which VCD takes place. This is followed by another review of literature, which presents new insights and perspectives on issues related to stakeholder learning in VCD. The third chapter sheds light on how smallholders accumulated their livelihood assets in response to interventions for building certified-coffee value chains in Central America. The final chapter reviews experiences with contract farming, an approach frequently used by large private firms to ensure adequate supplies of high-value produce, for processing or marketing operations.

*Part 3, Integrating agricultural innovation and inclusive value-chain development*, contains six chapters that report on experiences with integrating approaches for innovation with those for promoting inclusive VCD in Asia, Latin America, and Africa south of the Sahara. The first three chapters focus on the interface between technical R&D work and VCD, and highlight the importance of a systems view of innovation that accords importance to both supply and demand factors. The remaining three chapters focus more specifically on the role of multistakeholder platforms in fostering innovation.

*Part 4, Evaluating inclusive value-chain development*, contains four chapters that present approaches for evaluating complex interventions aimed at inclusive VCD, including quantitative tools for measuring gender differences within value chains. The Introduction provides a brief overview of each method, as well as its benefits and limitations, and the scenarios in which it should and should not be used.

## **Perspectives on Agricultural Research and Innovation**

Views on the role of agricultural research, innovation, and VCD in reducing rural poverty, and on their interrelationships, have evolved substantially. Agricultural research has often been confused with innovation. However, there are important differences between them. Research is concerned with the production of new knowledge, which may or may not be used in practice. Innovation, on the other hand, is concerned with processes of change in the production and marketing of goods and services—changes that may or may not be driven by research. A sourcebook on agricultural innovation systems published by the World Bank (2012, 2) defines innovation as “*the process by which individuals or organizations master and implement the design and*

*production of goods and services that are new to them, irrespective of whether they are new to their competitors, their country, or the world.”*

When CGIAR was established in the early 1970s, its strategy was “to use the best science in advanced countries to develop technologies for the benefit of food-deficit countries and populations” (Lele 2004, 3). At that time, agricultural research was viewed as the principal source of farm-level innovation to increase productivity and benefit poor farmers as well as consumers. In essence, research results were assumed to flow through an “innovation pipeline” from basic research conducted by advanced research institutes, to strategic research conducted by CGIAR centers, to applied and adaptive research conducted by regional and national programs, and finally through outreach or extension programs to farmer adopters (Biggs 1990; Ashby 2009).

Over time, the limits of the pipeline model have become apparent as our understanding of innovation processes has improved, more actors have become involved in research and innovation processes, and stakeholders have begun to expect agricultural research to solve more complex problems of rural poverty, food insecurity, nutrition, and sustainable management of natural resources. As a result, after the 1970s, priorities shifted from building agricultural research institutes to strengthening research systems, improving technology transfer, linking researchers with farmers, and most recently to strengthening agricultural innovation systems (Pant and Hambly 2009).

An agricultural *innovation* system is much broader and more complex than an agricultural *research* system. As defined by the World Bank (2012, 2) an agricultural innovation system is “a network of organizations, enterprises, and individuals focused on bringing new products, new processes, and new forms of organization into economic use, together with the institutions and policies that affect their behavior and performance.” Such a system is concerned not only with the production, exchange, and use of new knowledge, but also with fostering entrepreneurship, developing a vision for change, mobilizing resources, and overcoming resistance to change (Klerkx, Hall, and Leeuwis 2009, 411).

The innovation capacity of a country, sector, or market chain depends on the capacity of its researchers and development programs, and also on effective linkages and information flows among public and private actors, incentives for cooperation, and the policy environment (Hall 2006). Innovation is stimulated by the interaction of individuals and organizations with diverse—sometimes conflicting—stakes in the management of scarce resources or the governance of productive processes. For this reason, successful interventions often involve brokering or facilitation of group processes that enable diverse stakeholders to interact, experiment, and learn together in ways that stimulate

innovation (Dror et al. 2016; Klerkx, Hall, and Leeuwis 2009, 413). R&D professionals and especially CGIAR centers played crucial roles as innovation brokers or facilitators in the cases presented in Part 3 of this book.

One institutional arrangement for enhancing interactions that can lead to innovation is the *multistakeholder platform*, which provides a space for interaction among different stakeholders; to improve mutual understanding, create trust, define roles, and engage in joint actions related to a common interest or production process. Chapter 8 (Thiele et al.) describes two types of platforms. The first can operate at a national or sector level, bringing traders, processors, supermarkets, and others together with farmer associations and R&D organizations to foster the development of new market opportunities through commercial, institutional, and technological innovation. The second type is structured around geographically delimited supply areas, operating more locally, meshing farmers and service providers to address market governance issues in assuring volumes, meeting quality and timeliness constraints, and empowering farmers.

The institutional arrangements and standard operating procedures of most agricultural R&D organizations have lagged behind the evolution of thinking on innovation processes and systems (Hall 2009, 30). Nevertheless, project teams charged with using research to benefit the poor have experimented with new ways of strengthening the contribution of research to agricultural innovation processes (see Part 3 of this book). One weakness of many attempts to link research with development is a focus on the supply of innovations, rather than on the demand for new products, processes, or institutional arrangements. The cases presented in this book show how programs have moved beyond supply-driven approaches, developing more demand-oriented and systemic approaches for facilitating innovation and inclusive VCD.

## **Perspectives on Value-Chain Development**

Reardon and Timmer (2012) highlight the revolutionary nature of the transformation of food systems in developing countries since the mid-1980s. The recent transformation of supply chains includes shifts from traditional markets to modern retail formats (be they regional supermarket chains or local corner markets), and rapid institutional and organizational change (including extensive consolidation of ownership and modernization of procurement systems, through integration of supply chains or contract farming). A study in Asia (Reardon et al. 2012) indicates that the value chains for both high-value products and domestic staples are undergoing a “quiet revolution” in their

structures and performance. High-value chains that originate in developing countries can provide a more profitable outlet for smallholders, but require that they commit to producing and delivering pre-identified volumes in the proper form and quality. The extensive discussion on value chains that has emerged in recent years aims to understand the changes in rapidly changing markets for agriculture products and the implications for poor market actors (namely smallholders, rural laborers, and small and medium-sized enterprises) and effective options for governments, development organizations, and the private sector to support poor value-chain actors.

Value-chain concepts represent an important change in thinking about development and the relationships among agricultural producers, traders, processors, and consumers. The term “value chain” is used in different ways in the professional literature. In this book, a *value chain* refers to the sequence of interlinked agents and markets that transforms inputs and services into products with attributes that consumers are prepared to purchase. Millions of low-income people, a large proportion of whom are women, participate in agricultural value chains as producers, traders, processors, and retailers. Many millions more, including most of the developing world’s poor, participate in agricultural value chains as laborers or consumers. As Haggblade, Hazell, and Reardon (2010, 1429) note, “landless and near-landless households everywhere depend heavily on non-farm income for their survival, while agricultural households count on non-farm earnings to diversify risk, moderate seasonal income swings, and finance agricultural input purchases.” Therefore, improving the performance of agricultural value chains stands to benefit large numbers of people (Reardon and Timmer 2012; Reardon et al. 2012; Aramyan, Lansink, and van Kooten 2005; Lohman, Fortuin, and Wouters 2004; Lambert and Pohlen 2001).

Agroprocessing is a key component of the rural non-farm economy. Most studies of VCD associate “modern” enterprises with “large-scale” ones, which are highly visible in and around cities in the processing and retail sectors—employing large numbers of workers and serving large numbers of (mainly urban) consumers. In contrast, most of the chapters in this book highlight modernization processes that are taking place among small and medium-sized agro-enterprises located in rural areas and small towns. These enterprises often face the double challenge of responding to the demands of buyers and processors that purchase their outputs, as well as supporting their smallholder input suppliers in upgrading their capacity to deliver quality inputs in sufficient volumes. Lanjouw and Lanjouw (2001) note that promoting growth of the rural non-farm sector can have several benefits, including

- providing employment for the poor;
- smoothing employment and income over seasons and years, for people who have limited access to other risk-coping mechanisms;
- tightening rural labor markets, raising wages, or reducing unemployment; and
- lowering prices to the poor.

The term *value-chain development* describes a type of intervention that aims to address poverty through improved linkages between businesses and poor households. In contrast to development approaches that focus narrowly on improving the capacities of smallholders to increase their productivity or better manage natural resources, VCD challenges development organizations to work with diverse stakeholders to understand the performance of the value chain and identify mutually beneficial options for improving chain performance. It is reasoned that by working in closer collaboration with private-sector actors, VCD can increase the benefits for the poor and enhance the prospects for sustaining operations and benefits after the termination of an intervention. For smallholders, benefits may include increased income, more secure market linkages, and access to new services for production. For wholesalers, processors, and other downstream enterprises, benefits may include improved quality and flow of raw material, reduced transaction costs, and enhanced environmental and social credentials.

VCD often targets marginalized actors in a value chain, such as smallholders, small-scale businesses, and landless laborers. Such “inclusive” value-chain development has been defined as a “positive or desirable change in a value chain to extend or improve productive operations and generate social benefits: poverty reduction, income and employment generation, economic growth, environmental performance, gender equity and other development goals” (UNIDO 2011, 1). It is from this perspective that many development agencies, donors, and governments have adopted VCD as a key element of their rural poverty-reduction strategies (Humphrey and Navas-Alemán 2010).

There is reason for both optimism and concern regarding the poverty-reduction potential of VCD. While globalizing markets offer opportunities for marketing higher-value products that simply did not exist before, these markets generally demand considerably more in terms of business acumen, efficiency, and attention to quality and food-safety standards than markets for traditional products (Reardon et al. 2009).

Not all poor farming households can benefit from access to value chains for higher-value agricultural products. Value-chain participation in more demanding markets requires smallholders to deliver regular supplies of produce of consistent quality and sufficient quantity. Meeting these conditions requires access to land, inputs, technology, knowledge, organization, capacity, skill, and infrastructure, which may not exist in some communities or among some groups of asset-poor producers.

Research indicates that farming households require a minimum asset endowment to participate successfully in value chains (Chapters 2 and 3). For those who fall below minimum asset thresholds, it is unclear whether public- or private-sector interventions can create the necessary preconditions for their long-term participation in value chains. Similarly, cooperatives and other forms of collective enterprise may lack certain assets needed to develop viable business operations that are able to facilitate the participation of smallholders in value chains and to respond to the needs of buyers and processors further down the chain.

The asset endowment of an individual farm family is not the only thing that determines the benefits it derives from market participation. An analysis of data from Latin American countries (Berdegue, Bebbington, and Escobal 2014) indicates that the opportunities and performance of family farmers who are integrated into agricultural markets but face constraints because of their asset endowments are largely determined by the local economic environment, or “proximate context.” Smallholders who operate in areas experiencing open, dynamic development—for example, near provincial towns with growing incomes, markets, and employment—are likely to have more market opportunities and take better advantage of them than farmers in less economically dynamic areas.

There is an urgent need for learning from experiences to improve the design of VCD interventions. This reflects both the inherent complexity of designing interventions with small businesses and with the rural poor, and contemporary pressures to achieve greater outcomes from external assistance in less time and with fewer resources. This highlights the need for incorporating learning-oriented monitoring and evaluation into VCD interventions.

## **The Chapters in this Book**

Since the 1970s, international centers affiliated with CGIAR have worked with national and regional partners to stimulate agricultural innovation and growth. In many cases, the benefits derived by smallholders have been

constrained by these farmers' limited opportunities to market their products. In an attempt to expand the benefits of agricultural R&D for smallholders, since 2000, R&D organizations have experimented with approaches for promoting innovation and inclusive VCD. This book presents several cases that have been documented and published in professional journals. Other experiences are now being documented and prepared for publication. Interested readers are encouraged to visit the websites of individual CGIAR centers and the PIM ValueChains Knowledge Clearinghouse (<http://tools4valuechains.org>).

With roughly three-quarters of the world's poor living in rural areas, addressing global poverty requires paying attention to rural populations, especially smallholders in developing countries (Torero 2014, 155). One reason for the continuing poverty of smallholders is their limited asset endowments—not only their landholdings, but also their human, financial, social, and other forms of capital (Donovan and Stoian 2012). Another crucial reason is that most smallholders practice subsistence farming or operate largely in local markets, rather than in lucrative provincial, national, or global markets. Consequently, smallholders have few economic incentives to adopt new technologies or invest in productive assets that could raise their levels of productivity and incomes.

Two types of intervention appear critical for allowing smallholders to participate in growing markets:

1. ones that provide physical *infrastructure and information technology* to connect smallholders to markets; and
2. ones that create or strengthen complementary *institutions* that reduce the high marketing risks and transaction costs faced by smallholders, due to their small production surpluses.

The chapters in this book present various approaches for providing the institutional arrangements that can allow smallholders to participate more advantageously in growing markets.

As illustrated in Table P1.1, Part 2 of this volume discusses the opportunities created by VCD and the challenges smallholders face in participating more advantageously in this development. It includes a comparative review of guides for value-chain analysis and reviews of experiences with VCD approaches, as well as a review of the literature on experiences in contract farming with smallholders. One case study in Part 2 includes the impacts of interventions to improve access to coffee markets in Nicaragua. One general conclusion of the chapters in Part 2 is the need for VCD stakeholders to

understand the local context in which VCD takes place, including the livelihood strategies and asset endowments of smallholders, and how this shapes the opportunities for achieving genuinely inclusive VCD interventions.

**TABLE P1.1** Summary information on the chapters in this book

Chapter title	Reference (original publication date)	Value chain, country, or region	Approach	Main contribution
<b>Part 2. Challenges and approaches for inclusive value-chain development</b>				
1. Guides for value-chain development: A comparative review	Donovan et al. (2015)	General	Comparative review of guides for value-chain analysis	Summarizes the main features, strengths, and weaknesses of 11 guides. Provides recommendations for guide use by context, and identifies priorities for reflection and debate
2. Value-chain development for rural poverty reduction: A reality check and a warning	Stoian et al. (2012)	General	Review of literature and authors' experience	Extracts lessons for improving design of inclusive VCD. Makes a plea for integrating a livelihoods focus into VCD, with a particular focus on farmer asset endowments
3. Changing asset endowments and smallholder participation in higher-value markets: Evidence from certified-coffee producers in Nicaragua	Donovan and Poole (2014)	Certified green coffee in Nicaragua for export	Case study	Gauges outcomes of access to certified-coffee markets, noting limitations for achieving poverty-reduction goals posed by limited asset endowments of smallholders
4. Contract farming in developing countries: Theory, practice, and policy implications	Minot and Sawyer (2015)	General	Review of literature	Presents an extensive review of literature on contract farming with smallholders in developing countries. Notes relevant theory and identifies policy implications
<b>Part 3. Integrating agricultural innovation and inclusive value-chain development</b>				
5. Enhancing innovation in livestock value chains through networks: Lessons from fodder innovation case studies in developing countries	Ayele et al. (2012)	Livestock products in Ethiopia, Syria, and Vietnam	Comparative case studies	Illustrates the value of integrating innovation-system and value-chain approaches, to enhance smallholder innovation and market success

Chapter title	Reference (original publication date)	Value chain, country, or region	Approach	Main contribution
6. Transformation of smallholder beef-cattle production in Vietnam	Stür, tan Khanh, and Duncan (2013)	Beef in Vietnam	Case study	In addition to the underlying driver of strong market demand for quality meat, identifies key aspects of the context and the intervention that contributed to the transformation of beef-cattle production and marketing in a Vietnam case study
7. Collective action for market-chain innovation in the Andes	Devaux et al. (2009)	Potato products in Bolivia, Ecuador, and Peru	Comparative case studies	Develops a framework for analyzing collective action in value-chain innovation, taking advantage of potato diversity to improve smallholder access to markets. Applies the framework to identify early results and policy implications of Andean work
8. Multistakeholder platforms for linking small farmers to value chains: Evidence from the Andes	Thiele et al. (2011)	Potato products in Bolivia, Ecuador, and Peru	Comparative case studies	Identifies two types of multistakeholder platform based on differences in characteristics of the value chains, the participating actors, and institutional arrangements. Analyzes platform performance, and presents preliminary results and implications
9. Unraveling the role of innovation platforms in supporting coevolution of innovation: Contributions and tensions in a smallholder dairy-development program	Kilelu, Klerkx, and Leeuwis (2013)	Dairy products in Kenya	Case study	Highlights the dynamics, inherent tensions, and unexpected results of innovation processes, and the need to strengthen feedback, learning, and adaptive management of innovation
10. Dealing with critical challenges in African innovation platforms: Lessons for facilitation	Swaans et al. (2013)	Several chains addressed by 11 programs, mainly in Africa south of the Sahara	Synthesis of authors' experience and literature review	Highlights critical issues for effective platform facilitation, related to: platform dynamics, power differentials, gender, external vs internal facilitation, sustainability, scale, and evaluation
<b>Part 4. Evaluating inclusive value-chain development</b>				
11. Impact of third-party enforcement of contracts in agricultural markets: A field experiment in Vietnam	Saenger, Torero, and Qaim (2014)	Dairy products in Vietnam	Case study	Demonstrates the methodology and presents results of a field experiment (randomized control trial) to study the effect of eliminating information asymmetry in contract farming

Chapter title	Reference (original publication date)	Value chain, country, or region	Approach	Main contribution
12. Linking smallholders to the new agricultural economy: The case of the <i>Plataformas de Concertación</i> in Ecuador	Cavatassi et al. (2011)	Potato products in Ecuador	Case study	An exemplary evaluation, applying multiple methods to identify program impacts. Provides evidence of the effects of combining production support with facilitating market access
13. Lapses, infidelities, and creative adaptations: Lessons from evaluation of a participatory market development approach in the Andes	Horton et al. (2013)	Coffee, potato, and yam in the Andes	Comparative study of four cases	Examines issues in the evaluation of participatory VCD interventions, related to action and change models and the fidelity of implementation. Identifies three types of deviation from the intervention design and the implications for managers and evaluators
14. Using quantitative tools to measure gender differences within value chains	Madrigal and Torero (2015)	General	Review of literature	Presents four quantitative tools, widely used elsewhere, that could be used to study gender-related questions in agricultural value chains

**Source:** Authors.

**Note:** Original publications are listed in the References for their respective chapters.

Traditionally, different groups based in different types of organization have designed and implemented interventions that focused on either agricultural innovation *or* VCD. Part 3 presents several cases in which CGIAR centers and national collaborators have developed integrated interventions that involved *both* innovation-system and VCD approaches. The papers in this part identify factors that have influenced the performance of these integrated interventions, and provide important lessons for facilitating processes of innovation and VCD.

Evaluation is commonly identified as an area that requires strengthening in complex interventions, such as those that promote agricultural innovation and VCD. Part 4 reviews evaluation issues and experiences, and presents methods for improving evaluations that support learning and adaptive management, as well as accountability for the resources used in complex interventions.

## **Chapters on Challenges and Approaches for Inclusive Value-Chain Development (Part 2)**

The first set of papers discusses the challenges facing and approaches available for smallholders, businesses, and external supporters for achieving inclusive

VCD. This includes a comparative review of available guides for value-chain analysis, a review of literature on VCD for rural poverty reduction, an analysis of asset endowments and smallholder participation in coffee markets in Central America, and a review of experiences with contract farming.

Chapter 1 (Donovan et al.) provides a comparative review of tools available for designing VCD interventions. It reviews 11 guides for value-chain analysis—a first step in the design of VCD strategies. The guides provide a useful framework for understanding markets and engaging with value-chain stakeholders. However, the guides often overlook a critical issue for achieving inclusive VCD: the basic conditions necessary for VCD to advance development objectives and achieve sustainability. The authors suggest three areas for future critical reflection and debate on the design of guides for VCD: (1) concepts, methods, and tools for addressing the specific challenges and needs of the poor in value chains; (2) tools for identifying important factors in the context of value chains and the implications for interventions; and (3) mechanisms for mutual learning on the design and implementation of VCD interventions.

Chapter 2 (Stoian et al.) reasons that those engaged in VCD will achieve greater impact when they consider the bottlenecks, tradeoffs, and dilemmas that can arise when attempting to link poor farming households with higher-value markets. The authors' plea for a sharper focus on the needs and circumstances of local actors, which also serves as "a reality check and a warning," draws on their own experiences in working with nongovernmental organizations (NGOs) and the private sector, as well as an overview of recent experiences with VCD. The design of VCD interventions often assumes that poor households have sufficient resources to participate effectively in VCD, do not face substantial trade-offs when using these resources, and can assume higher risks when reinvesting capital and labor. However, these assumptions often do not reflect the realities and needs of the poor. The authors encourage donor agencies and development practitioners to adopt asset-based approaches to the design, implementation, and assessment of value chains, and to identify the nonmarket interventions needed for enabling disenfranchised groups to meet the minimum asset thresholds for their successful participation in value-chain initiatives.

Chapter 3 (Donovan and Poole) analyzes changing asset endowments and smallholder participation in Nicaragua's certified-coffee market in response to interventions that aimed to ameliorate the negative impacts of the "coffee crisis." The authors' analysis suggests that most small-scale coffee farmers built particular elements of their asset base and increased

their resilience to future shocks through access to value chains for certified coffee. However, households struggled to make effective use of the gains to improve their livelihoods. Few of the least-endowed households increased the scale or productivity of coffee, and most continued to depend heavily on subsistence production and seasonal off-farm income. The authors conclude that improved market access alone, even under relatively favorable market conditions and with considerable external support, may have uncertain impacts on rural poverty if the underlying constraints on household assets and investments are not addressed concurrently.

Contract farming is one way to address market failures by integrating smallholders into modern agricultural value chains, providing them with inputs, technical assistance, and market access. However, critics are concerned about the imbalance of power between farmers and the companies that organize and manage contract-farming schemes. Chapter 4 (Minot and Sawyer) reviews the theory and practice of contract farming in developing countries and their policy implications. Most empirical studies suggest that contract-farming schemes raise the incomes of participating farmers by 25–75 percent. The evidence is less clear on the degree to which buyers are willing to contract smallholders. In some cases, contractors accept or even prefer working with smallholders. Nevertheless, contract farming cannot serve as a broad strategy for rural development because it is economically justifiable mainly for certain high-value commodities in certain markets. In those circumstances, however, it can be an effective institution for helping smallholders raise productivity and access more remunerative markets.

### **Chapters on the Integration of Agricultural Innovation and Value-Chain Development (Part 3)**

The practical application of innovation-system and VCD approaches—and particularly the integration of these two approaches—is challenging, and there are few well-documented cases of their successful application. The chapters presented in Part 3 show how agricultural researchers and development professionals in national and regional organizations associated with CGIAR programs have grappled with fundamental issues of linking research with action, how they interpreted and applied innovation-system and VCD thinking, and the results that have been obtained in Asia, Latin America, and Africa south of the Sahara.

Fodder scarcity is a perennial problem for many smallholders in developing countries. Chapter 5 (Ayele et al.) presents lessons from fodder innovation studies in Ethiopia, Syria, and Vietnam. Fodder innovation is triggered and

diffused by actors interacting and learning in networks, and on farms. Fodder innovation, being only one element of livestock value chains, is sustainably enhanced when linked to other innovations and market-oriented activities that optimize productivity gains. Yet smallholders face systemic constraints to accessing markets, and need to organize in groups to exploit opportunities. The authors conclude that rather than treating innovation-system and value-chain approaches as separate tools, the integration of their complementary features enhances smallholders' innovation and market success.

Chapter 6 (Stür et al.) analyzes the transformation of smallholder beef-cattle production in rural Ea Kar, Vietnam, where smallholder crop–livestock farmers were able to take advantage of the rising demand for meat in urban centers and transform cattle production from a traditional, extensive grazing system to a more intensive, stall-fed system that supplies quality meat to urban markets. Introduction and expansion of farm-grown fodder production enabled farmers to produce fatter animals, achieve higher sale prices, and reduce labor inputs by moving from grazing to stall feeding. These benefits convinced farmers, traders, and local government that smallholder cattle production could be a viable enterprise. Within 10 years, the way that cattle were produced and marketed changed significantly in the area. In addition to the underlying driver of strong market demand for quality meat, several key factors contributed to this transition:

- a convincing innovation that provided immediate benefits to farmers and a vision for local stakeholders;
- a participatory, systems-oriented innovation process that emphasized capacity strengthening;
- a value-chain approach that linked farmers and local traders to markets;
- formation of a loosely structured coalition of local stakeholders that facilitated and managed the innovation process; and
- technical support over a sufficiently long period to allow innovation processes to become sustainable.

Chapter 7 (Devaux et al.) presents the case of the Papa Andina network, which used collective action in two approaches for fostering market-chain innovation: the Participatory Market Chain Approach (PMCA) and stakeholder platforms. Both of these approaches bring small-scale potato producers together with market agents and agricultural service providers to identify common interests, share market knowledge, and develop new

business opportunities. These forms of collective action help to overcome market failures by strengthening linkages among smallholders, service providers (including researchers), and market agents. The facilitated interactions have stimulated innovation and helped to create new market niches for native potatoes grown by poor farmers in remote highland areas. The authors describe Papa Andina's experiences with innovation in value chains and discuss the policy implications for R&D organizations and the need for R&D organizations to have the capacity to diagnose innovation systems and facilitate group processes involving people with diverse stakes in a commodity's production, marketing, and use.

Chapter 8 (Thiele et al.) focuses on multistakeholder platforms for linking smallholders to value chains in Bolivia, Ecuador, and Peru. Although value chains linked to urban markets and agro-industry present new opportunities for adding value and raising rural incomes, smallholders struggle to enter these markets, and a lack of trust among value-chain actors increases transaction costs and short-circuits innovation. Differences in characteristics of value chains, participating actors, and institutional arrangements have led to the emergence of two types of platform. One type brings traders, processors, supermarkets, and others together with farmer associations and R&D organizations to foster commercial, institutional, and technological innovation. The other type is structured around geographically delimited supply areas, meshing farmers and service providers to address market-governance issues in assuring volumes, meeting quality and timeliness constraints, and empowering farmers. The cases studied indicate that platforms that bring stakeholders together around value chains can result in new products, processes, norms, and behaviors that could not have been achieved otherwise and that benefit poor farmers.

The agricultural innovation-system approach emphasizes the collective nature of innovation and stresses that innovation is a coevolutionary process. These insights are increasingly informing interventions that focus on setting up multistakeholder initiatives, such as innovation platforms and networks to enhance agricultural innovation. A number of studies have addressed issues of platform organization, but there has been limited analysis of how platforms shape innovation processes. Chapter 9 (Kilelu, Klerkx, and Leeuwis) attempts to unravel the role of innovation platforms in supporting innovation through an in-depth case study of a smallholder dairy-development program in Kenya. The findings indicate that highly dynamic innovation processes produce interactional tensions and unexpected effects, and that intermediation and facilitation are crucial for resolving tensions that emerge at different actor

interfaces. Chapter 9 also notes that platforms are not always able to adapt adequately to emerging issues. This points to the need to look at platforms dynamically and pay more attention to mechanisms that strengthen feedback, learning, and adaptive management in innovation processes.

Innovation platforms are increasingly used by R&D initiatives to engage the poor in agricultural innovation processes. These platforms are forums for action and learning, in which different types of actors come together to address issues of mutual concern. The dynamic nature of the innovation process and the differences in interest, capacity, and power among the actors involved make facilitation of innovation platforms challenging. Based on group reflection on their personal experiences in facilitating innovation platforms, Chapter 10 (Swaans et al.) analyzes seven key issues critical to effective platform facilitation:

1. the dynamic and evolving nature of platforms,
2. power dynamics,
3. gender equity,
4. external versus internal facilitation,
5. sustainability of the process,
6. issues of scale, and
7. monitoring and evaluation.

### **Chapters on the Evaluation of Inclusive Value-Chain Development (Part 4)**

Part 4 addresses several issues related to the evaluation of complex interventions aimed at inclusive VCD. Some examples of these interventions are trade-offs between ensuring the fidelity of the intervention and promoting local adaptation of intervention protocols, identification of programs' economic impacts, use of experimental evaluation approaches, and quantitative tools for measuring gender differences within value chains.

Using a randomized field experiment in Vietnam, Chapter 11 (Saenger, Torero, and Qaim) examines the effect of alleviating the information asymmetry regarding product quality that is widespread in contracts between agricultural producers and buyers in developing countries. In contract farming, opportunistic buyers may underreport quality levels to farmers to reduce the price that they have to pay. In response, farmers may curb investment, thereby

negatively affecting farm productivity. In the experiment, the authors entitled randomly selected smallholder dairy farmers in Vietnam, who are contracted by a large company, to independently verify milk-testing results. Results indicate that treatment farmers used 12 percent more inputs, and they also significantly increased their output. Some wider research and policy implications are discussed.

Chapter 12 (Cavatassi et al.) presents an economic analysis of the use of multistakeholder platforms (*plataformas de concertación*) to link smallholders to high-value food markets by looking at the experience of a platform program in the Ecuadorian highlands. Multiple evaluation methods are used to ensure identification of program impact. The findings suggest that the program successfully improved the welfare of beneficiary farmers, as measured by yields and gross margins. These benefits were achieved through improving the efficiency of agricultural production and selling at higher prices. No significant health or environmental effects were found. Overall, the program provides clear evidence that combining production support with facilitating market access can be successful.

Participatory approaches are frequently recommended for international development programs, but few have been evaluated. To contribute to knowledge on the use and results of participatory methods, from 2007 to 2010 the Andean Change Alliance evaluated the Participatory Market Chain Approach (PMCA). Chapter 13 (Horton et al.) examines the fidelity of implementation, factors that influenced implementation and results, and the PMCA change model and four applications of it in Bolivia, Colombia, and Peru. The authors identify three types of deviation from the intervention protocol—lapses, creative adaptations, and true infidelities—and discuss the implications for intervention design and implementation. They also identify five groups of variables that influenced PMCA implementation and results:

1. Attributes of the macro context
2. Attributes of the market chain
3. Attributes of the key actors involved
4. Local rules in use
5. The intervention's capacity-development strategy.

Although there was insufficient information to test the validity of the PMCA change model, results were greatest where the PMCA was implemented with highest fidelity. The case analysis suggests that the single most

critical component of the PMCA is engagement of market agents—in addition to farmers—throughout the intervention. Lessons for planning and evaluating participatory approaches relate to the use of action and change models, the importance of monitoring implementation fidelity, the limits of baseline survey data for outcome evaluation, and the importance of capacity development for implementers.

Chapter 14 (Madrigal and Torero) explores the use of quantitative tools to measure gender differences within value chains, and argue that using quantitative tools to study gender-related questions in a value-chain context can encourage gender inclusion and promote economic growth in developing countries. Four tools are proposed, based on widely known methods in gender and labor economics literature, that have straightforward empirical implementation. These tools—which have been tested and proven useful for gender analysis in other settings—could help researchers identify critical issues and value-chain bottlenecks to pinpoint more effective and inclusive policies and development strategies.

## **Emerging Themes and Policy Implications**

The chapters in this book deal with many aspects of agricultural innovation and VCD in different geographic, social, economic, and institutional contexts. From this broad range of experiences, six common themes emerge, which relate to

- Opportunities created by the expansion of markets for agricultural products,
- Challenges for smallholders,
- Characteristics of agricultural innovation and VCD,
- Attributes of successful interventions,
- Centrality of institutional innovation, and
- Role of multistakeholder platforms in VCD.

### **Opportunities Created by the Expansion of Markets for Agricultural Products**

The chapters in this book reinforce the view that access to lucrative markets for agricultural products can benefit smallholders in developing

countries, and interventions that address technical, economic, and institutional challenges can help smallholders take advantage of these opportunities. Nevertheless, VCD is not a panacea that alone can solve rural poverty problems. In many cases, inclusive VCD interventions that support small-scale and rural enterprises will have little impact unless they are complemented with policy changes that create a more conducive environment for enterprise development and help smallholders gain a foothold in lucrative value chains.

In recent years, the policy and agribusiness environments of most countries have become more open, liberal, and dynamic (World Bank 2014). There has been rapid growth in urban demand for high-value foodstuffs in both developing countries and foreign markets. Niche markets in advanced urban economies continue to generate strong demand, especially for organic and fair-trade items.

Smallholders can supply markets with diverse food products (Hazell and Rahman 2014) and they may have a comparative advantage in producing high-value, labor-intensive products, such as perishable fruits, vegetables, and specialty crops (Chapter 4). Farmers in remote areas often have a deep knowledge of neglected and underutilized species, such as quinoa, amaranth, and native potatoes in the Andes, for which lucrative new markets are being developed (Giuliani et al. 2012). Improvements in transportation are reducing marketing costs, and information technology is helping reduce the asymmetries in market information that have traditionally put rural smallholders at a disadvantage vis-à-vis large farmers and market agents (Webb 2013).

### **Challenges for Smallholders**

Smallholders often find it difficult to exploit the opportunities presented by expanding markets. Concerns over the scarcity of agricultural raw materials in rapidly growing markets, coupled with more stringent food-safety and quality standards enforced by government agencies and supermarkets, have spurred market integration and increased coordination and collaboration among producers, processors, and retailers (Dolan and Humphrey 2000; Reardon and Timmer 2012). But smallholders are often excluded from these increasingly complex and dynamic markets.

Smallholders often have limited access to land, credit, technical advice, basic knowledge of the market system, and current information on market prices and conditions—all of which restrict their capacity to invest, expand their market surplus, and add value to their produce. The limited market surpluses of individual smallholders raise the unit cost of assembling, handling, and transporting their products. These common attributes of smallholders

highlight the importance of policies and programs that strengthen farmer associations and collective marketing. The research reported in this book indicates that poor households require minimum assets to successfully participate in VCD. Women are especially disadvantaged when it comes to access to land, labor, credit, and infrastructure. The implication is that gender issues need to be considered specifically in the design, implementation, and evaluation of interventions.

### **Characteristics of Agricultural Innovation and Value-Chain Development**

Agricultural-innovation and VCD processes are highly complex.<sup>1</sup> So many factors and variables are interacting in these processes, and there are so many unknowns, that there is no single recipe for success and the outcomes are unpredictable. This complexity has important implications for the design, implementation, and evaluation of interventions, which are discussed in the following section.

Different types of intervention, and innovation, often reinforce each other. For example, separate interventions that focus on improving the productivity of dairy cattle, on milk marketing, on credit, on farmer organization, or on policies may produce some benefits for smallholders on their own. But when combined, they may produce much more substantial and long-lasting benefits. The experiences with dairy development in Kenya and Vietnam reported by Kilelu, Klerkx, and Leeuwis (Chapter 9) and Stür et al. (Chapter 6) illustrate this point. The implication is that those who design and implement applied R&D programs should seek to combine efforts that promote agricultural innovation and VCD, rather than work in isolation.

The benefits of agricultural innovation and market development are unequally distributed. It has long been understood that early adopters stand to gain more from innovation processes than late adopters. The studies presented in this book indicate that the distribution of benefits in VCD depends in part on the initial asset endowment of participating farmers. Lower and upper asset thresholds are crucial for the distribution of benefits. Below a lower threshold, smallholders may have insufficient resources to participate in dynamic value chains and may be negatively impacted by VCD interventions. Between the lower and upper thresholds, participants may benefit significantly from the intervention. Above the upper threshold, participants

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<sup>1</sup> The distinctions between simple, complicated, and complex situations and interventions are discussed by Patton (2011, chapter 4).

may benefit little from the intervention, since they were already participating actively in markets and deriving significant benefits prior to the intervention.

The livelihood strategies and asset endowments of individual farming households are not, of course, the only aspects that determine the benefits derived from market participation. As Berdegué, Bebbington, and Escobal (2014) conclude in a regional study in Latin America, the benefits that farming households reap from engagement in agricultural markets are strongly influenced by the local economic environment. Recent trends in the international markets for coffee, cocoa, oil palm, and other crops have shown the major implications that sustained fluctuations in prices can have on the livelihoods of farming households. Approaches to promote innovation and VCD should take into account smallholders' livelihood strategies and asset endowments, as well as the local economic context. VCD interventions should apply asset-based approaches to identify the nonmarket interventions needed to enable the poorest groups to meet minimum asset thresholds to participate successfully in VCD initiatives, or transition out of agriculture. It is especially important to pay attention to the needs and opportunities of women and other marginalized groups, who may benefit from, or be adversely affected by, innovation and VCD. Identifying gender imbalances and designing appropriate interventions or components are necessary to achieve gender inclusion.

### **Attributes of Successful Interventions**

In the context of this book, a successful intervention is one that generates significant and potentially lasting benefits for the rural poor at scale. As noted at several points, few rigorous evaluations of VCD interventions exist, limiting the extent to which we can draw firm conclusions based on experiences to date. Nevertheless, our review of the cases presented in this book supports the following general propositions, which we hope will be tested in future applied research and evaluation studies:

- Interventions that have focused narrowly on either expanding production or developing value chains have had limited benefits for the poor.
- Interventions that combined agricultural innovation and VCD have had synergistic effects.
- Multistakeholder platforms that fostered commercial, technical, and institutional innovation have had more significant and lasting impacts than those focused on governance and coordination issues.

- Inclusivity is an elusive ideal. Effective participation in VCD requires a minimum set of assets (not only land and financial capital, but also knowledge, skills, social capital, and access to sources of technical support), which the poorest of the poor lack. So, while successful interventions broaden participation in VCD, benefitting the poor, they should not be expected to produce significant direct benefits for the poorest of the poor.
- The main benefits of VCD for the poorest rural groups—those with very small parcels or no land at all—come from expanded employment in production, processing, and marketing activities and in reduced prices of agricultural products.
- There is no single recipe for inclusive VCD. Interventions need to be tailored to fit the opportunities and constraints of particular places and targeted to reach specific groups.
- Flexibility of intervention design and implementation is crucial for success. Since innovation and VCD processes are inherently unpredictable and evolve over time, program managers need the flexibility to respond quickly to changing conditions.
- Project-based interventions are not enough. VCD interventions have been most successful where the economic and policy environments have supported rural enterprise development or where appropriate policy changes accompanied the interventions.
- Time is essential for results to emerge. The most successful interventions reviewed in this book benefitted from continuous support—from donors, international organizations, and national partners—over a decade or more. Follow-up studies show that the benefits of VCD interventions often continue to emerge years after the interventions terminate, through successive waves of innovation and change (Mayanja et al. 2012; Devaux et al. 2013)

Until recently, interventions have tended to focus either on agricultural research and farm-level innovation or on VCD. However, frustrations with traditional interventions, particularly with those focused on increasing production, have led to the development of more integrated interventions involving both agricultural innovation and VCD. Examples of successfully integrated interventions reported on in this book include the International Livestock Research Institute's (ILRI) work with the Smallholder Dairy Development Project in Kenya, their work with fodder innovation and

beef production in Vietnam, and the International Potato Center's (CIP) work with PMCA. Several other CGIAR centers and partner organizations have also implemented initiatives that have attempted to combine both agricultural-innovation and VCD approaches, but, to date, few of these cases have been documented in peer-reviewed publications.

Interventions that combined innovation systems and VCD approaches generally began with technical research, which was later complemented with participatory approaches involving farmers, and later yet addressed issues of market access and VCD. They were flexible and adapted to needs and opportunities as they emerged.

As the scope of work broadened from conducting research to facilitating innovation and then embraced VCD, the number and diversity of stakeholders increased and coalition building and facilitation became more important.

Based on their work with local Vietnamese researchers, development professionals, government officials, farmers, market agents, and others, over more than a decade, ILRI researchers have identified the following components of an emergent strategy:

- A convincing technical innovation
- A participatory, systems-oriented innovation process
- A VCD approach that links farmers and local traders to growing markets
- Formation of loosely structured coalitions of local stakeholders
- Provision of technical support over an extended period—perhaps a decade or more.

CIP's work with PMCA in South America also began with technical research. Early on, researchers incorporated participatory approaches to engage farmers in applied R&D. Later they began to work with other service providers and groups of market-chain actors to develop new products. Early marketing efforts stimulated innovation in both institutional arrangements and production technology—for example, contracts between farmer groups and processors, and use of new varieties and postharvest methods.

Interventions that have stimulated innovation processes that produced substantial benefits for smallholders have had to overcome numerous challenges. One set of challenges in public-sector agricultural research organizations relates to the limited availability of work vehicles, fuel, and per diems needed for work off station. Additionally, public research organizations are often hesitant to work with large private firms or NGOs. Researchers may

also be wary of “getting bogged down in development work” or discouraged from doing it because of the traditional research mandate of their organization. To cope with these challenges, international organizations have often taken the lead in facilitating innovation and VCD processes, and they have provided essential resources for off-station work. In some cases, they have enlisted the collaboration of NGOs to play leadership roles. Local ownership of, and responsibility for, interventions has been cultivated via the development of coalitions or platforms, discussed in a separate section below.

A second set of challenges concerns the involvement of large private firms. Creativity is positively associated with the diversity of stakeholders involved in innovation processes. In many cases, large marketing or processing firms could play important roles in innovation processes. But it has been difficult to encourage these firms to invest the time needed in what they often feel are unproductive meetings that produce few immediate results for them. For this reason, there has been a tendency for platforms to work initially with small entrepreneurs, and bring larger businesses on board once they can see the potential value of early innovations.

The lack of well-trained local facilitators or innovation brokers has been another common challenge, and this is an important reason why international organizations have often—at least initially—led the process of facilitating innovation, and then prioritized capacity strengthening for local facilitators. Development of methodological guides and capacity building have been among the most important contributions of international organizations to local innovation capacity. It is important to note, however, that it has been easier to strengthen the capacity of individuals than to bring about changes in their parent organizations to take full advantage of their newly developed capacities. This point is discussed more fully in the section on the importance of institutional innovation (below).

A final challenge has been to overcome donor demands for quick results. CGIAR, national, and regional R&D programs have been under increasing pressure from donors to produce quicker results with more limited resources (Pingali 2010; McCalla 2014). Interventions that have generated significant benefits have generally been carried out over a decade or more, with support from international donors and the stable organizational environments provided by CGIAR centers. The policy implication is that donors that wish to generate significant returns on investments in inclusive VCD should understand that external support is likely to be needed for a number of years—probably at least a decade.

### **Centrality of Institutional Innovation**

Existing institutional arrangements with buyers often limit the ability of smallholders and small market agents to increase their benefits from value-chain participation. Smallholders often distrust local buyers, which increases their transaction costs and reduces their incentives for investing in yield-increasing technologies. Product quality is increasingly important for determining farmers' pay in high-value markets, and costly technology is needed to assess invisible quality attributes, such as nutrient content and pesticide residues. In this context, weak institutions for ensuring the fair measurement of product quality and for enforcing contracts can negatively impact smallholders.

Institutional innovations—such as multistakeholder platforms, farmer organizations, innovative contract-farming arrangements, independent bodies for product quality verification, and new R&D approaches—have played key roles in inclusive VCD. Multistakeholder platforms will be discussed in the following section. Several chapters in this book show how farmer organizations have aided in reducing transaction costs in input and product markets, by improving product assembly and quality assurance, and by organizing supplies of inputs, credit, and technical assistance. They have also aided in negotiating more favorable contract terms and conditions for smallholders. It is important to note, however, that farmer organizations often require long-term external support (Berdegúé 2001).

Contract farming has helped farmers overcome market failures by linking them with output markets for high-value foods and guaranteeing them a market for their produce. When contractors provide inputs, credit, or technical advice, contract farming can also help farmers to access technology and input markets. Contract farming can raise the incomes of participating farmers. But its application is limited to high-value crops and livestock products sold in quality-sensitive markets. Where market institutions are weak, independent bodies for product-quality verification can improve contract enforcement, benefitting both buyers and sellers. Strengthening local institutional arrangements (for example, to enforce contracts and provide independent verification of product quality in contract-farming schemes) can contribute significantly to the development of agricultural markets and the benefits reaped by smallholders. Innovations in contract design are important to balance the power between smallholders and the monopsonistic power of contracting companies. One example is the third-party certification proposed by Saenger et al. (Chapter 11). Other innovations are mentioned by Minot and Sawyer (Chapter 4).

Innovations in R&D approaches are an important way to foster innovation processes in the productive sector, benefitting smallholders and other economic actors. Several chapters in this book show how the participation of research organizations in multistakeholder platforms and acting as innovation brokers has improved the linkages between researchers and other service providers and value-chain actors. This has contributed both to innovations in the productive sector and to improving the focus of applied research on challenges and opportunities identified by value-chain actors.

As a cautionary note, it is important to realize that institutions—be they market institutions or the rules and procedures of agricultural R&D organizations—are often highly resistant to change. This resistance is one reason why some promising new innovation systems or VCD approaches developed with support from externally funded “special projects” were not mainstreamed in the parent R&D organizations.

### **Role of Multistakeholder Platforms in VCD**

Many of the interventions presented in this book have involved the development of multistakeholder platforms that provide opportunities for interaction among individuals with different stakes in a common resource or process, to interact, improve their mutual understanding, create trust, and engage in joint activities. Some platforms have been primarily concerned with fostering market innovation, others with improving market-chain governance and coordination, and yet others with both innovation and chain governance.

Effective facilitation, or innovation brokerage, is crucial for the success of multistakeholder platforms, and involves not just the coordination of interactions, but network formation, technical backstopping, mediation of disputes, advocacy, capacity building, and documentation of results. In recent years, many NGOs have developed their own capacity for facilitating events, which provides a base for further developing their capacities for innovation brokerage. These skills are scarcer in publically funded agricultural research institutes, highlighting the need for investments in capacity development if agricultural research organizations are expected to facilitate the work of platforms.

Since innovation and VCD are complex processes, platforms may take different forms, and tend to evolve over time. The platforms analyzed in this book generally played different roles at different times and their structures evolved accordingly. Mechanisms for platform funding, planning, management, and governance need to allow for continual adaptation to emerging challenges and opportunities.

Platforms need to be flexibly managed, learn from experience, and adapt to unfolding events. Platform managers need the support of learning-oriented monitoring and evaluation. They also need evidence of impacts to justify platform funding. Since platforms facilitate processes but do not themselves produce tangible results, it is difficult to prove their value through impact studies. Developing the capacities needed for learning, documentation, and impact assessment remain challenges for many platforms.

Platforms have various degrees of formality and longevity. Some platforms have written charters and official government recognition, but most have less formal structures and operate through more informal interactions among actors for specific purposes. Where platforms are concerned with natural-resources management, their sustainability is crucial for achieving sustainable results. But transitory development coalitions can play useful roles in promoting innovation and inclusive VCD.

The chapters in this book illustrate how widely socioeconomic, institutional, ecological, and technical conditions vary over time and space, and how interventions that promote inclusive VCD need to be tailored to fit specific local conditions and need to be flexible enough to evolve in response to changing conditions, opportunities, and threats. For this reason, platforms also vary significantly over time and space. The policy implication is that while general principles of agricultural innovation and VCD are broadly applicable, rigid models for platforms and broader interventions cannot simply be scaled up or transferred from one area to another.

The need for flexible arrangements and quick responses can make it difficult for R&D programs in public agricultural research institutes to participate effectively in platforms. For this reason, organizational reforms may be needed for some public-funded agricultural research organizations to be able to play more effective roles in promoting innovation and inclusive VCD.<sup>2</sup>

## Conclusion

The chapters in this book suggest a number of priorities for future research to advance inclusive VCD. They are summarized in five points:

1. *Methods for implementing asset-based approaches to value-chain development.* There is a broad consensus that the asset endowments of smallholders and other market-chain actors influence their ability to

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2 For a discussion of the types of organizational changes that may be needed, see Horton (2012).

participate in and benefit from VCD interventions. It is, however, less clear how to practically assess initial asset endowments and implement asset-based approaches. Practical methods are needed for applying asset-based approaches for VCD, in particular, for determining the “value-chain readiness” of potential participants and capturing gender differences along the value chain.

2. *Platform membership, management, and facilitation.* Comparative assessment of experiences with different types of platform, management systems, and facilitation arrangements is needed to clarify how such aspects as member diversity, the formality of management structures and systems, and different facilitation arrangements influence platform performance in different contexts.
3. *Evaluation approaches and testing of action and change models.* Applied research and evaluation are needed to draw lessons from experience and test the (often implicit) action and change models that guide complex integrated interventions that promote inclusive VCD. Complex interventions such as inclusive VCD present evaluators with numerous challenges. Common themes in this book are the importance of improving evaluation to support adaptive management of interventions; to provide the information on cost-effectiveness needed for improved accountability for the resources used; and to answer more fundamental questions related to the effectiveness of inclusive VCD interventions, vis-à-vis alternative approaches for improving the lot of the rural poor. It is also important to reduce the cost of evaluations and identify practical methods for assessing changes along the entire value chain, and to guide efforts to scale up promising pilot schemes.
4. *Upscaling.* Most of the experiences with interventions that integrate innovation-system and VCD approaches documented to date have been at the level of pilot projects. Many questions remain concerning: (1) the feasibility of expanding and extending these pilots to achieve greater impact; and (2) as to how best to scale up successful promising approaches while taking into consideration the heterogeneity of conditions in which VCD takes place.
5. *Application of a “gender lens.”* Women participate in many activities along value chains, and VCD initiatives may have differential impacts on women and men. More applied research and systematic evaluation is needed to offer donors, practitioners, and researchers in the field

practical and effective methods and tools for designing and implementing intervention strategies that enhance the benefits realized by women who participate in value chains. Some experiences have been documented and offer recommendations for mainstreaming gender in agricultural innovation processes (for example, Polar et al. 2015). These should be reviewed with an eye to developing more inclusive agricultural-innovation and value-chain development processes. Deeper insights into the opportunities to improve the returns to women from VCD may provide guidance on how to incorporate youth, ethnic minorities, and other underrepresented groups in VCD.

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## **PART 2**

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# **Challenges and Approaches for Inclusive Value-Chain Development**



## **CHALLENGES AND APPROACHES FOR INCLUSIVE VALUE-CHAIN DEVELOPMENT: INTRODUCTION**

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**Jason Donovan, Dietmar Stoian, and Mark Lundy**

### **Summary**

Growing demand for higher-value agricultural products presents new opportunities for smallholders and market agents in developing countries. However, responding to these opportunities can require significant investment for enhancing productive capacities, business skills, and infrastructure. Nongovernmental organizations (NGOs), government agencies, and food processors recognize the opportunity—and need—to support the integration of smallholders and small and medium-sized enterprises (SMEs) into value chains. Chapters in this part shed light on critical issues for the design, implementation, and assessment of programs that support value-chain development (VCD). Chapter 1 (Donovan et al.) identifies the strengths and limitations of widely used methodological guides for designing value-chain interventions. Chapter 2 (Stoian et al.) stresses the importance of adopting a livelihoods perspective when engaging smallholders in VCD and advocates an asset-based, multi-chain approach toward this end. Chapter 3 (Donovan and Poole) applies an asset-based approach to assess smallholder capacity-building interventions for participation in certified-coffee markets. Chapter 4 (Minot and Sawyer) reviews experiences with contract farming—a specific private-sector-initiated intervention in value chains, the inclusive nature of which has been questioned in the literature. These chapters provide guidance on the design of future value-chain interventions and investments for smallholders and SMEs.

### **Introduction**

Growing demand for higher-value agricultural products, abroad and increasingly at home, presents smallholders and agriculture-based SMEs in developing countries with new opportunities to add value to their primary production. However, responding to the opportunities can require

significant investment for enhancing productive capacities, business skills, and infrastructure. Government agencies, NGOs, and the private sector have recognized the opportunity, as well as the need, to support smallholders and local enterprises to effectively participate in agrifood value chains. In some cases, government agencies and NGOs target their interventions at smallholders, with the aim of building smallholders' capacity to respond to the growing demand for high-value agricultural products and services in international markets. In other cases, they seek out options for enhancing the policy and institutional environment in which smallholders and their business partners operate, with emphasis on removing political–legal barriers and institutional bottlenecks to increased productivity and profitability. Agrifood companies may support smallholders and SMEs in their efforts to obtain better access to raw materials and semi-finished products, and to enhance their social and environmental credentials (“sustainable sourcing”). While poverty reduction may not be the primary goal when companies invest in their smallholder suppliers, such engagement may have important implications for pathways out of poverty and overall rural development (Humphrey and Memedovic 2006; Barrett et al. 2011). From a bi- and multilateral donor perspective, the promotion of VCD is explicitly geared toward poverty reduction, and related investments are made across a range of subsectors, developing regions, and actors (e.g. government agencies, NGOs, cooperatives, large-scale buyers, and processors) (DFID and SDC 2008; Humphrey and Navas-Alemán 2010).

Behind development organizations' interventions in value chains lies a desire to stimulate economic growth and, in some cases, enhance the environmental and social performance of value chains. Organizations have put particular emphasis on inclusion of the rural poor and expanded business opportunities for women, often in combination with incentives for environmentally friendly production technologies (UNIDO 2011). The term “inclusive value-chain development,” frequently used by organizations working in VCD, denotes the expanded set of expectations surrounding such value-chain interventions. Building inclusive value chains is an inherently complex process. It involves value-chain actors with different and often divergent interests, entrepreneurs and businesses of different sizes, farmers with a variety of assets and productive capacities, and an array of input and service providers, all operating in a dynamic business environment with severe limitations in terms of infrastructure and services. Despite anecdotal evidence regarding progress in VCD to extend benefits to the rural poor, the inclusive value-chain approach is fairly new, rigorous impact assessments are scant, and learning is still

emerging (Garloch 2012). Critical questions remain regarding the potential for poor farmers—including women, youth, and indigenous communities—to benefit from their participation in value chains: (1) How are interventions designed to meet the needs of the poor and advance business along the chain? (2) Who is excluded from participating in and benefitting from more demanding value chains? and (3) What are the underlying reasons for such exclusion, including those related to poverty, age, sex, and ethnicity?

Part 2 of this book, presented in four chapters, sheds light on some of these questions by exploring the conceptualization and implementation of VCD and its contribution to rural poverty reduction. Chapter 1 (Donovan et al.) compares VCD tools geared toward development agencies and the private sector with emphasis on methodological guides for designing value-chain interventions. Chapter 2 (Stoian et al.) questions the assumptions underlying VCD interventions in terms of smallholders' access to livelihood assets, their investment in value-chain activities, and the associated risks of specialization for livelihood resilience, particularly as regards market shocks, natural disasters, and crop losses due to pests and diseases. Chapter 3 (Donovan and Poole) explores how differences in asset endowments and livelihood strategies influence the outcomes of external interventions to build the capacity of smallholders in Nicaragua to participate in value chains for certified coffee. Chapter 4 (Minot and Sawyer) shifts the focus to private-sector-driven VCD in the form of contract farming, drawing lessons on the conditions under which private companies organizing smallholder production contribute to income and other benefits for smallholders.

## **Opportunities and Challenges for Developing Inclusive Value Chains**

Chapter 1 (Donovan et al.) reviews the concepts and methods embraced by 11 value-chain guides, and assesses their strengths and limitations for designing value chain interventions. The review is timely, as in recent years there has been a proliferation of guides to support the design of VCD. Guides differ in their developmental goals (for example, poverty reduction, economic growth, or “decent work”), their approach to achieving those goals (for example, a focus on better market links versus improved business environment), and their targeted users (government agencies, NGOs, or private sector). All of the guides place strong emphasis on institutions for the production and marketing of agricultural products and achieving sustainability of interventions through a strong demand orientation. The scale of intervention varies: some guides focusing on

the national level (with an orientation toward economic development or more affordable food for urban populations), while others zoom in on a particular group of smallholders and businesses (with an orientation toward improving commercial relations among the actors). The review sheds light on certain gaps and limitations in the guides for achieving rural poverty goals. First, greater attention must be given to understanding poor households and their capacity to engage in new market-oriented endeavors. Important questions need to be addressed regarding households' access to sufficient productive resources, potential for substantial trade-offs when using these resources, and their ability to take on higher risks when investing their capital and labor. Second, the guides should provide deeper guidance for dealing with variations in the context. Most guides assume that users will identify critical elements of the context, understand their relevance for VCD, and make the necessary adjustments in data collection and analysis. These contextual differences may relate to scale in shipping and processing (and the related need for smallholder organization), the pre-existing asset endowments of smallholders and local businesses (and the related need for investments in asset building prior to VCD), and the overall business environment (and the related need for advocacy as part of the VCD). Finally, more attention should be given to the capacities of those who implement the guides. Greater discussion on how to deal with complex research design and implementation issues, such as variability in returns, may help to improve the overall rigor of assessment and usefulness of VCD strategies. New debates and interactions among tool designers and users are needed to identify the costs and benefits of additional tools and their rigor, and to promote learning for improved design and implementation of VCD guides.<sup>1</sup>

Chapter 2 (Stoian et al.) draws attention to the link between VCD and smallholder livelihood strategies that comprise a complex mix of subsistence and market-oriented activities and that are diversified to meet multiple livelihood goals and mitigate risks;<sup>2</sup> and the authors address the related impli-

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- 1 Recent experiences by the Central American Learning Alliance (Lundy and Gottret 2007; Faminow, Carter, and Lundy 2009; Lundy, Gottret, and Best 2012) provide insights into the opportunities for collective learning around VCD. This collaboration between researchers and development practitioners has enabled them to collectively address critical questions and knowledge gaps, develop and test tools to fill those gaps, and document outcomes and collective learning about what works and why. After a decade of practice, evidence has shown that VCD practices and knowledge management have improved, as shown by increased effectiveness in existing projects and more strategic new projects.
  - 2 Other authors have also stressed the need to integrate a livelihoods framework with a value-chain framework (Dorward et al. 2003; Neilson and Shonk 2014). It is the focus on asset building at the level of both smallholder households and their businesses, as well as the direct link to development practice—design, implementation, and monitoring of VCD, and learning around its outcomes and impact—that sets Chapter 2 apart.

cations for the design and assessment of value-chain interventions. They question some of the underlying assumptions of NGOs, government agencies, and private-sector agents seeking to link smallholders to higher-value markets, namely: (1) smallholder households have sufficient resources to participate effectively in more demanding markets; (2) they do not face substantial trade-offs when aggregating these resources in a given value chain; and (3) they are able to assume higher risks when reinvesting their assets and labor in such a way. In reality, however, smallholder households carefully balance subsistence and market-oriented agriculture with off-farm labor and other nonagricultural income-generating activities, and highly constrained assets for many of these households. The crux of the authors' argument is that most strategies for VCD, with their focus on a single chain, steer smallholders to adopt specialization strategies, with higher investments of capital, labor, and other resources directed toward activities in a specific value chain. Such strategies may lead to higher returns, but they also imply greater risk and potentially higher trade-offs between economic growth and livelihood security.<sup>3</sup> The authors also argue that smallholders need to be endowed with a minimum amount of livelihood assets to participate successfully in value chains, and that smallholders below minimum asset thresholds require specific, nonmarket interventions to become "value chain ready." They advocate an asset-based, multi-chain approach to VCD in response to the shortcomings of conventional VCD interventions focused on a single value chain. Such an approach would take into account diverse options across a portfolio of value chains in a given territory, and intervention strategies would be adjusted to diverse asset endowments among smallholder households. Multi-chain VCD would also allow for access to and control over household assets to be differentiated by gender and age across a number of subsistence and market-oriented livelihood activities. This would imply greater coordination among those engaged in VCD in a given area to ensure complementarity among VCD

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3 The capacity of smallholders to participate in higher-value markets has been discussed at length in the debate on nontraditional agricultural exports (NTAE). Between the late 1980s and late 1990s, agricultural development strategies prioritized the promotion of NTAE. Multilateral and bilateral donors helped identify lucrative markets and provided technical assistance and the means for meeting market requirements (for example, training, subsidized credit, farming inputs, and infrastructure development). In Latin America, NTAE promotion involved fresh fruits and vegetables (for example, in Chile, Costa Rica, Guatemala, and Honduras), fresh cut flowers (for example, in Colombia and Ecuador), and processed products such as frozen concentrate organic juice (for example, in Belize and Brazil). However, researchers have strongly criticized these programs for their perceived lack of sustainability, inattention to poverty and the environment, and negative effects on gender relations (Stonich 1991; Carter et al. 1996; Donovan and Poole 2008).

interventions—investments that could deliver more sustainable outcomes and impacts over the long term.

Chapter 3 (Donovan and Poole) analyzes the accumulation of livelihood assets among smallholders producing certified coffee in Nicaragua. The authors are particularly interested in the capacity of resource-poor smallholders who pursue diversified livelihood strategies and operate in adverse conditions to significantly increase their income and build their asset base through engagement with more demanding markets. There is growing consensus that asset accumulation plays a critical role in providing a pathway out of poverty (Carter and Barrett 2004). However, the authors' case underscores that smallholder endowments with critical livelihood assets are overall limited and often imbalanced. They also show the implications of the fact that access to these assets is differentiated by gender and age. Results among the coffee-growing households in Nicaragua suggest a pattern of significant, but incomplete, asset building across critical livelihood assets. In terms of human capital, for example, most households acquired new skills that improved coffee quality, but few households developed more complex skills for improved plantation management—a critical determinant of coffee productivity through plant-disease control. The ability to intensify production practices was linked to endowments of human and financial capitals that were severely constrained in many cases. The results also highlighted the considerable heterogeneity in smallholders' capacity to build assets through new market linkages. Households with relatively low asset endowments prior to engaging in certified-coffee markets were the least likely to achieve major advances in asset building. These households benefitted from certified-coffee markets mainly through access to safety nets that helped reduce vulnerability to external shocks (through membership of a cooperative). The work reported in Chapter 3 suggests that much remains to be learned about how interventions for VCD that involve poor farmers can deliver lasting change in production systems and marketing options that positively impact rural livelihoods.

The review of existing studies on the impact of contract farming and smallholder access to contract farming (Chapter 4) sheds light on the role of the private sector in supporting smallholder access to lucrative value chains. Contract farming schemes typically involve a contractor company that provides producers with technical assistance, seeds, fertilizer, and other inputs on credit, and offers a guaranteed price in exchange for agricultural products that meet specified quality and volume requirements. The debate around contract farming and its potential to advance rural development goals is extensive, with strong proponents of contract farming as a facilitator of development

outcomes and a fair number of skeptics. Chapter 4 (Minot and Sawyer) provides clarity on the opportunities and limitations of contract farming as an institution that facilitates agricultural intensification by smallholders. They find that contract farming is more viable in value chains of fruits and vegetables for quality-sensitive markets, commercial dairy and poultry production, and certain cash crops (for example, tea, tobacco, sugarcane, and cotton). In terms of income benefits for smallholders, most case studies found considerable increases in income, in the range 25–75 percent. On the question of whether companies were willing to invest in building commercial relations with smallholders, the evidence was inconclusive. In general, however, larger companies seem to be willing to work with smallholders, but some crops benefit from economies of scale and other characteristics that tend to favor medium- to large-scale farmers. The literature points to contract breach by contractor companies, “side-selling” by producing households, and the high costs of working with large numbers of smallholders as major limitations to the growth of contract farming. This chapter stresses that contract farming, as a private-sector-led approach to linking smallholders with value chains, is not a broad-based solution to rural development, as only a small fraction of poor farmers in developing countries have access to contracts.

## **Conclusion**

The chapters in Part 2 of this book shed light on some important challenges facing efforts to encourage smallholder participation in higher-value markets. Chapter 1 identifies the gaps in a set of methodological guides for the design of VCD interventions that include the rural poor. These include scant attention to the needs and circumstances of diverse types of smallholders to be involved in VCD, and limited guidance on how to handle variations in the context that influence the activities, investments, and strategies of value-chain actors. Chapter 2 stresses the poverty conditions in which many smallholders realize their livelihoods and seek to mitigate risks, and the resulting need for broader interventions for rural development that go beyond VCD interventions addressing production, processing, and marketing issues for a single crop. Chapter 3 highlights the importance of pre-intervention asset endowments for VCD-related asset building, with the lowest levels of asset building observed among those farmers who were least endowed with assets prior to the interventions in the value chain of certified coffee. Participating in and benefitting from interventions for VCD pose considerable challenges to resource-poor farmers when certain preconditions for success are not met.

Preconditions relate to asset endowments, access to sufficient and effective services and affordable inputs, and minimum degrees of smallholder business organization. Chapter 4 provides a persuasive argument that contract farming is not a solution to broad-based rural development as it only involves a small fraction of smallholder households. This, in turn, can be seen as a consequence of high transaction costs resulting from poor infrastructure and services, underdeveloped grading and standards systems, and inconsistent volumes and quality of raw materials provided by smallholders and their businesses. From a private-sector perspective, these costs are often prohibitive and limit active engagement in VCD, either in the form of “embedded services” or, particularly, in the spread of contract farming. Even in those cases where these costs are manageable, the private sector has very limited capacity to address the needs of most resource-poor populations, including landless people, and smallholders with minimum landholdings and other assets.

On the whole, the chapters in this part suggest an urgent need for deeper coordination and collaboration among those who intervene in value chains in support of smallholders and rural development. Intensive collaboration between researchers and VCD stakeholders will open the door to more innovative approaches, methods, and tools that respond to the various realities and needs of smallholders and other resource-poor people. Evidence-based learning provides the best chance for expanding the options for inclusive VCD and achieving higher impact on poverty reduction and rural development in less time with fewer resources. Better investments in VCD will emerge from deeper links between development agencies, governments, and those engaged on the ground in support of VCD building based on shared objectives, joint learning, and mutual accountability. Finally, the farmers, buyers, processors, and input and service providers engaged in value chains will benefit from improved collaboration among themselves. Identifying critical elements for forging such innovative alliances, crafting the underlying institutional arrangements, making joint investments, and developing related risk- and benefit-sharing mechanisms are critical areas for future research in direct collaboration with stakeholders inside and outside of the value chain. Critical reflection, innovation, and risk-taking will be required among these actors to enable the shift in focus from short-term outputs to long-term development processes, and from one-size-fits-all approaches to strategies designed around the particular realities and needs of smallholders and other weaker actors engaged in a value chain.

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## GUIDES FOR VALUE-CHAIN DEVELOPMENT: A COMPARATIVE REVIEW<sup>1</sup>

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Jason Donovan, Steve Franzel, Marcelo Cunha,  
Amos Gyau, and Dagmar Mithöfer

### Introduction and Background

Value-chain development (VCD) features prominently in development programming aimed at stimulating economic growth and increasing the competitiveness of the agricultural sector (Humphrey and Navas-Alemán 2010; Staritz 2012). The approach challenges governments and civil society to look beyond individual actors, such as smallholders or cooperatives, when considering how to achieve development goals. It is argued that by focusing on the value chain and the links between the actors spread along it, development interventions can better identify common problems among actors in the chain and solutions that generate win–win outcomes. Improved chain relations and overall chain performance are expected to yield tangible benefits in terms of economic performance and, in some cases, poverty reduction. The potential to include medium- and large-scale businesses as active partners in VCD offers development agencies opportunities for achieving outcomes at greater scale, with potentially increased impact and sustainability. For many development agencies, donors, and governments, VCD has become a principal element of their poverty-reduction strategies.

Interest in VCD stems, in large part, from an increased awareness among development organizations that success in increasingly complex agrifood markets often requires stronger collaboration among chain actors, including producers, processors, and retailers (Hobbs, Cooney, and Fulton 2000;

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1 The authors thank the Technical Centre for Agricultural and Rural Cooperation, and the CGIAR Research Programs on Forests, Trees and Agroforestry (FTA) and PIM for providing the financial support that allowed us to carry out this study. Special thanks to Veronica Gottret, Douglas Horton, Mark Lundy, Andrew Shepherd, Felicity Proctor, and Anne Terheggen for their comments and suggestions. We would also like to thank the following authors of guides for value-chain analysis and development for their comments and suggestions: Thomas Bernet, Ruth Campbell, Carlos A. da Silva, Jeanne Downing, Veronica Gottret, Frank Hartwich, and Graham Thiele.

Humphrey and Memedovic 2006). Important factors that have spurred interest in VCD include growing urban demand for added-value food-stuffs in developing countries, more stringent quality and food-safety standards by governments and private firms, the growth of niche markets (for example, organic and fair trade), and concern over the scarcity of agricultural raw materials. In some cases, VCD responds to the need to reinvigorate development processes that led to the formulation of the Millennium Development Goals (MDGs), which view increased income as a precursor to livelihood security and a decent standard of living. The rapid growth in demand for agrifood products in which smallholders are considered to have a comparative advantage—for example, specialty crops like coffee and horticulture that require high labor inputs—has been considered an opportunity to combine economic growth and poverty-reduction goals (Bacon 2005; Weinberger and Lumpkin 2007).

With the emergence of value chains in development programming came a burst of activity to develop guides and diagnostic tools to help practitioners conduct value-chain analysis, usually as input for the design of interventions. Guides for VCD are analytical tools to design interventions on behalf of smallholders and small rural businesses that are affected by the expansion of international agribusiness (Haggblade 2007). In some cases, these tools respond to shifting power structures in global agribusiness markets, which have led to both opportunities and threats for small players in developing countries. However, recent studies have shown that significant differences exist in how the guides interpret chain-related concepts (Altenburg 2007; Nang'ole, Mithöfer, and Franzel 2011; Proctor and Lucchesi 2012), which can have important repercussions for how interventions are designed and their potential development impacts. Guides differ in their developmental approach (for example, a focus on better market links versus improved business environment), their developmental goals (poverty reduction, economic growth, decent work), and their targeted users (government agencies, NGOs, private sector). Guides also vary in terms of their information requirements, objectives and overall complexity, conceptualization of value-chain concepts, and incorporation of local actors into research and strategy formulation, among other factors.

This chapter reviews 11 guides for value-chain analysis and development. It compares the guides' concepts, objectives, and methods and identifies strengths, weaknesses, and gaps. The assessment characterizes the state of the art for designing interventions and interactions that seek to build value chains with smallholders. The chapter is organized as follows: the next section

presents the methodology applied in carrying out the review, the following section presents the results of this review, and the final section provides concluding comments.

## **Guide Selection and Comparison**

For the purposes of this review, we considered a guide to include a book, document, or Internet-based platform that provides users with a logical sequence of activities for designing and implementing VCD with smallholders and other chain actors. At a minimum, implementation of a guide must contribute to the generation of a strategy for (1) the design of interventions by development organizations for building mutually beneficial chain relations, (2) the design of new interactions between resource-poor chain actors (often smallholders and businesses in the upstream chain segment) and larger, better-endowed businesses further downstream, and/or (3) the design of policies that improve the institutional environment in which value-chain actors operate. Guides whose primary audience is researchers rather than development organizations or private-sector representatives were excluded in this review. In some cases, guides may aim to facilitate the building of value chains with smallholders without actually applying the concept of value chain or VCD. For example, guides built around the concept of “making markets work for the poor” (for example, DFID 2008; SDC 2008) aim to identify opportunities for improving the business environment in which the poor operate, and thus, for the purposes of this review, would constitute a guide for VCD.

This review looked at 11 guides for value-chain analysis and development<sup>2</sup> (Table 1.1). Selection considered previous work by Nang’ole, Mithöfer, and Franzel (2011), who identified 32 guides, tools, and manuals related to value chains that were available on the Internet in 2010. We selected eight guides that were the most comprehensive in the design of VCD (CIP 2006; FAO 2007; CIAT 2007; IIED 2008; M4P 2008; GTZ 2008; ILO 2009; World Bank 2010). These guides were complemented with three others: USAID (no date), an Internet-based portal that provides a comprehensive collection of tools and concepts related to VCD; DFID (2008), which describes how to design policies that improve the participation of the poor in markets; and

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2 For the sake of brevity, the guides are referenced in this article according to the organization that backed development of the guide. The authors of each guide are identified in Table 4.1. Citations for each guide (by authors’ name) are included in the reference section.

**TABLE 1.1** Guidelines for value-chain analysis and development reviewed

Guideline (abbreviation within this chapter)	Authors	Sponsoring organization
Participatory market chain approach (CIP 2006)	Thomas Bernet, Graham Thiele, Thomas Zschocke	International Potato Center (CIP)
Guidelines for rapid appraisals of agrifood chain performance in developing countries (FAO 2007)	Carlos A. da Silva, Hildo M. de Souza Filho	Food and Agriculture Organization of the United Nations (FAO)
Participatory market chain analysis for smallholder producers (CIAT 2007) <sup>a</sup>	Mark Lundy, Veronica Gottret, Carlos Ostertag, Rupert Best, Shaun Ferris	International Center for Tropical Agriculture (CIAT)
The operational guide for the making markets work for the poor (M4P) approach (DFID 2008)	Authors not specified	Department for International Development (DFID), Swiss Agency for Development and Cooperation (SDC)
Chain-wide learning for inclusive agrifood market development (IIED 2008)	Sonja Vermeulen, Jim Woodhill, Felicity Proctor, Rik Delnoye	International Institute for Environment and Development (IIED)
Making value chains work better for the poor: A toolbook for practitioners of value chain analysis (M4P 2008)	Tim Purcell, Stephen Gniel, Rudy van Gent	Making Markets Work Better for the Poor (M4P) Project, UK Department for International Development (DFID)
ValueLinks manual (GTZ 2008)	Andreas Springer-Heinze	German Agency for Technical Cooperation (GTZ), now German Agency for International Cooperation (GIZ)
Value chain development for decent work (ILO 2009)	Matthias L. Herr, Taper J. Muzira	International Labour Organization (ILO)
Building competitiveness in Africa's agriculture: A guide to value chain concepts and applications (World Bank 2010)	Martin Webber, Patrick Labaste	World Bank
Pro-poor value chain development: 25 guiding questions for designing and implementing agroindustry projects (UNIDO 2011) <sup>b</sup>	Lone Riisgaard, Stefano Ponte	United Nations Industrial Development Organization (UNIDO), International Fund for Agricultural Development (IFAD), Danish Institute for International Studies (DIIS)
Value chain development wiki (USAID no date)	Not specified	United States Agency for International Development (USAID)

**Source:** Authors.

**Notes:** <sup>a</sup> CIAT's guide for value-chain development was first published in Spanish in 2003. A revised version was published in 2007 in English and Spanish. The revised English version was assessed for this review; <sup>b</sup> The guide reviewed here, UNIDO (2011), is part of a toolkit for understanding and diagnosing value chains. See [www.unido.org/fileadmin/user\\_media/MDGs/IVC\\_Diagnostic\\_Tool.pdf](http://www.unido.org/fileadmin/user_media/MDGs/IVC_Diagnostic_Tool.pdf).

**TABLE 1.2** Parameters for the review of guides for value chain development (VCD)

General	Specific
Objectives and motivations	<ul style="list-style-type: none"> <li>• Development objective (the expected result of guide implementation)</li> <li>• Expected outputs from guide implementation</li> </ul>
Definitions	<ul style="list-style-type: none"> <li>• Definition of value chain</li> <li>• Definition of VCD</li> </ul>
Methodological design	<ul style="list-style-type: none"> <li>• Key concepts applied</li> <li>• Key methodological steps and components</li> <li>• Chain-selection process</li> <li>• Expected outputs from guide implementation</li> <li>• Expected participation of stakeholders in implementation</li> </ul>
Data collection and analysis	<ul style="list-style-type: none"> <li>• Recommendations for data collection from household member (including issues related to gender), households, businesses, facilitating organizations</li> <li>• Recommendations for data collection on market environment</li> </ul>
Methods and tools for data collection and analysis	<ul style="list-style-type: none"> <li>• Prescribed data-collection methods</li> <li>• Prescribed data-analysis methods and tools</li> </ul>
Assessing and monitoring outcomes and impacts	<ul style="list-style-type: none"> <li>• Suggested indicators</li> <li>• Suggested methodology</li> </ul>

**Source:** Authors.

UNIDO (2011), which provides guidance on important issues for the design of interventions for VCD.

Table 1.2 presents the parameters by which the guides were assessed. The parameters aimed to capture important elements of guide design and implementation, including (1) objectives and motivations for using the guides, including expected results and outputs; (2) key elements of methodological design, for example, chain selection, and recommended steps in data collection and analysis; and (3) the interpretation of key concepts that underpin guide design, such as value chain and VCD. Information on these parameters was used to understand the extent to which the guides allowed users to understand the needs and circumstances of resource-poor actors in a given value chain (for example, smallholders, small and medium enterprises, including cooperatives), the business environment in which chain actors operate, and the access by chain actors to various types of services (for example, technical assistance, credit, inputs). Discussions and recommendations on the design of guides were inspired by debates in the literature which highlight the challenges faced by smallholders and other resource-poor actors attempting to participate in more demanding agrifood markets (Dolan et al. 1999; Reardon et al. 2003; Zylberberg 2011), and the related need for more tailored development interventions involving poor rural households with diversified

livelihood strategies (Dorward 2009; Stoian et al. 2012; Donovan and Poole 2013).

Multiple reviews of the information on the parameters and the assessment of the information were carried out to achieve accuracy and objectivity. A coauthor of this chapter carried out a first review of a guide, collecting information on the parameters. This review was then examined by two other coauthors, to ensure accuracy and objectivity. The review was then passed to the guide author(s) for feedback. Authors were asked to identify potential misunderstandings or omissions and to highlight any disagreements with the information collected. Feedback was received from authors of eight of the guides. Their comments and suggestions were incorporated into the final dataset. Preliminary versions of the assessment were shared with all authors of the guides. Five authors provided feedback on the assessment. Draft versions of this chapter were reviewed by three external reviewers.

Our methodology has limitations. There are likely to be guides that meet the selection criteria yet were not included in this review. Nonetheless, our selection of guides is broad enough to provide a strong indication of the overall state of the art. Our review is based exclusively on the guides themselves—it does not present information from other sources on experiences with the application of the guides and the subsequent results. In general, case studies with critical feedback on tool design and application are scarce.

## **Results**

### **Objectives and Outputs**

#### **DEVELOPMENT OBJECTIVES**

In general, the interventions or changes in business relations that result from a VCD strategy are expected to yield tangible benefits for actors in the chain as well as for the overall business environment. The discussion here focuses on the specific development objectives to be achieved when the VCD strategy is implemented.

Seven guides include a development objective that focuses on improved income for marginalized populations. Examples include DFID (2008), which considers that VCD offers opportunity to “effectively and sustainably improve the lives of poor people by understanding and influencing market systems,” and IIED (2008, 11), which argues that “with the right support, small-scale

producers can be efficient and reliable providers of quality produce.” Other development objectives are also specified. ILO (2009) includes an overall improved business environment, as well as increased employment and income, as outcomes of VCD. UNIDO (2011) considers that guide implementation will result in VCD with a greater likelihood of achieving positive impacts on poverty and gender equity.

Exceptions to the strong emphasis on poverty reduction are the guides by FAO (2007) and World Bank (2010), which emphasize the economic-development aspects of VCD. FAO (2007) conceptualizes that guide implementation will contribute to the economic growth of a given subsector, with no direct mention of smallholders or small businesses. The World Bank (2010, 2) recognizes that “The value chain approach is being used to guide and drive high-impact and sustainable initiatives focused on improving productivity, competitiveness, entrepreneurship, and the growth of small and medium enterprises.” While the guide also recognizes that “enhancing value chain competitiveness is increasingly recognized as an effective approach to generating growth and reducing rural poverty” (World Bank 2010, 2), the tools presented and the related discussions focus on business and chain performance.

### EXPECTED OUTPUTS

At a minimum, implementation is expected to yield a strategy for tailoring VCD to a specific situation that includes inputs from chain actors and from organizations that are external to the chain, such as service providers. For example, FAO (2007, 2) states that implementation allows for the formulation of a “general approach toward the definition of chain interventions aiming at performance improvement, with the identification of stakeholder responsibilities for implementation.” Similar approaches to conceptualizing the outputs of guide implementation are taken by DFID (2008), ILO (2009), World Bank (2010), and UNIDO (2011).

In other cases, implementation is also expected to result in new or stronger business relationships that emerge from the sustained dialog among chain actors during the guide-implementation process. The design of these guides places greater emphasis on the participatory process for implementation. A focus on both strategy formulation and relationship building is clear in the guide by CIP (2006, 16), which considers that “building trust among market chain actors is a prerequisite for successful collaboration.” The design of guides by CIAT (2007) and IIED (2008) also relies heavily on sustained engagement with smallholders and other chain actors to understand the chain

and facilitate negotiations and interactions between actors. GTZ (2008) and USAID (n.d.) provide guidance for the elaboration of a strategy with chain stakeholders, as well as guidance on how to implement VCD, with modules, for example, on strengthening public–private partnerships, financing value chains, and improving the business environment of value chains.

### Key Definitions

Concepts related to value chains and VCD have been debated in the fields of business management, sociology, and development studies. Consensus has yet to emerge on the definitions of these concepts. This review examines the guides to understand how they define chain-related concepts.

#### VALUE CHAIN DEFINITION

The reviewed guides utilize different terms to describe market actors and the arrangements for production and marketing of agricultural products and services. Among the terms used are *value chain*, *supply chain*, *market system*, *market chain*, and *agrifood chain*. For the purpose of this review, the term *value chain* will be used independently of the particular term used in the guide.

There are major differences in the understanding of the value-chain concept among the selected guides. Value-chain definitions can be divided into three groups:

1. *Value chain as a set of activities.* Various guides base their definition on activities. World Bank (2010, 9) provides an illustrative example: “The term *value chain* describes the full range of value adding activities required to bring a product or service through the different phases of production, including procurement of raw materials and other inputs.” The same definition, or definitions similar in nature, are offered by FAO (2007), IIED (2008), GTZ (2008), ILO (2009), and USAID (n.d.).
2. *Value chain as a set of actors.* Other guides base their definition on actors. For example, UNIDO (2011, 3) defines a value chain as “actors connected along a chain producing, transforming, and bringing goods and services to end-consumers through a sequenced set of activities.” CIP (p. 159) defines a value chain as “all the actors, and the entirety of their productive activities, involved in the process of adding value to a specific crop or product.”

3. *Value chain as a strategic network.* In this case, value chains do not simply exist in a particular space, but are built for the purpose of responding better to consumer demand. Borrowing from Hobbs, Cooney, and Fulton (2000), CIAT (2007, 25) defines value chains as a strategic network among a number of independent business organizations, where network members engage in extensive collaboration. DFID (2008, 6) defines a market system as a “multi-player, multi-function arrangement comprising three main sets of functions (core, rules, and supporting) undertaken by different players... through which exchange takes place, develops, adapts, and grows.”

The variation in definitions reflects the evolution of the chain concepts from the different strands of debate (for example, agribusiness systems and supply-chain management, world systems theory, participatory appraisal, and French research on *filières*). The definitions are complementary to some degree: activities are carried out by actors, and actors of different types comprise a strategic network. That said, the chain definition applied has theoretical implications for the design of interventions that follow the chain assessment. With an activity-related definition, one may assume that VCD would focus on improving the efficiency of production processes, logistics, or the regulatory framework—farmers and businesses may not be central to the process. A focus on the “full range of activities” implies that the selected chain is local or national in reach, as interventions rarely extend beyond countries where the primary production takes place. With an actor-based definition, the focus is on actors, usually resource-poor actors, which are often among the weaker links in a chain. It follows that interventions for VCD would aim to strengthen the capacity of these actors to participate in the chain, with the idea that strengthening the weaker links provides benefits to all involved. With a network-based definition, value chains do not simply exist, but are cultivated over time. In this case, the formation of a value chain becomes the actual goal of interventions, which will be possible only in certain market contexts.

#### DEFINITION OF VCD

Two general types of definition for VCD can be drawn from the guides: (1) an actor/chain type that focuses on strengthening certain actors and improving relations between smallholders and other actors in a chain, and (2) a business-environment type that focuses on improving the business environment in which chain actors operate. Seven of the guides include a

more actor/network-focused VCD definition. For example, CIAT (2007) suggests that VCD aims to increase competitiveness for a subset of chain actors, which results in higher income for smallholders and small businesses. USAID (n.d.) considers that VCD is achieved by establishing win–win relationships among chain actors. The World Bank (2010, 12) defines VCD as actions that “upgrade the whole system to the benefit of all value chain participants.” Other guides with similar definitions for VCD include CIP (2006), FAO (2007), GTZ (2008), and ILO (2009). However, some of the guides that utilize an actor-focused definition of VCD employ an activity-based definition for value chain. Examples include USAID (n.d.), ILO (2009), and GTZ (2008). This suggests that greater clarity is needed in the conceptual frameworks that underpin guides aimed at achieving rural-development goals through work with resource-poor actors. In general, we consider an actor- or network-based definition to provide a more coherent conceptual framework when VCD is focused on a targeted group of chain actors.

DFID (2008), IIED (2008), and M4P (2008) consider improving the environment in which the smallholders and other chain actors produce and market agricultural products as the basis for achieving VCD. The guides facilitate the identification of options to enhance opportunities for smallholders’ participation in chains by influencing the political, legal, and business environment and by establishing new linkages between smallholders and promising markets. For example, M4P (2008, 4) considers that analysis should focus on gaining an understanding of the context in which producers and/or small traders operate as participants in the value chain. Similarly, IIED (2008) considers VCD to center on understanding the institutional framework in which smallholders and other chain actors operate and identifying options for influencing institutional change in a way that creates smallholder opportunities and benefits. A focus on the business environment reflects the influence of debates on globalizing food markets (Reardon et al. 2003) and discussions among practitioners about making markets work for the poor (Ferrand, Gibson, and Scott 2004).

## Conceptual and Methodological Frameworks

### CONCEPTUAL FRAMEWORKS

Several guides build their conceptual framework around the concepts of governance<sup>3</sup> and upgrading. These guides include ILO (2009), GTZ (2008), World Bank (2010), and USAID (n.d.). These guides help users to formulate a VCD strategy for building or improving relations between smallholders and other chain actors, taking into account (1) the existing governance patterns, and (2) the political, legal, and market context in which the chain actors operate. The guides assume that a clear governance pattern can be identified and that chain-development prospects are present within existing patterns that provide meaningful benefits to smallholders and other actors. Guides by CIAT (2007) and IIED (2008) do not use the terms *governance* or *upgrading*, but contain conceptual frameworks that are similar in nature. For example, IIED (2008) builds its conceptual framework around the formal and informal institutions that make up “modern markets” and the potential for smallholders to respond to the demands of these markets.

Other guides are constructed around a conceptual framework that pays attention to the political, legal, and market context in which chain actors operate. For example, DFID (2008) aims to understand the “market system” (that is, the actors that make the production of final products possible and the set of rules that they follow) and identify options for addressing “systemic constraints” (that is, the underlying reasons for underperformance and possible intervention points). Unlike the value-chain concept, the market-system concept does not explicitly include an element of vertical coordination. FAO (2007) also focuses attention on understanding the political, legal, and market environment in which firms operate as a basis for promoting synergies and increased competitiveness in a chain. Particular areas of focus include the regulatory environment, technologies and inputs available to chain actors, and the degree of competition in the subsector.

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3 Chain governance often refers to the vertical coordination by firms in one node of the chain with firms in other chain nodes. Coordination can assume various modalities that include strategic alliances and contractual partnerships. These determine how product flows are regulated in terms of prices, quality, quantity, and delivery specifications, among other aspects (Humphrey and Schmitz 2005). Governance structures are considered to have important consequences for the access of chain actors in developing countries to markets and the range of activities that developing-country actors can undertake. A wider framing of the governance concept includes legislative aspects that shape business interactions, such as food safety and environmental standards (Kaplinksy and Morris 2002; Tallontire et al. 2011). The concept of upgrading refers to the potential of businesses and producers in developing countries to improve their performance and obtain greater benefits from value-chain participation.

Among the guides that focus on governance and upgrading, two important questions remain largely unaddressed in the guides. First, how can an upgrading strategy be defined in cases where no clear or uniform governance pattern is discernible? Clear governance patterns do not always exist, as holds true for undifferentiated crops sold in local markets, for example. In other cases, governance patterns may differ within a given node in the chain as well as between different nodes in a chain. At times, government policy in producing countries may be the most important determinant of development options, rather than rules established by value-chain actors (Cramer 1999). Where weak vertical relationships exist and unclear governance patterns prevail, a focus on a market structure–conduct–performance framework or the supply-chain concept may be a more appropriate framework for diagnostics. Second, when does upgrading represent an opportunity for smallholders or other marginalized actors? For some smallholders, the potential benefit from upgrading (for example, improved prices) may be less than the costs (such as increased labor allocation, collective action), particularly in the absence of support from development organizations and/or downstream chain actors.

None of the guides discusses how guide implementation leads to development outcomes and impacts for smallholders, other actors in the chain, or the chain itself. For example, the guide by CIP (2006), which conceptualizes VCD around innovation, says little about the potential returns from innovation or the conditions under which innovation by one actor could lead to innovation and improved outcomes for others in the chain. In a similar fashion, the guide by ILO (2009), which considers VCD in the context of decent work, does not discuss which chain actors are more likely to promote decent work and how such outcomes would contribute to VCD. Guides by CIAT (2007), FAO (2007), GTZ (2008), and IIED (2008) consider the potential to achieve VCD based on investments by smallholders and other chain actors but do not describe the actor-specific conditions under which these investments are most likely to take place (for instance, investment needs, potential costs and benefits, and the risks related to investment).

#### **ATTENTION TO THE CONTEXT**

The context in which farmers and businesses operate has important implications for the design and implementation of strategies for VCD. For instance, comprehensive strategies to develop value chains that link smallholders with international markets for specialty products will likely discuss issues related to certification compliance and the ability of cooperatives and producer associations to meet the demands of their members and of downstream

buyers. Alternatively, strategies to develop value chains in local markets will likely focus attention on understanding consumer demand and the opportunities for value adding with local processors and intermediaries. Context is also important when considering the ability of smallholders to participate in VCD. In cases where VCD requires relatively large investments by smallholders, understanding their interests and capacities will be important for the design of sustainable interventions. The greater a guide's focus on issues particular to a given context, the greater its potential to provide tailored guidance to its users. Many of the guides recognize the overall importance of the context and provide guidance on how to assess the marketing and business context (for example, CIAT 2007 and DFID 2008). However, none of the guides discusses its implementation according to the key element of the marketing or business context. Potential guide users are left to contemplate the benefits and strengths of a particular guide in the context in which they are working. At the level of producing households, some guides stipulate that the value chain selected for analysis and development should be relevant to rural livelihoods. However, there is limited discussion on how to measure differences in the interests and capacities among households, or on the implication of these differences for achieving the reported goals of VCD.

### CHAIN SELECTION

Value-chain selection has important implications for the households and businesses involved, as well as for the external organizations that aim to facilitate the development process. Some guides identify steps for chain selection, while others assume that a chain has already been selected (Table 1.3). Where steps for chain selection are provided, decisions on chain selection rest mainly in

**TABLE 1.3** Approach to chain selection

Selection led by local stakeholders	Selection led by external experts	Assumption that chain has already been selected
<ul style="list-style-type: none"> <li>• CIAT</li> <li>• M4P</li> </ul>	<ul style="list-style-type: none"> <li>• FAO</li> <li>• DFID</li> <li>• GTZ</li> <li>• ILO</li> <li>• World Bank</li> <li>• UNIDO</li> </ul>	<ul style="list-style-type: none"> <li>• CIP</li> <li>• IIED</li> <li>• USAID</li> </ul>

**Source:** Authors.

**Note:** CIAT = International Center for Tropical Agriculture; CIP = International Potato Center; DFID = Department for International Development; FAO = Food and Agriculture Organization of the United Nations; GTZ = German Technical Cooperation Agency; IIED = International Institute for Environment and Development; ILO = International Labour Organization; M4P = Making Markets Work Better for the Poor; UNIDO = United Nations Industrial Development Organization; USAID = United States Agency for International Development.

the hands of chain stakeholders or with NGOs and others that are external to the chain, often with validation from local stakeholders. In general, steps for chain selection involve the selection of indicators/criteria, an extensive period of data collection and analysis, and one or more workshops to present results and make decisions. Most guides include criteria related to market potential. Those guides aiming to address rural poverty also include criteria on the potential of the value chain to improve rural livelihoods. Few guidelines deal with how to collect and analyze the data. In some cases, effectively responding to a criterion would require complex data collection and analysis, for example, assessing the “potential of the product/activity for poverty reduction” (M4P 2008, 20) and identifying the “markets with potential for achieving improved growth and access” (DFID 2008, 24).

#### RECOMMENDED DATA COLLECTION

Depending on the objectives of the guide and its intended users, data collection at some levels (for example, household, business, value chain) may be more relevant than at others. The guides therefore differ markedly in their attention to data collection at different levels of value-chain analysis. Some guides place more emphasis on understanding actors in the chain and their perspectives on opportunities for VCD, while others concentrate data collection on understanding the value chain itself and the overall context in which it operates. Table 1.4 compares the recommended data collection at five levels of value-chain analysis: intrahousehold, household, business, chain/market, and service provider.

Few guides consider data collection at the intrahousehold level. As a result, the strategies that emerge from guide application may overestimate the potential for women and other disadvantaged members to participate in and benefit from VCD. In case of VCD aiming at inclusive or pro-poor development, this omission may also result in outcomes below their potential. UNIDO (2011) addresses the lack of attention by existing guides to specific social issues, including gender equity. With regard to gender, UNIDO (2011) identifies various important issues that should be considered as part of value-chain analysis when marginalized producers are involved, including access to assets, social roles, and risks faced specifically by women. The guide does not provide suggestions on how to collect or analyze gender-related information, but it does provide various references to gray literature where issues related to gender and VCD are addressed.

Attention placed on issues at the household level varies considerably. Three guides stand out for paying relatively strong attention to household-level

**TABLE 1.4** Data collection recommended (indicators, guiding questions) by the guides, by level

Level of data collection	Limited or no data recommended	Moderate amount of data recommended	High amount of data recommended
Intrahousehold	<ul style="list-style-type: none"> <li>• CIP</li> <li>• CIAT</li> <li>• FAO</li> <li>• DFID</li> <li>• GTZ</li> <li>• IIED</li> <li>• M4P</li> <li>• ILO</li> <li>• World Bank</li> <li>• USAID</li> </ul>		<ul style="list-style-type: none"> <li>• UNIDO</li> </ul>
Household	<ul style="list-style-type: none"> <li>• CIP</li> <li>• DFID</li> <li>• IIED</li> <li>• World Bank</li> </ul>	<ul style="list-style-type: none"> <li>• FAO</li> <li>• GTZ</li> <li>• ILO</li> <li>• USAID</li> </ul>	<ul style="list-style-type: none"> <li>• CIAT</li> <li>• M4P</li> <li>• UNIDO</li> </ul>
Businesses, including cooperatives and producer groups	<ul style="list-style-type: none"> <li>• DFID</li> <li>• IIED</li> <li>• World Bank</li> <li>• UNIDO</li> </ul>	<ul style="list-style-type: none"> <li>• GTZ</li> <li>• ILO</li> <li>• USAID</li> </ul>	<ul style="list-style-type: none"> <li>• CIP</li> <li>• CIAT</li> <li>• FAO</li> <li>• M4P</li> </ul>
Chain/market		<ul style="list-style-type: none"> <li>• CIAT</li> <li>• UNIDO</li> </ul>	<ul style="list-style-type: none"> <li>• CIP</li> <li>• FAO</li> <li>• DFID</li> <li>• GTZ</li> <li>• IIED</li> <li>• M4P</li> <li>• ILO</li> <li>• World Bank</li> <li>• USAID</li> </ul>
Service provider	<ul style="list-style-type: none"> <li>• CIP</li> </ul>	<ul style="list-style-type: none"> <li>• CIAT</li> <li>• FAO</li> <li>• DFID</li> <li>• GTZ</li> <li>• IIED</li> <li>• M4P</li> <li>• ILO</li> <li>• World Bank</li> <li>• UNIDO</li> <li>• USAID</li> </ul>	

**Source:** Authors.

**Note:** CIAT = International Center for Tropical Agriculture; CIP = International Potato Center; DFID = Department for International Development; FAO = Food and Agriculture Organization of the United Nations; GTZ = German Technical Cooperation Agency; IIED = International Institute for Environment and Development; ILO = International Labour Organization; M4P = Making Markets Work Better for the Poor; UNIDO = United Nations Industrial Development Organization; USAID = United States Agency for International Development.

production and marketing issues: CIAT (2007), M4P (2008), and UNIDO (2011). In addition to basic information on output and income, these guides recommend data collection on livelihood strategies, capacities and asset endowments, and perceptions on benefits and challenges in chain

participation. In most cases, however, detailed information on how to collect and analyze these data is not provided (for example, assessment of livelihood strategies), although some references to important articles in gray literature are provided. In general, neither the academic nor gray literature provides extensive insights into rural livelihoods in the context of value chains and VCD (Stoian et al. 2012). Four guides (FAO 2007; GTZ 2008; ILO 2009; USAID n.d.) recommend data collection on basic issues related to producing households (such as income, productivity, and farmgate prices), while the remaining four guides do not discuss the role of households in value chains and VCD.

Attention placed on businesses<sup>4</sup> and producer groups also varies considerably. Four guides focus considerable attention on these actors: CIAT (2007), M4P (2008), FAO (2007), and CIP (2006). Data collection recommended by these guides focuses on businesses, their capacities and access to resources, and their incentives to invest in upgrading and/or increased collaboration with chain actors. These guides do not distinguish data-collection methods or indicators according to the type of business, for example, smallholder-managed cooperatives or privately owned industrial processors. Guides that briefly discuss data collection on businesses are USAID (n.d.), ILO (2009), and GTZ (2008). These guides recommend a basic set of assessment indicators, including annual income and sales, export prices, and business functions. Four guides forgo data collection on businesses as part of the strategy formulation for VCD: DFID (2008), IIED (2008), World Bank (2010), and UNIDO (2011).

All of the guides place a moderate to high level of attention on data collection at the level of value chain and market. Those that place relatively less attention on data collection at the chain and market level were those that focus relatively more attention on individual actors in the chain (CIAT 2007; UNIDO 2011). Most of the guides also recommend data collection on service providers. Data collection is basic, often focusing on the identification of existing service providers in a given area and generally avoiding more complex issues, such as the need for services by chain actors, gaps in service provision in a given territory to meet these needs and how to resolve the latter, and the overall suitability of existing services. CIAT (2007) provides the

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<sup>4</sup> The term *business* refers to privately owned small, medium, and large businesses, as well as community-based businesses such as cooperatives, producer associations, and farmer organizations that are commercially active. In some cases, businesses may receive VCD assistance from governments and civil society (for example, cooperatives with links to smallholders) and, in other cases, businesses may support VCD, for example, through their investments in more intensive relations with smallholders and upstream businesses (for instance, large-scale retailers, exporters, and processors).

most extensive coverage on service provision, giving guidance on methods for assessing the quality of service provision and identifying the unfulfilled demand for services.

## **Recommended Methods and Tools**

### **METHODS FOR DATA COLLECTION**

The guides provide various indicators or research questions for the collection of data for value-chain analysis. Recommendations emphasize both qualitative and quantitative data, although there is a strong inclination toward qualitative data. As for the type of methods prescribed, the guides vary little. These methods include: review of existing information, key-informant interviews with chain actors and participatory chain mapping, as well as workshops and focus groups with chain actors. In some cases, methods are also provided for carrying out a market assessment, either as an annex to the guide (CIP 2006) or as a separate, but linked, guide (CIAT 2007). Three guides (DFID 2008; World Bank 2010; UNIDO 2011) omit information on how to collect or analyze data, perhaps reflecting an orientation toward researchers.

The guides suggest that tool users increase the rigor or depth of data collection and analysis through triangulation and participatory workshops. However, no guide provides in-depth discussions on the optimal levels of rigor and depth or on the various practical options for achieving them. Discussions on practical options for sampling (both how to sample and how many units to sample), data management, and questionnaire design are also scarce among the guides. A salient gap in virtually all guides is the issue of variability in costs and returns for farmers and business that invest in upgrading their operations and the implications of these for decisionmaking.

### **METHODS AND TOOLS FOR DATA ANALYSIS**

All of the guides seek data from chain stakeholders for the design of VCD strategies. The two most commonly recommended methods for analyzing data are participatory workshops and key-informant interviews. During participatory workshops, tool users report raw and processed data on chains, markets, and chain actors to stakeholders for discussion, analysis, and decisionmaking. Most guides provide questions and templates for preparation of workshops. Workshops and key-informant interviews form the methodological pillar of CIP (2006), CIAT (2007), IIED (2008), and ILO (2009). In some cases, guides provide additional support for data analysis as input for participatory workshops, such as value-chain mapping (GTZ 2008),

participatory rural appraisal tools (CIAT 2007), and analysis of strengths, weaknesses, opportunities, and threats (CIP 2006; FAO 2007; USAID n.d.). Involving stakeholders in the process serves two purposes: participatory analysis for decisionmaking and encouraging buy-in to the strategy-formulation process.

In general, these guides offer relatively simple analytical tools and methods that allow users to obtain a rough idea of the value chain and the needs and circumstances of its participants. In some cases, the outputs of implementation are likely to be insufficient for the design of development strategies among actors with different interests and varying capacities to invest in more intensive value-chain participation. When VCD does involve resource-poor households and businesses, then the case for careful exploration of the needs and capacities of resource-poor chain actors becomes more pressing. An expanded set of tools and methods could improve the outcomes of guide implementation. These might include tools for assessing the return and variability in return on investments, incorporating risk into decisionmaking, scoring investment options by households, assessing the viability of small and medium enterprises, and drawing inferences from quantitative data. In some cases, participatory research tools designed for farm and natural-resource management may be applicable (for example, Dorward, Shepherd, and Galpin 2007). In other cases, new tools specific to the context of VCD may be needed. Discussions are needed among tool designers and tool users about the applicability of different tools under different conditions.

Other guides offer a greater selection of methods and tools for data analysis. M4P (2008), World Bank (2010), UNIDO (2011), and USAID (n.d.) provide the most extensive sets of methods and tools for analysis of value chains, value-chain actors, and markets. For example, USAID (n.d.) includes knowledge assessment, cost and margin analysis, distribution of income analysis, and competitiveness analysis. M4P (2008) stands out for its discussion of a range of qualitative tools for understanding value-chain relations and the financial implications of investments in value chains. Among the tools presented by UNIDO (2011), a particularly noteworthy one is the tool for incorporating gender issues in the analysis. In general, for each method or tool presented in the guides, authors provide an overview of the method or tool to be applied, as well as examples of its use and results. In most cases, however, discussion is brief and examples lack detail. The lack of discussion about options for adjusting the methods and tools to different contexts may frustrate implementation by some users given the diversity of contexts in which VCD is carried out and the difficulty of collecting data from households and the private sector.

Following a discussion on data collection and analysis, the guides present a process for the actual design of the interventions for VCD. The process usually begins by organizing a subset of chain actors into a “task force” or “working group” or something similar in nature. Most guides suggest that “key actors” from one or more chain nodes be included in the process, although criteria for identifying key actors are often left to the discretion of those implementing. The guides recommend one or more workshops be carried out with the selected actors. During these meetings, results from prior data collection and analysis are presented: the chain is described, the end market discussed, bottlenecks presented, and in some cases, potential solutions are presented for validation (for example, FAO 2007). More participatory guides consider strategy development as a separate and final step in the process. This may consist of a single workshop (for example, CIAT 2007, which recommends a “negotiation workshop”) or a more elaborate process (for example, CIP 2006, which recommends various sessions over several months). Guides may warn users on the potential for conflicts during the process (for example, IIED 2008). In general, however, discussion on the process by which actors come together to negotiate solutions and pursue common interests, and how this process evolves over time, is lacking (see Staatz and Donald 2010, for discussion). Under what conditions is joint strategy development and implementation most likely to succeed? What options exist when win–win solutions fail to emerge? How does the process vary according to differences in the local context? Looking beyond the actual workshops, the guides avoid challenging users to question the strategy itself: What worked? What did not work? And how could strategies be redesigned (improved) for future work? This would imply a strong focus on joint reflection and learning to be carried out throughout the strategy-implementation process.

### **Monitoring and Evaluation**

Five of the guides do not discuss monitoring and evaluation (CIP 2006; FAO 2007; IIED 2008; M4P 2008; World Bank 2010). Thus, the following analysis focuses on the six guides that do.

CIAT (2007), GTZ (2008), and USAID (n.d.) provide the most extensive set of indicators for monitoring and evaluation. Most of their indicators focus on data collection at the chain and market levels. Among the recommended indicators are sales volumes and values, production costs, yields, profitability, product offer, and technologies applied. CIAT (2007) and GTZ (2008) also suggest indicators at the household level. In both cases, indicators relate mainly to income and the contribution of the value chain being developed to

household income. UNIDO (2011) includes the largest selection of indicators at the household level, with indicators on skills and capacities, productive assets, and women's control over income. ILO (2009) suggests various indicators related to the concept of decent work, including employment creation and labor conditions. The indicators suggested by the guides provide relevant and important information for understanding the outcomes and, in some cases, the impacts of VCD. With the exception of UNIDO (2011), these guides are not designed to provide a deep understanding of the needs and circumstances of more vulnerable actors in a given chain, including household producers and small businesses, or how VCD-related interventions shape their ability to participate and benefit from deeper engagement with markets.

Guidance on how to collect and analyze information for monitoring and evaluation is limited. GTZ (2008) stands out for presenting a rigorous approach to monitoring and evaluation, with recommendations for the elaboration of an impact pathway, formulation of impact hypotheses, and use of control groups for attribution. However, given the complexity of the suggested approach, the guide does not provide sufficient help to practitioners in its implementation. In general, users are expected to already understand the basics of monitoring and evaluation in a VCD context or apply readily available monitoring and evaluation guides designed for project assessment (for example, Baker 2000; Grun 2006). However, guides designed for the monitoring and evaluation of project assessment are likely to fall short in the context of VCD, given the multiple levels at which VCD takes place and the possibility that changes result from multiple sources (see Stoian et al. 2012).

## **Recommendations for Using the Guides**

Based on the results from our analysis of guides, we provide recommendations for tool users according to the context in which they are working, their objectives in pursuing VCD, and the methods for data collection and analysis that best suit their needs and interests (Table 1.5). For example, some guides are particularly suited to developing value chains that link smallholders to local markets (CIP 2006; CIAT 2007; IIED 2008) whereas others are especially appropriate for links to export markets (World Bank 2010).

## **Conclusion**

The guides provide a framework for development practitioners to engage with market actors and set the stage for collaboration in VCD following guide

**TABLE 1.5** Recommendations to users on which guides are most appropriate for particular objectives, contexts, and methods

Area of interest	Recommended guides	Remarks
<b>Value-chain development (VCD) for specific contexts</b>		
Design of policies for VCD at the macro level (covering all actors involved in the production and marketing of a given product)	FAO, DFID, M4P, USAID	Considerable attention to understanding the political, legal, and marketing context in which value-chain actors operate
Design of interventions and new chain interactions among a selected group of actors in a given subsector	CIP, CIAT, GTZ, ILO	Implementation involves considerable participation from selected value-chain actors, to include analysis of the chain and the design of interventions for chain development
Development of value chains that link smallholders to export markets	World Bank	11 detailed case studies on VCD oriented toward export markets
Development of value chains that link smallholders to local and national markets	CIP, CIAT, IIED	Considerable attention given to understanding the circumstances of actors in a chain and the overall marketing context in a given area
<b>Conceptual frameworks (CF)</b>		
CF built around governance and upgrading	GTZ, ILO, World Bank, USAID, M4P	Designed to assess existing chain governance and opportunities for upgrading by smallholders and other chain actors
CF based on synergy, efficiency, and competitiveness	FAO, CIAT	Bottlenecks in chain performance and options for increasing chain competitiveness through improved cooperation and coordination identified by users
CF based on political, legal, institutional, and market context	DFID, IIED	Assistance with identifying options to design policies that offer smallholders greater development opportunities in regional and national markets
CF based on innovation and potential to achieve innovation	CIP	Implementation aimed at identifying opportunities for innovation within a given market context
CF that address issues related to the conditions of labor in a value chain	ILO	Help with focusing attention on the conditions of labor in a value chain and methods provided for identifying opportunities to improve conditions for labor
<b>Methodological elements</b>		
Selecting a chain for VCD using outside experts	FAO, DFID, ILO, GTZ, USAID	Parameters for data collection recommended that inform the decision on which chain to engage
Selecting a chain for VCD with local stakeholders	CIAT	Steps suggested for carrying out interviews with actors in selected territories for selection of chain
Participatory and practitioner-friendly approach to VCD	CIP, CIAT	Relatively easy-to-follow text, with numerous examples complemented by simple figures and tables; strong focus on participatory workshops and key-informant interviews for data collection

Area of interest	Recommended guides	Remarks
Innovative methods and tools for analyzing value chains and chain actors and for designing VCD strategies	World Bank, USAID, M4P	Most complete selection of concepts and tools for value-chain analysis and VCD provided by USAID, followed by M4P and World Bank
Detailed and well-structured approach to value-chain mapping and analysis	GTZ, USAID	Detailed discussion of tools and methods for understanding and mapping the value chain provided by GTZ
Monitoring and evaluation	CIAT, GTZ, USAID	Indicators recommended for data collection for monitoring and evaluation; limited discussions on methodology—for more detailed discussions on monitoring and evaluation in a VCD context, see Tanburn and Sen (2011), and Donovan and Stoian (2012)
Focus on circumstances of households, businesses, and individuals	USAID, UNIDO	Module with general guidance on VCD in conflict zones in USAID; discussion of options for addressing risks and gender in UNIDO
<b>Data collection at different scales</b>		
Gender and intrahousehold	UNIDO	A short discussion of intrahousehold data collection and analysis—see Mayoux and Mackie (2008), Rubin et al. (2009), Riisgaard et al. (2010), and Coles and Mitchell (2011) for more detailed discussions on gender and VCD
Household-scale production and marketing	CIAT, M4P, UNIDO	Most in-depth discussion on household-level data collection in UNIDO
Businesses and producer groups	CIAT, M4P, FAO, CIP	Most data collection from key-informant interviews with business leaders—more detailed assessments likely to require additional resources—for an example see Ortiz-Marcos, Naranjo, and Cabo (2011)
Chain and business environment	CIP, FAO, DFID, GTZ, IIED, M4P, ILO, World Bank, USAID	Most detailed discussion of assessment at the level of chain and business environment in GTZ, DFID, and USAID
Service providers	CIAT	Methods to assess the quality of service provision and to identify services without demand, and demands without services

**Source:** Authors.

**Note:** CIAT = International Center for Tropical Agriculture; CIP = International Potato Center; DFID = Department for International Development; FAO = Food and Agriculture Organization of the United Nations; GTZ = German Technical Cooperation Agency; IIED = International Institute for Environment and Development; ILO = International Labour Organization; M4P = Making Markets Work Better for the Poor; UNIDO = United Nations Industrial Development Organization; USAID = United States Agency for International Development.

implementation. They prioritize the institutions that shape the actions and interactions of chain actors and the related implications for chain development. Institutions of particular interest are those governing the relationships, agreements, and interactions among chain actors, the informal and formal

rules that determine what individuals and organizations should or can do, and the recurring actions carried out by individuals or organizations (such as provision of services, functions, and products). The implementation process brings chain actors and development organizations together to seek answers to questions of common interest, including inquiry into the limitations to chain growth and potential solutions that benefit all stakeholders. The guides embrace the use of participatory research methods, including key-informant interviews, participatory workshops (participatory chain mapping), and focus groups, thus facilitating their implementation by practitioners working in environments where data are scarce and large-scale sampling may be prohibitively expensive.

The guides reflect the interest of development organizations in achieving greater sustainability for their interventions. An underlying premise is that sustainability can only be achieved with a strong focus on consumer demand and the needs of certain chain actors (for example, supermarkets or overseas importers) for quality, volume, and social and environmental responsibility. By focusing attention on demand, the guides recognize that smallholders and other upstream chain actors must be able to respond to the demands of consumers, which opens the door for building more productive dialog and interactions with the private sector. The role of support services in helping smallholders better meet the needs of downstream chain actors is another aspect in which the guides address sustainability.

The review also sheds light on certain gaps and limitations in the guides related to VCD design. First, greater attention must be given to the needs and circumstances of poor households. The guides often implicitly assume that rural households are a homogeneous group and have sufficient resources to participate in VCD, do not face substantial trade-offs when using these resources, and are able to assume higher risks when investing their capital and labor. Insights from the literature show that these assumptions often do not reflect the needs and conditions of the poor. Recent publications have highlighted the need for greater attention to the needs and interests of smallholders when considering options for VCD (Seville, Buxton, and Vorley 2010; Stoian et al. 2012; Vorley, Pozo-Vergnes, and Barnett 2012). The design of strategies for VCD that include poor and vulnerable populations may require additional concepts and tools that take these aspects into account. This will increase the complexity of tool implementation; however, it also offers the opportunity to design more viable and efficient strategies. Debate continues as to which concepts and tools are most useful and how to incorporate them into guides without alienating users.

Second, the guides should provide deeper guidance for dealing with variations in the context. Most guides assume that users will identify critical elements of the context, understand their relevance for VCD, and make the necessary adjustments for data collection and analysis. These contextual differences may relate to scale in shipping and processing (and the related need for smallholder organization), the pre-existing asset endowments of smallholders and small businesses (and the related need for investments in asset building prior to VCD), and the overall business environment (and the related need for advocacy as part of the VCD). Future guides would benefit from increased attention to critical contextual issues related to VCD—for example, the need for collective business development, the existing governance pattern along the chain (or lack thereof), and the reach of the chain (international versus national/regional/local). Alternative implementation pathways based on differences in the context may increase the complexity of the guides themselves but should result in more tailored strategies for VCD.

Finally, more attention should be given to capacities of those who implement the guides. More discussion on how to deal with complex research design and implementation issues, such as variability in returns, may help to improve the overall rigor of assessment and usefulness of the VCD strategies. The incorporation of fully developed case studies (rather than snapshots of good practices from diverse sites) will also help to inform users about potential implementation pitfalls and options for avoiding them. Conceptual frameworks should explicitly show the relationships between tool implementation and the ultimate development goals to be achieved. Guides would benefit from a conceptualization of how guide implementation leads to outcomes and impacts for different types of chain actors. The incorporation of new tools and methods must recognize the trade-offs faced by users between ease of use and rigor. New debates and interactions among tool designers and users are needed to identify the costs and benefits of additional tools and rigor and promote learning for improved design and implementation of VCD guides. While individual authors and organizations have developed learning groups around specific guides, a wider group of users and guide designers is needed to address important issues and dilemmas facing tool design and implementation.

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## VALUE-CHAIN DEVELOPMENT FOR RURAL POVERTY REDUCTION: A REALITY CHECK AND A WARNING

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Dietmar Stoian, Jason Donovan, John Fisk, and Michelle F. Muldoon

### Introduction

In the late 1990s, a sense of urgency over the need to reinvigorate development processes led to the formulation of the Millennium Development Goals, which incorporated the view that increased income is a prerequisite to livelihood security and a decent standard of living. To date, however, notable progress in poverty reduction—measured in terms of income and passing the US\$1 a day absolute poverty threshold—has mainly been made in Southeast and East Asia, especially China, while significant poverty pockets continue to persist in the rural areas of Africa south of the Sahara, and in South Asia, and Central and South America (UN 2011). In search of viable alternatives to reducing poverty, value-chain development (VCD) emerged in the early 2000s as (1) a market-based approach to meet poverty-related Millennium Development Goals, and (2) a response to new opportunities in international markets signaling stronger demand for agricultural and forest products and services produced with environmental and social responsibility.

VCD has generally been defined as an “effort to strengthen mutually beneficial linkages among firms so that they work together to take advantage of market opportunities, that is, to create and build trust among value chain participants” (Webber and Labaste 2010). Key concepts related to VCD are win–win relationships, upgrading, innovation, and added-value. From a macroeconomic perspective, VCD may be promoted with a view to the competitiveness of a given sector or subsector. From a microeconomic perspective, VCD may target marginalized actors in the upstream segments of a value chain. Such “pro-poor” VCD has been defined as a “positive or desirable change in a value chain to extend or improve productive operations and generate social benefits: poverty reduction, income and employment generation, economic growth, environmental performance, gender equity

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and other development goals” (UNIDO 2011). It is principally from the latter perspective that many development agencies, donors, and governments have adopted VCD as a key element of their rural poverty-reduction strategies (see DFID and SDC 2008; Humphrey and Navas-Alemán 2010). In addition to targeting poor and vulnerable populations in the rural sector as primary beneficiaries, some value-chain initiatives seek to link to the macroeconomic environment by broadening their approach toward resource-constrained enterprises in the upstream segments of a value chain, and the promotion of changes in the political–legal, institutional, and regulatory frameworks (see Kula, Downing, and Field 2006).

Despite the prominent role of the VCD approach in current development agendas, surprisingly little is known about its impacts on rural poverty. The urgency of making tangible progress toward the poverty-related Millennium Development Goals and the uncertainty about the actual and potential contributions from VCD call for taking stock in terms of what we already know about its design, implementation, and impact; and what we have yet to learn to direct growing investments in such initiatives and ensure substantial effects on poverty. In this chapter, we first present those claims regarding VCD that are backed by clear evidence or broad consensus (“what we know”), followed by a discussion of issues where more evidence and consensus are needed (“what we think we know”). Next, we examine those questions where current knowledge falls short and where innovative action is needed (“what we still need to know and do differently”). We conclude with a call for an asset-based approach to design, implementation, and assessment of VCD and the need for nonmarket interventions to help particularly disenfranchised groups to meet the minimum asset thresholds for their successful participation in VCD.

## **What We Know**

*Actors promoting VCD vary widely, as do their motives. NGOs often pursue explicit poverty-reduction goals, while the private sector may see them as a by-product.*

The strengthening of mutually beneficial business relationships between two or more chain actors, including producers, distributors, processors, wholesalers, and/or retailers, requires improved interactions between them, often facilitated by the provision of technical, business, and financial services from outside of the chain. Related interventions aim at strengthening

capacities and enhancing mechanisms for sharing information, benefits, and risks. The stronger the win–win nature of such relations, the more likely they are to endure over time. While pro-poor value-chain initiatives have an explicit focus on poverty reduction, other value-chain initiatives may not. This, however, does not mean that they could not have an important, though unintended, poverty impact. Further, in many cases a diverse set of stakeholders from within and outside of the value chain invest in the chain, at times with little or no coordination between them. Private companies, for example, may invest in their relationships with poor producers to improve their environmental and social credentials, while an NGO may provide technical and financial assistance to the producers and other chain actors. From the company’s perspective, VCD is one among several types of business strategies pursued to ensure a positive image, market positioning, and the sourcing of scarce raw materials (Box 2.1). From the NGO’s perspective, their work with upstream chain actors is in explicit pursuit of poverty-reduction goals.

*VCD involving the poor needs to account for their diversified livelihood strategies and related risks and trade-offs.*

A review of value-chain methodologies and case studies (see, for example, Kula, Downing, and Field 2006; Tanburn and Sen 2011) shows that the poverty-reduction potential of VCD is often based on the assumption that poor households (1) have sufficient resources to effectively participate in VCD, (2) do not face substantial trade-offs when using these resources, and (3) are able to assume higher risks when reinvesting capital and labor. In reality, however, many poor households pursue diversified livelihood strategies by combining subsistence and market-oriented agriculture with off-farm labor and other nonagricultural income-generating activities. In the attempt to spread risk and smooth incomes, they optimize their overall livelihood system rather than one of the subsystems (for example, coffee production). In contrast, the participation in VCD often requires them to pursue a specialization strategy, with higher investments of capital, labor, and other resources in a given chain. Involving the rural poor in VCD therefore calls for a sound approach to address the complex trade-offs between income generation, food security, gender equity, sustainable natural resource management, and overall livelihood resilience.

According to empirical evidence, threats for the rural poor are much greater and opportunities more limited where the competitiveness of the domestic business sector lags far behind international standards (Altenburg

### **BOX 2.1 Private-sector initiatives that link to the poor**

Value-chain development is but one approach to involve the poor in private-sector initiatives. An alternative approach is the base-of-the-pyramid (BoP), where large companies aim to involve the poor in markets either as providers of raw materials or as customers of affordable products. Such approaches often aim at producing more with less and ensuring long-term business viability. Concerns have been raised that BoP approaches underappreciate heterogeneity among the poor, as well as the intricacies of participatory partnerships between transnational companies and poor communities (Arora and Romijn 2009). Other approaches go beyond economic goals by incorporating environmental and social goals. Corporate social responsibility (CSR) strategies call for exceeding legal mandates by involving ethical standards, stakeholder claims, and international norms in the business model. Pioneers of CSR have made notable investments in determining and improving their carbon, poverty, and other environmental or social footprints in pursuit of company or industry-wide goals. Lately, though, CSR has been criticized by Porter and Kramer (2011) for not being a solution as social issues remain at the periphery, not at the core. Instead, they advocate creating shared value (CSV) as a strategy to generate value for both companies and the society by reconceiving products and markets, redefining productivity in the value chain, and enabling local cluster development. The adoption of BoP, CSR, and CSV approaches signals private-sector interest in alternative ways of doing business in an era of increased competition for nonrenewable resources and unprecedented social change. These approaches share relevant features of VCD and, in theory, can facilitate asset building, generation of higher value-added, and win-win relationships involving the rural poor. However, more critical analysis and mutual learning are needed to ensure that economic, social, and environmental goals are adequately addressed, and that trade-offs encountered along the way will be minimized through continuous improvement.

**Source:** Authors

2007). Under these conditions a “multi-chain approach” to VCD, as suggested by Stoian and Donovan (2007) for agricultural and forest sectors, helps to minimize risks and maximize poverty-reduction potential by strengthening not only the most promising, often export-oriented value chain, but also a variety of domestic or regional chains to which smallholders have access. Charette (2011) argues similarly, advocating a “portfolio approach” to VCD programs that stretches across sectors, in particular where the

agricultural sector is highly subject to price and weather shocks, and where the manufacturing and/or services sectors show strong potential for growth and development. Despite these recent conceptual advances in VCD, it is still common practice to focus on a single value chain without due attention to the impact of value-chain participation of the rural poor on overall livelihood resilience and related trade-offs. In any case, VCD is only part of achieving rural poverty reduction. A comprehensive strategy should include a complementary focus on rural infrastructure and services; food security; and local markets for traditional products, such as basic grains.

*Pro-poor VCD has both advocates and skeptics. Either side lacks sound evidence to substantiate their claims.*

Given the intricacies of VCD, the diverse nature and interests of the stakeholders, and a general dearth of sound evidence of related impact, it does not come as a surprise that this approach has both advocates and skeptics. The former argue that the most promising option for lifting rural people out of poverty, other than rural–urban migration, is linking poor farming households to lucrative markets through skills development and new institutional arrangements along the chain. Skeptics, on the other hand, regard VCD as unsuitable for working with the very poor, given its perceived emphasis on risk-taking and entrepreneurship, and the additional challenges faced by the very poor when responding to economic incentives (Fowler and Brand 2011). The history of stimulating export-oriented production of nontraditional agricultural products illustrates some of the challenges faced when seeking to integrate the poor into more demanding markets (although not all VCD programs target export markets). From the skeptics’ perspective, such an approach may be seen as an example for failed pro-poor VCD, while advocates would hold that precisely the absence of good VCD practice has limited the impact of nontraditional agricultural export programs on poverty (Box 2.2).

When looking for evidence of the impact of poverty-focused programs, it becomes evident that “despite the pressure for measuring and reporting on results, most development agencies have in effect failed to measure and report on significant results in eradicating poverty” (Tanburn and Sen 2011). As a result, neither advocates nor skeptics can base their claims regarding the efficacy of VCD on sound impact assessment. In fact, most methodologies used for assessing the impact of VCD on poverty are fairly simplistic and yield partial information on its strengths and limitations as a pathway out of poverty. Assessments typically focus on the generation of employment

### **Box 2.2 Struggles of smallholders to participate in nontraditional agricultural exports**

Beginning in the 1970s and through the 1990s, governments and donor agencies promoted nontraditional agricultural exports (NTAE) in Latin America and Africa through trade liberalization, cooperative development, export promotion, fiscal incentives, subsidized credit, technical assistance, and infrastructure development. These initiatives were often geared toward medium- and large-scale agribusinesses, while smallholders participated with varying levels of intensity without being the primary beneficiaries of NTAE interventions. In some cases, the private sector has taken the lead in organizing the production of nontraditional export products. Food processors and supermarkets in Europe and the United States have redirected part of their sourcing of raw materials to traders, processors, and producers in developing countries. There is ample evidence that the conditions for smallholder participation in NTAE were often inadequate to allow for poverty reduction, and many of them dropped out of programs due to low productivity, high input costs, falling export prices, and limited access to farming inputs and credit. In other cases, smallholders were pushed out due to their limited ability to meet the quality or volume requirements of traders and processors. Over the years, consensus has emerged that NTAE development programs lacked economic sustainability, and did not adequately address poverty or the environmental and social costs of export-oriented production by large agribusinesses. VCD today, with its focus on both supply and demand factors for the design of sustainable market linkages, responds to the lessons learned from earlier NTAE experiences. However, there is an urgent need for those that fund and implement value-chain initiatives to address the poverty implications of their interventions in a more integrated way.

**Source:** Authors

and income, rather than broader changes in terms of critical livelihood and business assets (see Humphrey and Navas-Alemán 2010). Resulting reports thus provide an incomplete and potentially biased picture of VCD impact on the livelihoods of the poor and the viability of smallholder enterprises of which they may be a part. For example, a given initiative may have increased the income derived from commercializing crop production, while simultaneously it had compromised household food security and induced gender inequalities in terms of labor division and decisionmaking; or a smallholder enterprise may have increased permanent staff, though increased payroll costs undercut the prices paid to producer members.

*Current assessments of VCD tend to provide an incomplete picture of their impact.*

The limited utility of one-dimensional assessments follows a general trend of ineffective design and implementation of monitoring and evaluation for development interventions, including those in agriculture (Haddad, Lindstrom, and Pinto 2010). Discussions in the gray literature on private-sector development have advocated traditional logframe-based project assessment for understanding VCD poverty implications, with emphasis on enterprise rather than household-level impacts (see Tanburn and Sen 2011). While logframes and similar tools for “rigorous” planning and monitoring and evaluation may serve the reporting needs of project managers and donors, they are inappropriate for understanding complex development processes (Jones 2011), as they assume that the implementing organization can achieve the targeted outcomes and impacts on its own. The failure to adequately account for external factors, such as changes in the political–legal or market context, or the effects of value-chain interventions by others, provides an incomplete and potentially distorted picture of VCD impact. The reported impact is made more questionable if household-level impacts are deducted from enterprise-level outcomes rather than measured.

## **What We Think We Know**

Unlike the previous section, where we summarized views of VCD for which clear evidence or broad consensus exists, this section addresses our insights or those of others that are yet to become part of the mainstream discussion on VCD.

*Conceptual models underlying pro-poor VCD tend to lack a holistic perspective.*

Many value-chain initiatives involving the poor are based on fairly simple conceptual models focusing on a few variables (output, employment, income, production practices, infrastructure), while minimizing or omitting other critical albeit complex factors (for example, social and human capital building, vulnerability). Such initiatives often aim for greater productivity and better prices for poor households, and the resulting increase in income is seen as a proxy for poverty reduction, if not overall development. On the upside, the simplified design of a value-chain initiative reduces both monitoring and evaluation and implementation costs, and makes the results easy to communicate across the chain and to other stakeholders. On the downside, such an approach does not recognize the full set of assets needed by poor households to effectively

participate in VCD, nor does it address how these assets can be built over time to escape poverty and ensure livelihood resilience, or deal with the trade-offs the rural poor face when making decisions about their allocation of time and resources between a specific value chain and other livelihood activities.

*Poor households and smallholder enterprises require minimum assets to successfully participate in VCD.*

Despite the warning that poor households vary in their asset levels, income flows, social networks, and abilities to cope with shocks (Fowler and Brand 2011), many value-chain initiatives treat poor rural households as a uniform stakeholder group with the same response capacity. In reality, both external factors, such as access to basic infrastructure and services, common pool resources, and social stability, as well as internal factors, such as asset endowments, interests, and power, ultimately determine the extent to which poor households are “ready” to participate in specific value chains. Similarly, the “value chain readiness” of small and medium-sized enterprises (SMEs) requires adequate policies to improve overall investment conditions, attract foreign investment, and provide better business services to increase their competitiveness (Altenburg 2007). Minimum asset thresholds for successful participation in VCD apply at both household and enterprise levels, as illustrated by an example of a coffee cooperative in Nicaragua (Box 2.3). Below these thresholds, specific, nonmarket-based interventions are needed to create the necessary preconditions for poor households and resource-constrained enterprises to become value-chain ready.

*VCD stakeholders would benefit from an asset-based approach, clear impact models, and sound metrics for understanding poverty impacts and identifying options for improved pro-poor VCD.*

There is a growing consensus that conventional poverty definitions need to be broadened to take account for critical livelihood assets and vulnerability (for example, McKay 2009). These definitions allow for the endowments of and changes in human, social, natural, physical, and financial capital, and their effects on livelihood resilience. When applied in VCD, such an asset-based approach is critical to determine whether value-chain readiness is reached by meeting minimum asset thresholds. It can also prove the existence of positive feedback loops; that is, processes in which the building of one asset (for example, financial capital) leads to the building of others (for example, human or physical capital). These would be understood as indicators of broad-based and lasting impact on rural livelihoods in pursuit of well-being and resilience.

### **Box 2.3 Evidence of asset thresholds for successful participation in certified coffee markets**

The Nicaragua-based coffee cooperative Soppexcca links roughly 500 smallholder producers to international buyers of certified fair-trade and organic coffee. Following the coffee crisis—a period between 1999 and 2004 when prices fell below the cost of production for many producers in Central America—donors and NGOs invested \$2.1 million in building the capacity of Soppexcca and its members to expand their output and better meet the quality demands of international buyers. Donovan and Poole (2011) assessed the changes in tangible and nontangible assets for both Soppexcca and a representative sample of its members between 2006 and 2009. For the cooperative, interventions enabled major expansion of infrastructure and processing machinery, increased coverage of its technical assistance, and increased the ability to engage with new fair-trade coffee buyers in the United States. Related investments provided an option for generating income through expanded service provision to members, and thus were considered critical for the co-op's long-term survival. Most co-op members benefitted in terms of increased income flows and greater resilience through their membership in the cooperative. Nearly a fourth of the households were able to take advantage of credit provided by Soppexcca and others to expand their landholdings, diversify their agricultural production, and/or rejuvenate their coffee plantations. However, important weaknesses and gaps in assets remained unaddressed by the interventions and by Soppexcca itself. For example, financial assets remained seriously underdeveloped during the assessment period, while long-term debt increased significantly. Extension services expanded during the period, but had difficulties in responding to members' needs. One-third of the sampled households faced major barriers to intensify coffee production, access crucial inputs and services, and increase or diversify their production of basic grains. These households tended to be strongly constrained in their endowment with or access to assets, as reflected in very small landholdings, insecure land tenure, and high dependence on off-farm income for their livelihoods. They were also more likely to have older household heads or to be headed by a female. The Soppexcca case shows that greater attention needs to be paid to the asset endowments of smallholders and the related dynamics, if VCD is to reduce rural poverty in an integrated and significant way.

**Source:** Authors

Despite advances in thinking about the nature and causes of poverty, most skeptics and advocates of VCD rely on a limited set of indicators and data to

substantiate their poverty claims. The former tend to describe the limited poverty impact of VCD by focusing on either the limited *relative* share of benefits captured by the poor in a given chain or the exclusion of the poorest sections of the rural population. Advocates, on the other hand, argue that the contribution of VCD to poverty reduction needs to be measured as an *absolute* increase in income through interventions in a value chain, and that employment effects among the poor are relevant irrespective of the overall distribution of benefits. In both cases, clear impact models with plausible cause–effect relationships, or refined metrics that allow for both positive and negative effects of VCD, are largely absent.

There is an urgent need and an opportunity for public and private investors in VCD to promote the adoption of an asset-based approach to the design and implementation of value-chain initiatives, based on well-defined impact models, and to the development of sound metrics that help demonstrate under which conditions VCD generates high poverty impact. Recent work by an international coalition of development practitioners and researchers highlights the opportunities and the challenges for the application of an asset-based approach to VCD (Box 2.4).

*VCD requires adequate linking of technical, business, and financial services.* In addition to successful collaboration between public and private sectors and civil society, pro-poor VCD requires a combination of technical, business, and financial services. Some of these services are available from within the chain, particularly those that help improve quality or efficiency. Such “embedded services,” typically provided by downstream actors to their upstream business partners, have the advantage of focusing on clearly identified needs and upgrading opportunities in the chain. On the other hand, certain services may not be readily available from within the chain, especially those that help improve environmental and social performance or that address long-term issues related to capacity building and skills development among the poor. These services may need to be sourced from external service providers, such as government agencies, NGOs, development projects, and consulting firms. The diverse nature of the services needed poses a challenge to their effective and efficient delivery. Technical services related to production and, to a lesser extent, processing technologies tend to be readily available for traditional products, from either downstream actors or external service providers. Financial services may be provided in the form of advance payments or credits within the chain, or through government programs and microfinance projects from outside of the chain. Usually,

#### **Box 2.4 International collaboration to design an asset-based approach to value-chain development assessment**

Between 2008 and 2011, an international group of development practitioners and researchers, representing Bioversity International, the Tropical Agricultural Research and Higher Education Center (CATIE), Catholic Relief Services (CRS), the World Agroforestry Centre (ICRAF), HELVETAS Swiss Intercooperation, Lutheran World Relief (LWR), Mennonite Economic Development Associates (MEDA), Swisscontact, TechnoServe, and Winrock's Wallace Center, among others, collaborated on the design and testing of the *5Capitals Toolkit*—an asset-based approach assessing the poverty impacts of VCD (see Donovan and Stoian 2010). In collaboration with local NGOs and consultants, and with financial support from the Ford Foundation, the toolkit was designed and validated through 23 case studies in Latin and North America, Africa, and Asia. The aim was to design a tool that would (1) assess the impact of a whole set of VCD interventions, rather than that of a particular intervention; (2) consider changes in assets among both households and the enterprises that maintained links with them; and (3) differentiate between the impacts of the combined VCD interventions and those induced by external factors. Experiences gained in tool testing demonstrated the potential of an asset-based approach to VCD assessment, along with related challenges. Case-study collaborators agreed that (1) such an approach is very useful to gain in-depth insight on VCD-related poverty impacts; (2) the focus on both household and enterprise assets sheds additional light on poverty impacts; (3) the context analysis as the first step of the methodology is critical to isolate VCD-related impact from context-induced change; and (4) the results of impact assessment have highest value when used for redesigning VCD interventions. At the same time, they found that this approach (1) implies investments of human and financial resources that are reasonable but not low-cost, (2) requires a flexible handling of the enterprise assessment due to the varied nature of “linked enterprises,” and (3) depends on systems thinking to make the most out of it. The final version of the toolkit (in English and Spanish) and an edited case study volume are available on the CATIE and ICRAF websites (Donovan and Stoian 2012).

**Source:** Authors

however, they are not available to highly resource-constrained smallholders. Business services often turn out to be the Achilles' heel in VCD as specialized business service providers for the rural sector are largely absent. A further challenge for VCD-related services is their provision in an isolated

fashion. Service providers are typically specialized in one of these three types of services and rarely make an effort to partner with those who provide complementary services. Effective and efficient services for VCD require a sound demand analysis and a concerted approach to the delivery of technical, business, and financial services that are well-linked and complement each other in a logical fashion. Following the subsidiarity principle, that is, that all functions in the chain should be performed on the “lowest” level possible, only those services that cannot be sourced from within the chain would be provided from outside of the chain.

## **What We Still Need to Know and Do Differently**

Despite the increasing focus on poverty by governments, development agencies, and civil society organizations, and some tangible success stories, the number of rural people living in desperate conditions under various degrees of vulnerability remains high. Undoubtedly, we have advanced our understanding of poverty issues and there is a growing consensus on the importance of pro-poor interventions in value chains. There are a number of crucial issues on which our knowledge is still insufficient. In the absence of an asset-based approach to designing, implementing, and monitoring value-chain initiatives, related impact models and theories of change are incomplete. Under these conditions, it is virtually impossible to identify the best options for helping poor people to *exit* out of poverty, let alone to *stay* out of poverty. In addition to these knowledge gaps, there are a number of “action gaps” related to areas that require forms of engagement in value chains in addition to, or other than, those applied to date.

### **Need for Improved Knowledge**

- *How to determine value-chain readiness?* If the goal of the intervention is to reduce vulnerability and lift people out of poverty, how can we determine whether poor households and their business organizations are ready to participate in VCD? Which minimum asset thresholds do they need to meet and, if not available, what are the best options to help them become value-chain ready?
- *Can asset building at the level of smallholder enterprises spur asset building at the household level?* Since business organization of smallholders is often considered a prerequisite for their successful participation in value chains,

we need to understand under what conditions asset building at the level of the smallholder enterprises positively influences household assets and reduces vulnerability; and how VCD can help to create more synergy in this respect.

- *How to ensure that assessing VCD impact is both effective and efficient?* Current impact assessment of value-chain programs tends to be low-cost and fairly one-dimensional, whereas an asset-based approach to assessment yields more robust results while requiring higher investments. There is a clear need for experimenting with differentiated approaches to impact assessment; for example, the routine measuring of outputs, the assessing of outcomes to the extent possible, and full-fledged impact assessment through in-depth case studies. The Donor Committee for Enterprise Development (DCED), for example, recommends three “universal” impact indicators (scale, income, and jobs) for ongoing results measurement; at the same time, it acknowledges that this cannot replace rigorous impact assessments, nor evaluations, as these ask broader questions (Tanburn and Sen 2011).
- *How best to use an asset-based approach for planning, implementing, and assessing VCD?* This question is at the heart of any improvements in VCD. In particular, we need to understand what indicators within each asset type—typically including human, social, natural, physical, and financial capital—tell us the most about reducing poverty and vulnerability. Which proxies can be used to make assessment manageable and cost-effective? How do we adapt or tailor VCD to different contexts and varying asset levels in given populations? How can we best deal with nonlinear asset pathways (asset building followed by asset erosion or vice versa)?
- *Which roles correspond to private, public, and civil society sectors in promoting VCD?* What can the private sector do alone? Under what conditions will the private sector invest in the long term, or go the extra mile for pro-poor VCD? What can realistically be expected from private-sector initiatives, such as base of the pyramid, corporate social responsibility, or creating shared value? Where and how do public–private partnerships work best, and where are their limits? What is the specific role of NGOs in helping build assets beyond the contributions from public and private sectors?

## Need for Improved Action

- *Account for the evolution of income and asset objectives.* VCD programs need to account for the dynamics and variations of asset endowments and livelihood objectives among poor and vulnerable populations. Different measures are needed in each stage when following a pathway out of poverty from “(i) stabilizing household consumption/stemming asset loss, to (ii) smoothing household consumption/protecting assets, to (iii) smoothing household income/acquiring assets, to (iv) expanding household income/leverage assets, and to (v) stabilized income-generation and asset accumulation” (Fowler and Brand 2011).
- *Differentiate between those who are value-chain ready and those who are not.* Market-based interventions work for those who meet minimum asset thresholds and, therefore, are value-chain ready. Those who do not meet those thresholds require specific, nonmarket-based interventions to create the necessary preconditions for their participation in VCD. These include, but are not limited to, customized technical assistance and training to build human and social capital, rehabilitation of natural capital where eroded, investments in basic infrastructure and services, and resolution of land-tenure conflicts where they exist. These interventions fall outside the realm of VCD, but are critical for its success if the poorest sections of the rural population are to benefit.
- *Follow logical sequence of asset building.* There are plenty of examples of programs where donors have given processing equipment to farmer organizations, but the initiatives have failed because of lack of business skills. In many cases, human and social capital need to be built before considering investments in physical capital. In other cases, eroded natural capital needs to be rebuilt before meaningful business development is possible.
- *Ensure synergies among public and private sectors and civil society promoting VCD.* Based on the subsidiarity principle, public sector and civil society should only engage in those interventions that cannot be performed by the private sector. This requires determining which services can be provided from within the chain (“embedded services”) and which need to be sourced from external service providers (in many cases government agencies or NGOs). For example, rather than donating equipment, donors might link farmers to credit agencies to buy the equipment. If necessary, agencies could subsidize the cost of credit.

- *Improve the quality of and the linking between technical, business, and financial services.* In the absence of integrated service providers, we need to make major efforts to link technical, business, and financial services in ways that allow for meaningful asset building at household and smallholder-enterprise levels. At the same time, we need to ensure that the linking of these services is geared to the requirements identified by the chain actors rather than outside agents from the public sector or civil society.
- *Create awareness among donors and development practitioners about the advantages of adopting an asset-based approach to the design, implementation, and assessment of VCD.* There is a need to provide evidence that the increased costs and complexity of an asset-based approach are outweighed by tangible benefits in terms of higher impact on poverty reduction, livelihood resilience, and viability of smallholder enterprises.
- *Promote comprehensive strategies for rural development.* There is both a need and an opportunity to combine VCD with other approaches to rural development, such as sustainable rural livelihoods, territorial development, and investments in rural infrastructure and services.
- *Innovate in partnerships for joint learning and continuous improvement.* The diverse nature of stakeholders in VCD provides a great opportunity for joint learning. Each of them brings specific perspectives, skills, and experiences to the table, but we need to define appropriate forums and mechanisms for sharing and capitalizing on these. The outcome of such learning alliances and communities of practice will be highest if nurtured by genuine interest in learning and authentic commitment to continuous improvement.

## **Conclusion**

Our current knowledge of the poverty impacts of VCD is limited. Regardless of whether related initiatives are driven by private, public, or civil society sectors, the use of sound metrics to determine their impact at both enterprise and household levels, and to isolate VCD from context-induced change, should be the rule rather than the exception. If VCD is to be effective in addressing rural poverty, it must embrace the complex needs and realities of the rural poor. This includes the recognition that market-oriented activities are important but not exclusive elements of rural livelihood strategies. Particular attention needs to be paid to the specific challenges and needs of the very poor,

given their higher risk and vulnerability. Otherwise, there is a substantial risk that pro-poor VCD does not live up to expectations and causes undue trade-offs in the livelihood strategies of the rural poor.

An asset-based approach to the design, implementation, and assessment of VCD is a powerful vehicle to address these challenges and risks. Not only does it provide an appropriate measure of the multiple dimensions of poverty and vulnerability, but it also helps to determine which households and smallholder enterprises are ready for VCD, and which require specific preparatory interventions to become value-chain ready. An asset-based approach to VCD comes at a price, however. Related planning, data collection, and analysis are relatively time-consuming, complex, and costly. At the same time, such an approach helps forgo higher expenses to mitigate unintended effects of interventions in value chains. It provides public-sector and civil society organizations with the necessary information to justify the investment of taxpayers' money, and holds the potential to improve the environmental and social credentials of private-sector companies pursuing base of the pyramid, corporate social responsibility, creating shared value, or similar strategies.

VCD is not a panacea to rural development. When seeking impact beyond poverty reduction on resilience of livelihoods and ecosystems, it needs to be paired with complementary approaches. Comprehensive strategies for rural development would include improvements in local infrastructure and services, political–legal frameworks, food security, local markets for agricultural and forest products, and income generation through services and off-farm employment. Appropriate design, implementation, and monitoring and evaluation of such strategies, again, will best be achieved by pursuing an asset-based approach.

Much remains to be learned about the best possible design and implementation of value-chain programs and pertinent combinations with other approaches. Undoubtedly, however, an asset-based approach to pro-poor VCD is a critical element of such strategies. Governments, donors, development agencies, NGOs, and private-sector agents committed to poverty reduction will need to invest in pilot projects, tool development, and capacity building; engage in multistakeholder platforms for joint learning; and commit to continuous improvement. Without the adoption of an asset-based approach to VCD, poor households and smallholder enterprises in the upstream segments of the chain will continue to be exposed to high uncertainty and risk and, in particular, to potentially harmful trade-offs between value-chain optimization and resilience at the household and business levels.

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## CHANGING ASSET ENDOWMENTS AND SMALLHOLDER PARTICIPATION IN HIGHER-VALUE MARKETS: EVIDENCE FROM CERTIFIED-COFFEE PRODUCERS IN NICARAGUA

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Jason Donovan and Nigel Poole

### Introduction

Intensify, innovate, and specialize—this was the essential message for governments and donors looking to address the devastations of the coffee crisis in Central America and other coffee-producing regions. Between 1999 and 2005, prices paid for green coffee did not allow producers in Central America to cover their variable costs of production (IADB 2002). Most smallholders reduced investment in coffee productivity, while others abandoned coffee plantations altogether, or uprooted plantations in favor of basic grains and other crops (Castro, Montes, and Raine 2004). Influential publications argued that smallholders had limited opportunities to increase their share of the benefits from trade in commodity coffee markets, given that the overwhelming proportion of economic returns flowed to actors in developed countries (Oxfam 2001; Ponte 2002; Gibbon and Ponte 2005).

Consensus emerged that support for building smallholders' links to specialty coffee markets, including those for certified fair-trade and organic coffee, would improve the prospects for smallholders in the short and long term (USAID 2003; Varangis et al. 2003; IICA 2004; Bacon 2005; Kilian et al. 2005). The specialty market exhibited rapid demand growth, in contrast to slow growth for bulk coffees. Access to these markets required that smallholders meet stricter quality requirements and, in some cases, obtain access to certification. Subsequent development interventions aimed to improve coffee quality and productivity, facilitate access to certification, strengthen collective enterprises in regions where the production of high-quality coffee was most viable, and promote diversification out of coffee for regions with less potential.

Recently, however, various studies have tempered expectations regarding the poverty-reducing potential of access to markets for fair-trade and organic coffee. Arguments have centered on the persistence of low yields and relatively high

labor requirements (Valkila 2009; Barham et al. 2011; Beuchelt and Zeller 2011), declining prices relative to conventional coffee (Weber 2011), and the limits of smallholders to intensify coffee systems given their livelihood insecurities and rising production and household-consumption costs (Raynolds 2002; Bacon et al. 2008; Mendez et al. 2010; Wilson 2010). These findings on coffee echo those of well-documented studies in the Mediterranean, Africa, and Latin America on the struggles of smallholders to meet stricter buyer demands for product quality, volume, and timeliness of delivery across a range of agrifood sectors (for example, Reinhardt 1987; Dolan et al., 1999; Reardon, Humphry, and Harris-Pascal 2003; Garcia-Martinez and Poole 2004).

While nongovernmental organizations (NGOs), donors, and development agencies have maintained their enthusiasm for facilitating smallholder links to higher-value markets (Devaney 2011), few value-chain studies or assessments of value-chain interventions have explicitly documented the impact of improved market access on poverty, gender, or the environment (Bolwig et al. 2010; Stoian et al. 2012). Project assessments generally have relied on only a few generic impact indicators (for example, output per unit area, size of holding, income gained) and thus have provided limited understanding of the determinants of household participation and the benefits across different types of households (for example, Zandniapour, Sebstad, and Snodgrass 2004; Humphrey and Navas-Alemán 2010). As a result, policymakers and development practitioners have inadequate guidance for the design of the necessarily complex interventions that seek to help farmers benefit more from their linkages with higher-value markets.

Deeper insights into how smallholders benefit from linkages to higher-value markets can be obtained by adopting a livelihoods perspective, with special emphasis on households' assets and the ability of households to build their endowments over time. In this chapter, we undertake an analysis of household asset building to explore how differences in market participation reflect variations in households' endowments of livelihood assets, namely natural, human, social, physical, and financial capitals. We consider:

- initial asset endowments of producing households,
- the contribution of development interventions to household asset building, and
- how initial asset endowments and subsequent household changes determine smallholders' participation in high-value export markets.

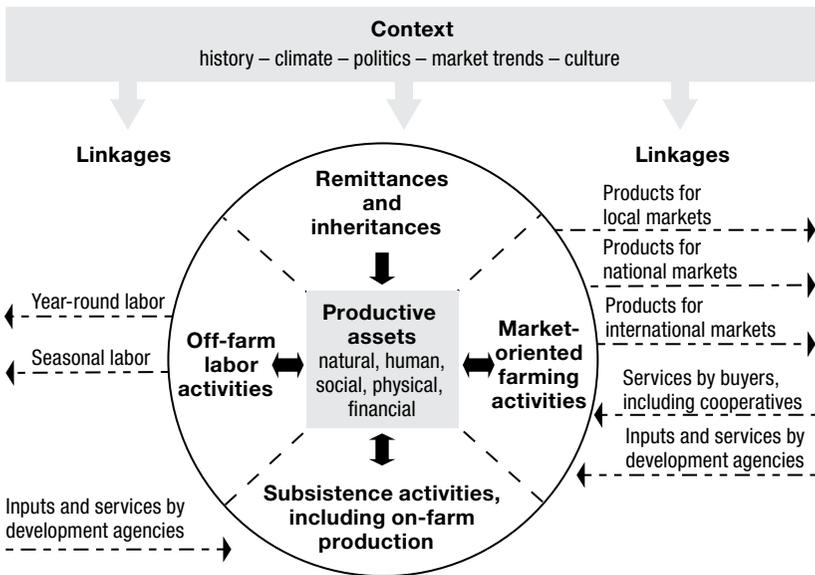
We describe the asset-building framework; provide contextual information on the case study in Nicaragua; discuss the methods used for data collection; present the results on asset changes by coffee-producing households; and then discuss the implications of the findings for the design of development interventions aimed at linking smallholders to higher-value food markets.

## **An Asset-Building Framework**

Poverty debates reflect a growing interest in the importance of assets for understanding poor people's ability to respond to shortages and shocks and generate future income and consumption (for example, Moser 1998; Rakodi 1999; Anderson 2012). Economists have argued that a focus on assets provides a better option for understanding the underlying causes and the dynamics of poverty than a focus on income or consumption variables alone (for example, Birdsall and Londono 1997; de Janvry and Sadoulet 2000). Carter and Barrett's (2006) theoretical work on asset thresholds and poverty traps drew attention to how insufficient access to assets jeopardizes the long-term ability of households to pull themselves out of poverty. An understanding of asset endowments and interactions forms a core element of the frameworks for livelihood conceptualization and analysis (for example, Carney 1998; Ellis 2000).

Academic discourse on the links between poverty reduction and access to higher-value markets suggests that the poorest smallholders often have too few assets to effectively participate over time. However, such insights into the roles of assets in shaping rural livelihoods have yet to translate into the design and assessment of interventions for linking smallholders to higher-value markets (Stoian et al. 2012). For example, the various methodologies for designing strategies that better link smallholders to markets pay little attention to households' capacities, needs, and circumstances, thus making the implicit assumptions that households (1) have sufficient assets to effectively participate in higher-value markets, (2) do not face substantial trade-offs when using these assets, and (3) are able to assume higher risks for their investments (Donovan et al. 2013). Making such assumptions reduces the complexity for methodological implementation, but runs the risk of formulating intervention strategies that provide limited long-term benefit to the rural poor.

More effective policies, programs, and projects for linking smallholders to globalizing food markets will require that key aspects of the development challenge be addressed in formal tools and frameworks. The framework presented here stresses the relationships between a household's endowment of livelihood assets and its ability to engage in various livelihood activities (Figure 3.1).

**FIGURE 3.1** Household asset allocations and linkages with markets and service providers

Source: Authors.

Livelihood assets, namely natural, physical, social, financial, and human capitals, may be individual or collectively owned. These are built up through returns from market activities, remittances and inheritances, and inputs and services provided by NGOs and other external actors. Variations in asset accumulation may be explained, in part, by variations in the overall political, legal, and institutional context that shapes the decisions of producers and buyers. The stronger a household's asset base, the greater is its ability to expand and intensify livelihood activities and thus benefit from links with more demanding markets.

Households maintain different types of commercial relations with buyers linked to local, national, and international food markets. In addition, households may engage in seasonal and year-round labor provision. Investments in household labor and financial resources and returns to those investments vary according to the market and over time. To the extent that new (more intensive) market linkages require new (increased) investments, trade-offs are likely between assets and among activities required to implement other livelihood activities, including subsistence production. Opportunities to reduce the costs and risks related to market investments may originate from collective enterprises, other buyers, and nonmarket actors (for example, NGOs, government agencies).

This framework suggests that the design of pro-poor interventions in value chains must progress beyond the categorization of the types of capital to identify priorities for policy and interventions supporting asset building. Such prioritization should relate poor people's access to different types of assets to the functions of those assets within changing and dynamic livelihood strategies, identifying the most effective livelihood-development paths and the changing roles of different assets within those paths. The framework and methodological approach used here enables a systematic analysis of asset endowments and the diverse livelihood strategies of the poor. It will help policymakers assess whether access to new or higher-value food markets will help households climb out of poverty, and address questions such as which households are more able to build their asset bases? How are assets built up over time? Which households are best able to invest in new or more intensive market linkages?

## **Case Study Background**

Coffee is the most important agricultural product exported by Nicaragua, accounting for 37 percent of the total value of agricultural exports in 2008 (CEPAL 2009). With an average (green) coffee productivity of 672 kg/ha, Nicaragua is the least efficient producer in Central America. Its coffee productivity is roughly 50 percent of Costa Rica's and 40 percent of Guatemala's (Varangis et al. 2003). There are about 48,000 coffee farmers in Nicaragua, 80 percent of whom are producers with less than 3.5 ha under cultivation (Flores et al. 2002). Despite the large number of smallholders, farms larger than 3.5 ha produce more than 85 percent of the Nicaraguan coffee harvest due to higher intensity of management and better access to purchased inputs. In general, coffee producers are better-off than the landless or those who produce basic grains and tubers mainly for subsistence. That said, the poorest of coffee farmers often lack resources for coffee production and basic living expenses, and are vulnerable to negative changes in output and input prices, production risks, and other shocks.

The research examined asset building by smallholders in north-central Nicaragua who were linked to certified fair-trade and organic coffee markets through the cooperative Soppexcca. Soppexcca has roughly 500 members. It emerged in 2001 from the ashes of its predecessor cooperative, which dissolved due to unpaid debts owed to international coffee buyers. Soppexcca's membership more than doubled during the coffee crisis, as smallholders sought credit and higher coffee prices. In addition to providing access to certified markets, Soppexcca offers annual credit for coffee production, multiyear

credit for strategic coffee-related investments, technical assistance for increasing coffee productivity and reducing environmental impacts of coffee production, and some forms of social protection. In 2009, all of Soppexcca's coffee exports were fair-trade certified, and approximately 15 percent were certified for both fair trade and organic. Since its beginnings, Soppexcca has maintained strong ties with a small group of European coffee buyers. Recently, the cooperative has forged ties with US coffee buyers.

Soppexcca, like other relatively large and well-established cooperatives in Nicaragua, maintains close links with NGOs and development projects. Between 2003 and 2009, Soppexcca received about US\$2.1 million from NGOs and development projects to build its infrastructure, strengthen its internal organization, and expand its service offer to members. Soppexcca maintains links to alternative lending institutions for access to low-cost credit for infrastructure development and the purchase of coffee from its members. In addition, Soppexcca receives support from coffee buyers in the form of fair-trade contracts (with social premium and floor prices) and zero-interest credit for purchase of coffee from its members. On average, in 2009, buyers offered Soppexcca prices that exceeded by 5 percent to 15 percent those established by fair-trade standards.

## **Study Design and Methods**

Data collection focused on identifying changes in endowments of livelihood assets among coffee-producing households affiliated with Soppexcca during the four-year period between 2005–2006 and 2008–2009. Quantitative and qualitative data were collected to understand the changes in assets, and qualitative information was used to understand the relevance of—and the reasons for—the changes. Feasibility of empirical research and the tractability of analysis required a focus on specific elements of the five livelihood assets rather than undertaking a comprehensive analysis of all asset concepts. After exploratory and participatory research among producers to validate asset concepts and methodology, the most important asset changes were assessed using the following set of indicators:

- *Natural capital*: access to land and area under coffee production, land-tenure arrangements, access to fertilizers (proxy for soil fertility), and waste management
- *Human capital*: management skills in coffee production, ability to participate in cooperative governance

- *Social capital*: linkages and reciprocity in relationships with coffee buyers
- *Physical capital*: capital for production and processing
- *Financial capital*: access to credit, income benefit from coffee sales to Soppexcca.

In most cases, what we observed and measured provided a partial understanding of the five assets and their relevance for livelihood strategies. This is especially true in the case of social capital, the concept of which admittedly has been much contested (for example, Fine 1999). In research on smallholders, social capital has been explored in various ways, including interactions with neighbors (for example, Elder, Zerriffi, and Le Billon 2012) and links with farmer organizations (for example, Uphoff and Wijayaratna 2000). In this study, the assessment of social capital focuses on relations between Soppexcca members, the cooperative itself, and transactions with other coffee buyers, with special attention to the formation of mutually beneficial trading relationships. The data collected focused on the services and inputs received by smallholders from buyers, and, in the case of Soppexcca, the ability of the cooperative to service, and source raw material from, its members.

Environmental-sustainability issues were addressed under the management of natural asset (soil fertility) and human asset (waste-management practices). Commercial sustainability was subsumed within concepts of social and financial capital. Equity issues, such as differential impacts and outcomes for households, were addressed through the clustering approach.

In addition to information on assets, data were collected on other major income sources, on contextual factors that could have facilitated or hindered asset building, and members' insights into the reasons why a given change did or did not take place.

The sample comprised 292 coffee-producing households—about 95 percent of the membership of 11 of Soppexcca's 18 base cooperatives. Criteria for base cooperative selection included distance from Soppexcca's headquarters and geographical concentration of members in a given base cooperative. To facilitate data collection, preference was given to those cooperatives with a higher concentration of households. Unless otherwise indicated, coffee quantities are presented as pre-dried parchment coffee—the semiprocessed state of coffee when it is sold by producers to buyers such as Soppexcca. One hundred pounds (45.4 kg) of export-ready (green) coffee is commonly processed from roughly 200 pounds (90.7 kg) of pre-dried parchment coffee produced by farmers in north-central Nicaragua.

Data collection was conducted in Jinotega and Matagalpa districts during a nine-month period in 2009–2010. Primary data from household surveys and key-informant interviews were supplemented by secondary information from Soppexcca staff. Twenty key-informant interviews were conducted with Soppexcca leaders, international coffee buyers, certification agents, and other chain actors. Recall information was used to identify current asset endowments and changes in asset endowments over the assessment period.

Cluster analysis allowed for understanding the potential for asset building by different types of households. Clusters were formulated using a two-step clustering technique using SPSS. Two variables with strong correlation that formed the basis for formation of the clusters were: (1) area under coffee production in 2008–2009, and (2) percentage of total household income derived from off-farm sources in 2008. A three-cluster solution emerged from this analysis, with household livelihoods descriptors and cluster characterization as follows:

- *Small-scale diversified livelihoods (SDL)* (n=77): relatively small area under coffee production; high dependence on income derived from off-farm labor activities (often as wage labor for other, usually larger, farmers); some contribution from other crops.
- *Small-scale specialized livelihoods (SSL)* (n=162): relatively small area under coffee production; majority of income derived on-farm from coffee, with contributions from banana, citrus, beans, and other products.
- *Large-scale specialized livelihoods (LSL)* (n=53): relatively large area under coffee production; majority of income derived from coffee, with contributions from livestock, banana, citrus, and other products.

Table 3.1 provides insights into the differences between the clusters. The mean total annual income for the sample was \$4,969 (or, given an average household size of 5.2, \$956 per capita). Pushing up the average was total income for LSL households, which at \$14,627 was several-fold higher than that of other households. For both LSL and SSL households, coffee contributed between 85 percent and 93 percent of total income. For SDL households, coffee contributed approximately 33 percent of total income, with 5 percent coming from other farming activities and 62 percent from off-farm. In most cases, these households depended on short-term, low-skill jobs in the agricultural sector. Across all the clusters, cash income derived from agricultural sources other than coffee was generally a small share of total income. The analysis of variance (ANOVA) results suggest that the cluster

**TABLE 3.1** ANOVA results comparing selected indicators across clusters

Variable	Cluster			Total (SD)
	Small-scale diversified livelihoods (SDL) (SD)	Small-scale specialized livelihoods (SSL) (SD)	Large-scale specialized livelihoods (LSL) (SD)	
Total income 2008 (\$) F (2, 292) = 80.98, P <.05	2,617 (±2,557)	2,927 (±2,730)	14,627 (±13,221)	4,969 (±7,605)
Income from sale of coffee 2008 (\$) F (2, 292) = 50.73, P <.05	867 (±1,033)	2,486 (±1,828)	13,474 (±8,579)	4,053 (±4,543)
Income from off-farm sources 2008 (\$) F (2, 292) = 61.79, P <.05	1,618 (±1,651)	157 (±466)	304 (±757)	569 (±1,154)
Area under coffee production (ha) 2008–2009 F (2, 290) = 96.98, P <.05	1.5 (±0.4)	1.8 (±1.5)	6.3 (±6.8)	2.5 (±2.9)
Highest education achieved Soppexcca-registered household member (highest grade achieved) F (2, 290) = 0.34, P >.10	3.6 (±3.8)	3.0 (±2.2)	3.3 (±2.5)	3.2 (±2.7)
Age of household head registered with Soppexcca F (2, 290) = 2.84, P <.10	44.1 (±12.2)	42.0 (±13.3)	48.6 (±10.7)	43.3 (±12.6)

Source: Authors.

Note: ANOVA = analysis of variance; SD = standard deviation.

solution was robust and thus provided a solid basis for analysis of changes in livelihood assets.

## Changes in Assets of Coffee-producing Households

### Natural Capital

#### ACCESS TO LAND AND AREA UNDER COFFEE PRODUCTION

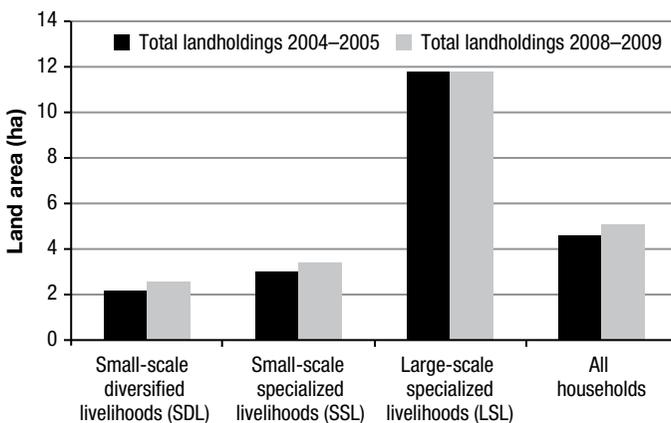
The expansion of landholdings and the area under coffee production provide important indicators of natural capital management and the overall ability of smallholders to improve their well-being through access to specialty coffee markets. For both indicators, results suggest a notable improvement in natural capital for a broad section of the sample. Eighty households, or nearly

one-third of the sample, expanded their landholdings. The average landholding increased from 4.6 ha to 5.1 ha (Figure 3.2). Among the clusters, the largest percentage increase in landholdings, at 15.4 percent, was recorded by households from the SDL cluster. Households from the SSL cluster increased their landholdings, on average, by 11.8 percent, while, on average, households from the LSL cluster experienced limited change in landholdings.

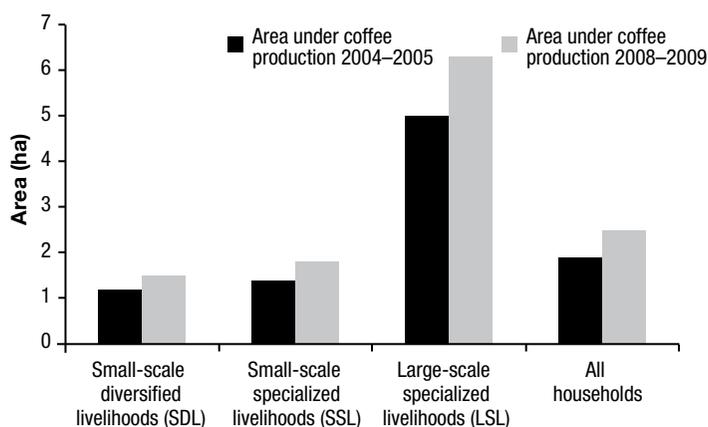
Many households also increased their area under coffee production through new land purchases or the conversion of existing land to coffee production. Roughly half the sample, or 158 households, expanded coffee production. The average area increased from 1.9 ha to 2.5 ha (Figure 3.3). Households from the LSL cluster increased area under coffee, on average, by 1.4 ha (28 percent increase over the pre-existing area). Households from the SSL cluster increased area under coffee, on average, by 0.4 ha (31 percent increase over the pre-existing area), while households from the SDL increased their area under coffee by an average of 0.29 ha (26 percent increase over the pre-existing area).

Expansion of landholdings and area under coffee represent considerable investments over multiple years. Households often identified a mix of factors that allowed for expansion in coffee area, including access to credit with extended repayment periods, income from coffee sales, and income from other sources, including that generated off-farm. Soppexcca was the only source of multiyear credit identified by sampled households. Fifty-six percent of the sample received three-year credit for land purchases

**FIGURE 3.2** Change in total land area, by cluster, 2004–2005 to 2008–2009



Source: Authors.

**FIGURE 3.3** Change in area under coffee production, by cluster, 2004–2005 to 2008–2009

Source: Authors.

and renovation of coffee plantations (for details, see the financial capital section). Logistic regression showed the relative importance of credit, off-farm income, and pre-existing land size in predicting the expansion of coffee production. The strongest predictor of coffee expansion was access to multiyear credit. For each \$500 installment of credit obtained, households increased their odds of expanding their area under coffee production by nearly five times (Table 3.2).

**TABLE 3.2** Multiple logistic regression showing effects of credit, off-farm income generation, and pre-existing land ownership on coffee expansion

Variable (N = 292) <sup>a</sup>	B	SE	Sig.	Odds ratio
Pre-existing landholding (2004–2005)	-0.065	0.025	0.010	0.937
Percentage of income generated off-farm	-1.230	0.525	0.019	0.292
Age of Soppexcca member	-0.028	0.013	0.030	0.972
Total credit received between 2004–2005 and 2008–2009 (\$500 units)	1.589	0.282	0.000	4.897
N household members	-0.038	0.065	0.561	0.963
Constant	1.532	0.572	0.007	4.627

Source: Authors.

Notes: B = coefficient for the constant; SE = standard error around the coefficient of the constant; Sig. = significance level; N = size of sample.

<sup>a</sup> The model as a whole correctly classified 77.2 percent of all cases.

### LAND-TENURE ARRANGEMENTS

Land-tenure insecurity is a legacy of the agrarian reform, which left many potential coffee farmers in ambiguous legal positions regarding landownership, vulnerable to appropriation of land titles by banks. This situation has long challenged rural development in Nicaragua (Broegaard 2005; Fraser, Fisher, and Arce 2013). For some Soppexcca-affiliated households, uncertain tenure arrangements before joining the cooperative severely restricted investments in farm production. These households belonged to two Soppexcca-affiliated base cooperatives, which, when combined, formed roughly one-third of the SDL cluster. For members of one of these two base cooperatives, Julio Hernández, considerable progress was achieved in building natural capital and other assets during the period. However, for members of the base cooperative El Esfuerzo, insecure tenure persisted and would likely constrain their investments in coffee into the distant future.

The cooperative Julio Hernández illustrates key points in asset management and building. Before 2001, the members lived and worked on a state-owned coffee enterprise. In 2001, a collective title was obtained for the plantation and, soon after, individual plots were distributed among the former plantation workers. With individual plots came the urgent need for members to build skills in coffee production, renovate coffee plantations, and link with coffee buyers. Soppexcca facilitated the organization of the base cooperative and provided technical assistance and credit for coffee renovation. Productivity levels for Julio Hernández members increased significantly during the period, from a two-year average of 314 kg/ha in 2004–2005 and 2005–2006 to 503 kg/ha in 2008–2009 and 2007–2008. Anecdotal evidence suggested that the advances in productivity were linked to services provided by Soppexcca: pre-existing assets among members were relatively low and no other provider of technical assistance or credit was identified during the period. Moreover, Julio Hernández members emphasized the role of Soppexcca in building their natural and financial capitals during interviews.

However, the case of El Esfuerzo illustrates the vulnerability of households where members had yet to overcome power abuse and conflict related to land tenure. During the 1990s, the households that would form El Esfuerzo farmed collectively titled land and sold their coffee through a collective enterprise. The coffee was sold to an exporter who provided credit in exchange for a set amount of green coffee. In 1999, the exporter failed to provide credit, and households struggled to collect sufficient coffee to meet their delivery quota. In response, the exporter took possession of their land. The households

retained a lawyer and fought the case for nine years before achieving success. Currently [2013], the lawyer holds the collective land title and will release it to the households when she is paid the \$80,000 owed for her services. By 2009, El Esfuerzo members continued to rank among the least productive coffee farmers and were among the least able to sustain their livelihoods through on-farm production.

#### ACCESS TO FERTILIZERS (PROXY FOR SOIL FERTILITY)

Coffee production mines nutrients from the soil, which, if not replaced through organic or inorganic fertilizers, results in gradually declining productivity (Van der Vossen, 2005). Thus, use of fertilizers and maintenance of soil fertility are key indicators of resource management and sustainability. Evidence from long-term experiments in Nicaragua suggests that shade-grown organic and conventional coffee production can reach productivity levels of 1,487 kg/ha and 1,927 kg/ha, respectively, with ‘moderate’ levels of fertilization (Haggar et al., 2011). However, the average productivity for the sampled organic and conventional producers, at 726 kg/ha and 1,278 kg/ha, fell far below these estimates. Among households in the SDL cluster, results were more discouraging still, at 552 kg/ha for organic producers and 582 kg/ha for conventional producers. This suggests that lack of access to fertilizers remains a barrier to building and maintaining natural capital.

All organic producers applied coffee pulp to their plantations as a source of fertilizer. For some, it was the main fertilizer. However, the coffee pulp available from a given farm likely provided only a fraction of the soil nutrients lost through coffee production.<sup>1</sup> For some organic coffee producers, processed chicken manure, sold under the brand name Biogreen, provided an important organic source of nutrients. One 45-kg sack of Biogreen provides 1 kg of nitrogen. However, between 2006–2007 and 2008–2009, on average, only 36 percent of organic producers applied Biogreen to their coffee plantations. Moreover, among these households, few were able to purchase enough Biogreen to achieve reasonable productivity levels.<sup>2</sup> The mean number of bags of Biogreen applied per hectare ranged from a high of 21.9 in 2006–2007 to

1 To achieve reasonable yields from organic coffee production in Nicaragua, Haggar et al. (2011) reported the use of nearly 9 metric tons of coffee pulp per ha/year. This is roughly two to three times as much pulp as just returning the pulp from the coffee produced.

2 To keep coffee yields at a reasonable level and to maintain soil fertility, a minimum of 36 kg of nitrogen/ha need to be supplied annually (Valkila 2009). This assumes that producers recycle their coffee pulp and use nitrogen-fixing shade trees—both of which are common practices among smallholders in Nicaragua.

a low of 16.7 in 2008–2009. These results suggest that soil nutrient requirements for organic coffee production are not being met, and therefore natural assets are being depleted.

Among households that produced conventional coffee, the relatively high cost of inorganic fertilizer (Ganes-Chase 2009) presented a challenge to replenishing soil nutrients lost to coffee production for cash-strapped producers. Data on inorganic fertilizer utilization ('complete' and urea) were collected from 152 households between 2006–2007 and 2008–2009. Twenty-two households, or 14 percent of those sampled, reported no purchase of inorganic fertilizer during the entire period. For any one year, the percentage of households that reported inorganic fertilizer usage varied from a high of 79 percent in 2008–2009 to a low of 61 percent in 2006–2007. Evidence suggested that overall fertilizer usage by households in the SDL and SSL clusters was on the rise. The number of SDL households that applied at least one bag of complete fertilizer increased from 21 percent in 2006–2007 to 42 percent in 2008–2009. Similarly, 75 percent of SSL households applied at least one bag of 'complete' in 2008–2009, compared to only 53 percent in 2006–2007. No major change was reported in fertilizer use for LSL households. On average, 92 percent of LSL households applied 'complete' fertilizer between 2006–2007 and 2008–2009. Despite the overall increase in fertilizer application, however, households in the SDL cluster generally did not reach the estimated nitrogen threshold (39 kg of nitrogen/ha) for achieving reasonable productivity levels. Most households identified annual credit from Soppexcca and other coffee buyers as the main contributing factor to increased fertilizer purchases.

## **Human Capital**

### **MANAGEMENT SKILLS IN COFFEE PRODUCTION**

One important element of human capital for coffee growers is the knowledge, skills, and capacity to manage plantations sustainably and produce uniform, high-quality beans. In general, smallholders in Nicaragua do not practice regular pruning or other forms of improved crop management on their coffee plantations (Rice 1999). This, combined with knowledge that several of Soppexcca's base cooperatives had only recently gained land titles and thus the opportunity to invest in their coffee production, suggests that overall human-capital endowments in this context were low prior to the period. Before joining Soppexcca, most interviewed households reported

not having access to technical assistance for coffee production. Technical assistance and training by Soppexcca in shade management and pruning techniques aimed to support their members to sustain coffee yields, while at the same time enhancing natural capital (for example, reduced contamination, protection from erosion, enhanced nutrient recycling).

Results among the sample were mixed. On one hand, most households acquired new skills for reducing contamination from coffee milling and providing higher-quality coffee. Fifty-four percent of the households reported the application of selective harvesting (of mature beans) during the period. Most of these households were from the SSL cluster ( $n = 31$ ) and the LSL cluster ( $n = 12$ ). Six households from the SDL cluster reported the implementation of selective harvesting. Similarly, 66 percent of the households disposed of wastewater in infiltration pits in 2008–2009 (compared to only 11 percent of the sample three years prior). SSL households were the most likely to have adapted the new techniques for wastewater treatment (74 percent), followed by LSL households (70 percent), and SDL households (58 percent).

The overall low coffee productivity suggests that improper plantation management may continue to be a genuine concern. While it was not possible to observe or measure plantation-management practices for this study, insights were gained on the effectiveness of technical assistance through interviews with technical assistance staff and from Soppexcca members. The evidence suggests that Soppexcca's technical assistance program struggled to provide the coverage and quality of services needed for upgrading the production skills of poor coffee farmers. According to one key informant, efforts to encourage more intensive plantation management have been ineffective, due in part to (1) a reluctance by producers to trim or stump coffee trees that are productive, and (2) the inability of Soppexcca staff to work intensively with producers to upgrade their crop management skills (Pinedo, pers. comm.). Soppexcca had yet to implement a monitoring system for plantation management. Moreover, there was no link between Soppexcca technical assistance and the credit department.

Households reported their perceptions of the value of technical assistance for coffee production between 2007–2008 and 2008–2009. For most households, Soppexcca was the only provider of training and on-site technical assistance. Forty-four percent ( $n = 129$ ) reported being dissatisfied or highly dissatisfied with technical-assistance provision. Selected household responses shed light on the nature of the problem:

- Household #26: “We were visited once in 2008, but the extensionist didn’t provide technical advice; he arrived to inform us of a meeting at the cooperative.”
- Household #265: “I lack advice when I need it: on one occasion, I requested a visit from the extensionist because the coffee berries were falling off the branches, but he never came.”
- Household #187: “He only comes to estimate the harvest. I am only able to consult with the extensionist during training events—that is how I have obtained technical assistance.”
- Household #277: “Visits are only for estimating the harvest—the extensionist does not know my coffee plantation. He sends others from the community to assist me and does not provide advice.”
- Household #282: “Sometimes he indicated which product I should use, but the extensionist did not indicate the doses and I burned the plants.”

#### SKILLS FOR COOPERATIVE GOVERNANCE

A share in ownership and governance by members is an important cooperative principle and feature of human capital. Findings showed that representation of members on the board of directors was mostly tokenism. The main reasons were insufficient skills by the board and lack of information from Soppexcca. The former president of the board noted that she received no training in basic business or cooperative management prior to assuming her post as the board president. During her period on the board she had limited understanding of how Soppexcca formulated its prices for parchment coffee, nor did she participate in setting the agenda for board meetings. Other informants noted that the board and Oversight Committee did not have access to timely financial information, due mainly to the absolute lack of the information, rather than inaccessibility of the information. Interviews highlighted the board’s reluctance to question, debate, or probe Soppexcca’s executive management on strategic decisions and investments. External service providers remained distant on the empowerment of Soppexcca’s members and engaged directly with Soppexcca’s professional management.

Strong professional leadership—combined with a long-term commitment from buyers and NGOs to its development, and the institutional framework provided by fair-trade certification—has played an important role in building Soppexcca’s organizational asset base, but this has come through

external investment rather than organic human-capital growth among the membership. Limitations to building effective internal leadership within the cooperative have resulted in a high concentration of power and information in the professional manager, hence vulnerability of the organization and all the value-chain relationships.

### **Social Capital**

From an individual or household perspective, the extent to which linkages with coffee buyers generate tangible benefits for maintaining and improving livelihoods forms an important element of social capital (Portes 1998). Our discussion of social capital focuses on the supply-chain relationship benefits derived from collaboration with Soppexcca and the significance of institutional arrangements for reducing transaction costs.

Smallholders rarely have access to affordable credit in Nicaragua (Bastiaensen 2005). Before joining Soppexcca, most households from the SDL and SSL clusters (69 percent and 67 percent, respectively) sold their coffee exclusively to buyers in the towns of Jinotega and Matagalpa. In contrast, only 36 percent of households from the LSL employed intermediaries for marketing their coffee prior to joining Soppexcca. Few households reported access to buyer-provided credit in the year before joining Soppexcca (20 percent) and even fewer reported access to buyer-provided technical assistance (9 percent). Households from the LSL cluster were more likely to have forged linkages with direct exporters before their having joined Soppexcca, and thus were more likely have access to credit and higher prices.

Having forged new linkages with Soppexcca, most households retained their previous relationships with pre-existing coffee buyers. Buyers differed in terms of services offered and the transaction costs of doing business (Table 3.3). Relative to other buyers, Soppexcca was the most demanding in terms of quality but also offered the most extensive range of services. In 2008–2009, credit was available for most members without formal land titles or other forms of collateral at an annual interest of 16 percent for annual credit and 14 percent for multiyear credit. Soppexcca was the only buyer that offered protection from future downturns in coffee prices through the fair-trade floor price.

Soppexcca provided other valuable services. Beginning in 2007, the cooperative employed a team of eight extensionists to provide technical assistance. In addition, Soppexcca provided safety nets for its members (vehicular transport for emergencies, donation of a coffin on the death of a member or member's spouse, credit/donations for medical expenses), and access to

**TABLE 3.3** Characteristics of trading relationships for coffee sold by Soppexcca members

Buyer	Two-year average farmgate price (2007–2008 to 2008–2009)	Payment conditions in 2008–2009	Services offered in addition to coffee marketing in 2008–2009
Soppexcca	Organic: \$136 Conventional: \$109	<ul style="list-style-type: none"> <li>• Floor price (fair trade)</li> <li>• Interest rate 1.2%/month</li> <li>• Initial payment with short-term credit (20%), partial payment upon delivery to warehouse (60%), final payment in June (20%)</li> </ul>	<ul style="list-style-type: none"> <li>• Technical assistance</li> <li>• Certification</li> <li>• Fertilizer for purchase (delivered to farm)</li> <li>• Short- and long-term credit (no collateral required, interest rate between 1.2% and 1.3% per month)</li> <li>• Emergency credit</li> <li>• Other services<sup>b</sup></li> </ul>
Market buyers <sup>a</sup>	Conventional: \$97	<ul style="list-style-type: none"> <li>• Full payment upon delivery</li> <li>• Price to producer: direct exporter price, minus commission</li> </ul>	<ul style="list-style-type: none"> <li>• Purchase of coffee</li> <li>• Exchange of basic food items for parchment coffee (before and after harvest)</li> <li>• Short-term credit (no interest on credit taken prior to harvest; 5%/month interest on all other credit)</li> <li>• Flexibility in credit repayment (paying coffee debt with basic grains production)</li> </ul>
Community-based buyers	Conventional: \$97	<ul style="list-style-type: none"> <li>• Land title not required for credit</li> <li>• Full payment upon delivery, price based on New York market price</li> </ul>	<ul style="list-style-type: none"> <li>• Technical assistance</li> <li>• Short-term credit (interest rate at 1.5% to 2%/month)</li> <li>• Fertilizer for purchase (delivered to farm)</li> <li>• Transport of coffee to warehouse</li> </ul>
Direct exporters	Conventional: \$99	<ul style="list-style-type: none"> <li>• Contract required for credit (with collateral)</li> <li>• Final payment upon delivery, priced based on New York market price</li> </ul>	<ul style="list-style-type: none"> <li>• Short-term credit (interest rate 1.5% to 2%/month)</li> </ul>

**Source:** Authors.

**Notes:** <sup>a</sup> Information based on results from 18 key-informant interviews carried out on site with buyers of coffee at the markets of Jinotega and Matagalpa in August 2009; <sup>b</sup> For example, emergency transport to hospital, contributions to meeting funeral expenses, assessment with land-tenure disputes.

development projects. However, doing business with Soppexcca was relatively costly. Payment for coffee was made in three installments, the final installment (approximately 20 percent of the total price) being delayed until May–June. All credit and payment transactions required travel to Soppexcca’s office in Jinotega and producers assumed all risks for transport of coffee to the warehouse.

Compared to Soppexcca, transactions with market buyers offered faster payment, with cash upon delivery of coffee and credit on demand; however, producers had to trade off ease of sale and timeliness of payment against generally slower business processes and higher costs for credit.

Few sampled households sold to direct exporters of coffee ( $n = 5$ ). Exporters provided annual credit on a contract basis, with land titles generally required as collateral unless producers had a history of compliance with contractual obligations. Annual credit during the 2008–2009 season was offered at a 17 percent annual interest rate. Producers had the option to receive final payment (market price minus amount of annual credit) upon delivery of parchment coffee. Additional services, such as on-site technical assistance and pick-up of parchment coffee, were not reported.

Side-selling is a common but complex phenomenon affecting cooperative operations and relationships with members. Data on coffee sales by buyer indicated Soppexcca's difficulty in increasing its capture of raw material from its members. For organically certified households, the mean percentage of coffee sold to Soppexcca between 2007–2008 and 2008–2009 was 73 percent, while for conventional producers, the mean percentage was 57 percent (Table 3.4). This suggests that price was not the major factor behind selling to buyers other than Soppexcca. Responses presented below illustrate the diversity of reasons. The most common response hinged on the need to cover production expenses for the coffee harvest ( $n = 31$ ). In other cases, households identified

**TABLE 3.4** Percentage of coffee sold to Soppexcca, by producer type and cluster

Cluster	Average percentage of production sold to Soppexcca from 2006–2007 to 2008–2009 (SD)	N
<b>Conventional<sup>a</sup></b>		
SDL	54.6 ( $\pm 32.8$ )	50
SSL	59.5 ( $\pm 30.9$ )	128
LSL	53.5 ( $\pm 33.9$ )	43
All	57.2 ( $\pm 31.9$ )	221
<b>Organic</b>		
SDL	70.1 ( $\pm 33.3$ )	27
SSL	74.5 ( $\pm 22.5$ )	32
LSL	77.0 ( $\pm 30.0$ )	10
All	73.2 ( $\pm 27.8$ )	69

**Source:** Authors.

**Notes:** SD = standard deviation; N = number; SDL = Small-scale diversified livelihoods; SSL = Small-scale specialized livelihoods; LSL = Large-scale specialized livelihoods.

<sup>a</sup> Differences between the means for conventional and organic producers were significant at the .05 level.

emergencies and expenses as the main reason for selling to other buyers ( $n = 8$ ), poor quality ( $n = 4$ ), and restricted access to credit ( $n = 2$ ). Below are quotes from households in SDL cluster (emphasis added):

- Household #190: “Don Osman pays better than Soppexcca; Soppexcca has too many price deductions, and he is less concerned with quality.”
- Household #24: “Because my brother needed money, I sold coffee in the market to resolve his need.”
- Household #188: “Due to delays in the provision of credit—the intermediary is much quicker. Soppexcca always delivers credit in June, while the intermediary delivers in May.”
- Household #19: “The amount of credit offered by Soppexcca is very small ... from Atlantic [direct coffee exporter] I receive \$10,000 and Soppexcca has not provided any. Soppexcca also demands too much in terms of quality.”
- Household #194: “Transport is very difficult from our farm to the road. The other buyer collects our coffee at the farm.”

## Physical Capital

### CAPITAL FOR PROCESSING

Improvements in infrastructure at the household level played a major role in Soppexcca’s strategy for improving coffee quality. Physical capital for wet milling includes the construction/refurbishment of mill enclosures, construction/refurbishment of fermenting tanks, and the purchase/repair of machines for depulping and pumping water. The average investment by households from the SDL cluster was \$198 during the period, skewed upward by a few households; among the 72 households in the cluster, only 12 reported cash investments for improved wet milling. Investments by SSL, while significantly higher than those of the SDL cluster, remained low at \$593. Moreover, 70 SSL households, or nearly half the cluster, reported no cash investments during the period. Investments by LSL households, at nearly three times those of SSL households, showed considerably less variation within the cluster. Credit by Soppexcca contributed roughly 48 percent of the total reported household expenditure.

### CAPITAL FOR PRODUCTION

Households also reported their acquisition of machinery, tools, and infrastructure for agricultural production in addition to those used for wet milling.

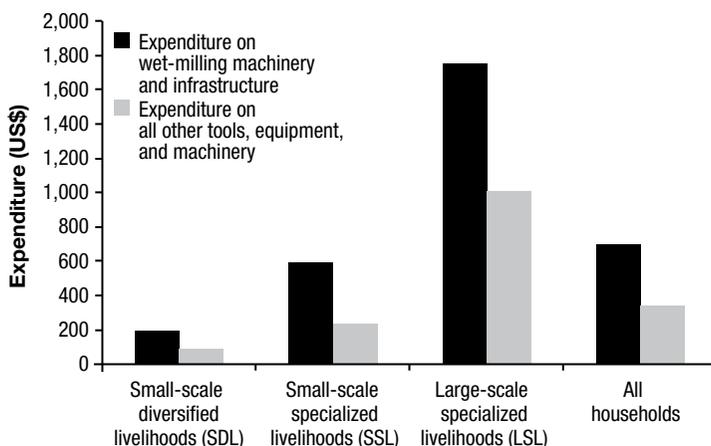
Notable is the extremely low investment by households in the SDL cluster, at \$91 (Figure 3.4). When investments were made by SDL households, they were generally confined to basic tools for production of coffee and basic grains (machetes, shovels, sprayers). Similarly to experiences in the building of physical capital for wet milling, households in the SSL cluster achieved higher investments than their SDL counterparts, but the absolute level of investments was low. Findings suggest that households from SDL and SSL clusters generally struggled to build their physical-capital endowments for farm production compared to the level of productive investments made by LSL households. These included relatively large purchases of machinery for the production of coffee, investment in livestock, and generation of off-farm business activities.

## Financial Capital

### ACCESS TO CREDIT

The ability of households to build natural and physical capital was strongly related to their access to multiyear credit. Between 2004–2005 and 2008–2009, some 56 percent of the sample, or 164 households, received credit for the purchase of land or expansion of coffee production. SDL households (36 percent) were the least likely to have received access to multiyear credit during the period, compared to SSL households (65 percent) and LSL households (58 percent). The average amount of credit was \$1,271. Among the

**FIGURE 3.4** Capital expenditures by cluster



Source: Authors.

clusters, the average amount varied from a low of \$889 for households in the LSL cluster to a high of nearly \$1,319 for households in the SSL cluster. Among households in the SDL cluster, an average of \$957 in credit was received, all of which Soppexcca provided.

As noted previously, many sampled households (57 percent) reported no access to annual credit before joining Soppexcca. During the assessment period, opportunities for obtaining annual credit increased, in part due to linkages with Soppexcca, with only 12 percent of sampled households reporting no access to annual credit. Among the households that received annual credit, most ( $n = 160$ , fifty-five percent) reported Soppexcca as their only source of credit. Other sources included specialized lending organizations, coffee buyers, NGOs, and, to a lesser extent, informal lenders and commercial banks. Collateral requirements varied.

While the terms offered by Soppexcca were relatively favorable, the average amount provided by Soppexcca was small. For example, in 2007–2008, the mean credit value was \$197 for SDL households, \$390 for SSL households, and \$1,805 for LSL households. Even for households with relatively small coffee holdings, credit from Soppexcca was unlikely to cover variable production costs, much less facilitate more strategic investments in asset building. Moreover, few households were able to access credit consistently: only 9.3 percent, 11.3 percent, and 25 percent of the SDL, SSL, and LSL households, respectively, were able to access annual credit for each year of the assessment period. Between 20 percent and 55 percent of SDL households ended the production year with debt to Soppexcca, with similar results recorded for SSL households.

#### **INCOME BENEFIT FROM COFFEE SALES TO SOPPEXCCA**

Findings regarding benefits of coffee sales through Soppexcca are illuminating. As noted above, it is not uncommon for smallholders to divert sales from formal to informal channels. Table 3.5 presents estimates of the income benefit for Soppexcca members from coffee sales, taking into account sales to Soppexcca and other buyers, and allowing for the differences in farmgate prices between coffee buyers. Among households from SDL and SSL clusters that produced conventional coffee, the actual income benefits from participation in Soppexcca were small, at \$32 and \$87, respectively. These income estimates reflect that 41–45 percent of the potential income benefit from the sale of fair-trade coffee was lost due to the selling of coffee to other buyers. Certified-organic households from the SDL and SSL clusters experienced higher income benefits than their conventional counterparts, at \$77 and \$94,

**TABLE 3.5** Estimated income (US\$) benefit from coffee sales to Soppexcca, by cluster (average, 2007–2008 to 2008–2009)

Cluster	Average total coffee production (45 kg sack green coffee)	Potential income if all coffee sold to Soppexcca <sup>a</sup>	Potential income benefit if all coffee sold to Soppexcca <sup>b</sup>	Actual income taking into account sales to other buyers	Income forgone due to sales to other buyers	Percentage income benefit forgone due to sales to other buyers
<b>Conventional</b>						
SDL	5.9	643	71	611	32	45
SSL	18.0	1,962	216	1,875	87	41
LSL	100.2	10,922	1,202	10,363	559	46
All	31.3	3,412	376	3,251	161	43
<b>Organic</b>						
SDL	6.6	898	257	821	77	30
SSL	9.5	1,292	371	1,198	94	26
LSL	49.4	6,718	1,927	6,275	443	23
All	14.0	1,904	546	1,758	146	27

Source: Authors.

Notes: SDL = Small-scale diversified livelihoods; SSL = Small-scale specialized livelihoods; LSL = Large-scale specialized livelihoods.

<sup>a</sup> The following two-year average farmgate prices were offered by Soppexcca: \$109/45-kg sack for conventional coffee and \$136/45-kg sack for organic coffee; <sup>b</sup> Difference in income generated from 100 percent of coffee production being sold to Soppexcca versus income generated from 100 percent of coffee being sold to other buyers. A two-year average farmgate price of \$97/45-kg sack was used for estimating income from sales to other buyers.

respectively. However, these households also struggled to maximize their income benefits from participation in formal markets. On average, 27 percent of the total potential income benefit from the sale of fair-trade organic coffee was lost due to the selling of coffee to other buyers. For producers of conventional coffee, the small size of the price benefit generated through sale of coffee to Soppexcca may have facilitated their decision to sell to other buyers. For both types of producers, the strong need to sell coffee outside of Soppexcca often reflected farmers' urgent needs for annual credit linked to coffee production, for the ability to respond to shocks, and to smooth income generation over the year.

## Discussion

For poor smallholder coffee growers, research has highlighted both the potential and the limitations of asset building by coffee growers in Nicaragua in

response to more intensive value-chain interactions and development interventions. Our discussion begins with a look at the overall changes in asset endowments and then examines the differences in asset building based on cluster affiliation.

Many households built up key elements of natural capital, including expanded areas under coffee production and renovated coffee trees. These investments helped to overcome the erosion of natural capital that took place during the coffee crisis. For households that depend on coffee production for most of their income, these investments are likely to have positive future impacts on rural livelihoods. Access to credit with extended repayment periods played a critical role in expanding and improving natural capital. On the other hand, lack of progress in addressing other dimensions of natural capital, such as nutrient mining due to lack of affordable fertilizers and insecure land tenure, is likely to diminish hopes that poor households will improve their coffee productivity in the future.

A similar pattern of significant, but incomplete, asset building was detected for the other capitals. In terms of human capital, evidence suggests that most households acquired new skills that improved coffee quality, but few households had acquired the more complex skills for improved plantation management—a critical determinant of coffee productivity and disease resistance. The ability to implement more intensive production practices was also linked to endowments of human and financial capitals, which were also severely constrained in many cases.

Results suggest that there were limited impacts to build human capital through cooperative-provided technical assistance. Soppexcca had no monitoring system in place nor had it attempted to link technical assistance with its other services (for example, credit) or external services (for example, specialized providers of business development and technical services). Donors, projects, and NGOs that financed technical assistance by Soppexcca were reluctant to insist on accountability or engage Soppexcca in identifying outcome-enhancing measures.

Results also draw attention to challenges faced by Soppexcca's volunteer leadership to participate effectively in Soppexcca's governance. Volunteer leaders lacked basic business skills prior to assuming their posts, as well as access to critical information on business performance. They indicated apprehension about confronting authority, and conflicts emerged among members when professional managers were questioned. Reluctance to challenge the management was likely enhanced by the failure of Soppexcca's predecessor cooperative, juxtaposed with its success in expanding sales of certified coffee

and securing support from NGOs and projects.<sup>3</sup> Results here support previous findings on the autocratic nature of cooperative governance in Nicaragua and the distant engagement of NGOs in the development process (Kroeker 1996).

Links to Soppexcca and markets for certified coffee resulted in an important increase in social capital for households. Soppexcca offered some protection from the recurrent economic, social, and environmental uncertainties that characterize coffee production in Nicaragua. Technical assistance and credit allowed households to rebuild assets that were eroded during the coffee crisis. For many households, Soppexcca offered the first opportunity to access credit and technical assistance since they initiated coffee production. Despite the importance of links to Soppexcca, most households diverted considerable quantities of coffee to local intermediaries or direct exporters. Mujawamariya, D'Haese, and Spellman (2013) suggest that smallholders' decisions to deal with buyers outside the cooperative likely respond to their trust relations with local buyers based on repeated transactions in credit. Evidence from Soppexcca supports this argument. The use of credit for meeting consumption needs, combined with the relatively high costs of selling to Soppexcca (for example, high quality demands, delayed payment, transport to warehouse) also encouraged side selling by Soppexcca members. Households managed a portfolio of buyer relationships that took into account farmgate prices, access to credit and other services, and buyer demands for quality.

Most households struggled to build physical capital for agricultural production in general, and coffee production in particular. The expansion of wet-milling infrastructure and equipment was one element of physical capital where considerable investments were detected. Multiyear credit by Soppexcca facilitated these investments. The credit was provided to Soppexcca by NGOs looking to support the cooperative in its efforts to enhance coffee quality and reduce water consumption and contamination in the processing of coffee cherries.

The income benefits from access to certified-coffee markets were generally limited during the period under assessment, reflecting the high prices of conventional coffee relative to those for certified coffee. At the time of data collection (2009–2010), international commodity prices for coffee

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3 During the coffee crisis, Soppexcca used half of the social premium from fair-trade coffee sales to pay down the debt with coffee buyers. In 2009, the decision was made to apply half the social premium to pay down the new debt acquired in the purchase of the processing plant. Both uses of the premium can be justified from a business perspective; however, concerns arise as to whether an empowered board of directors would have invested the premium in the same manner, especially after having paid off the initial debt to buyers.

were higher than at any period in the past 20 years. However, boom and bust are recurrent features of coffee markets, suggesting that a future analysis of income benefits from another crisis would present strikingly different findings. Indeed, Soppexcca's initial growth occurred before the period of this study when the price premium for certified coffee was very attractive to smallholders struggling with the aftermath of the coffee crisis. Despite relatively small income benefits, engagement with the cooperative was important for other reasons: access to credit facilitated coffee production and provided a form of insurance against shocks such as illness, death, and crop failures, which otherwise would have resulted in asset erosion. While many households received credit for coffee production for the first time through Soppexcca, access to credit was often inconsistent and the amount of credit was insufficient to intensify coffee production or make longer-term strategic investments in asset building.

This study offers a cautious but positive view on the potential of poor smallholders to improve livelihood security through links to cooperatives and higher-value coffee markets. Feasibility constraints limited the chosen set of indicators of livelihoods assets, but the most significant changes have been captured. Improvements in natural, social, and financial capital ensured that households had the minimum endowments needed to participate in the Soppexcca value chain. Access to Soppexcca offered safety nets, lower marketing risks, and access to inputs, which have important positive implications for livelihood maintenance and security. On the other hand, there was little evidence that interventions by the cooperative and its NGO and donor partners allowed households to intensify production or to generate new products and services outside of the coffee value chain. The extent to which potentially greater gains in livelihood security could have been achieved through physical capital expansion aimed at increased efficiency and productivity of other crops, such as bananas, beans, and maize, remains to be explored by Soppexcca and its external partners. Thus complex business skills remained undeveloped. This may be explained by the incomplete nature of asset building during the assessment period, the overall weak household asset endowments before the assessment period, and the time it takes to develop individual human and collective social capital.

### **Heterogeneity in Asset Building**

Significant variation due to pre-existing endowments was evident in the ability of households to build assets. Table 3.6 summarizes and compares asset building among the three clusters. In general, SDL households were

**TABLE 3.6** Differences in asset building in response to new links to certified coffee markets

Cluster	Social capital	Natural capital	Human capital	Physical capital	Financial capital
<b>Small-scale diversified livelihoods (SDL)</b>					
Evidence of considerable asset building	N/A	N/A	N/A	N/A	N/A
Evidence of low to moderate level of asset building	New links to Soppexcca—a trusted buyer of coffee and provider of marketing, technical assistance, and credit services	Generally able to expand area under coffee production and renovate existing plantations through Soppexcca credit	N/A	N/A	Limited income benefits from certified coffee
Little/no evidence of asset building	Lack of complementary assets implied that households struggled to benefit significantly from new links; links maintained with local coffee buyers	Major limitations for improving soil fertility	Least likely to have upgraded knowledge and skills for improving coffee quality; few able to modernize plantation management practices	Least able to reinvest gains from higher coffee prices or improved credit access into the accumulation of physical assets for on-farm production	Least likely to have access to multiyear credit; access to annual credit limited due to low productivity
<b>Small-scale specialized livelihoods (SSL)</b>					
Evidence of considerable asset building	Links to Soppexcca provided first-time access to credit, technical assistance, and other services; greater capacity to leverage Soppexcca access for building of other assets (for example, natural capital)	N/A	N/A	Major gains in machinery and infrastructure for wet milling, often with assistance from Soppexcca credit	N/A
Evidence of low to moderate level of asset building	Links maintained with local coffee buyers, due to stronger pre-existing links and inability to fully take advantage of Soppexcca access	Possibility to expand area under coffee production, renovate existing coffee plantations, and expand total agricultural area, often with Soppexcca-provided credit	Likely to have upgraded knowledge and skills for improving coffee quality	Limited investments in other tools, equipment, and machinery for on-farm production	Limited income benefits from certified coffee; most households with new access to multiyear credit; limited amount of annual credit accessible
Little/no evidence of asset building	N/A	Major limitations for improving soil fertility	Difficulty to modernize plantation management through access to technical assistance	N/A	N/A

Cluster	Social capital	Natural capital	Human capital	Physical capital	Financial capital
<b>Large-scale specialized livelihoods (LSL)</b>					
Evidence of considerable asset building	N/A	N/A	Generally able to upgrade their knowledge and skills for coffee production; effective access to complementary assets (social and financial capitals) for modernizing production system	Significant increase in physical capital through higher coffee prices and long-term credit; average investments for wet milling exceeded those of SSL households by twofold	Some income benefits from certified coffee; access to multiyear and annual credit was favorable
Evidence of low to moderate level of asset building	Pre-existing endowments were relatively high, with strong links to local intermediaries and direct exporters of coffee; Soppexcca offered an additional source of credit	Relatively large pre-existing areas of agricultural production; area under coffee production increased, on average	N/A	N/A	N/A
Little/no evidence of asset building	N/A	N/A	N/A	N/A	N/A

**Source:** Authors.

**Note:** N/A = not applicable.

the least likely to have achieved major advances in asset building. This was especially true regarding human, physical, and financial capitals. SDL households benefitted from certified-coffee markets mainly through access to Soppexcca safety nets and reduced vulnerability to external shocks. The experiences of SDL households that seem to fall below a responsiveness threshold showed that rural poverty goals might best be achieved by helping those households with the smallest asset endowments to transition out of agriculture. SSL households experienced altogether greater gains in asset building, and the gains were more evenly spread across the different types of capital. Nevertheless, the better-endowed LSL households were the primary beneficiaries in terms of financial capital and most of the other areas of asset building.

## Conclusion

This study applies a livelihoods framework to understand smallholder asset building in response to new links with a coffee cooperative that enabled participation in high-value certified-coffee markets. Embedded in these links were a set of interactions, interventions, and processes that shaped how smallholders participate in the value chain. This use of a livelihoods asset framework marks a conceptual and methodological contribution to the literature through its exploration of how households are able to benefit from new links to markets, the differences in household participation based on variations in livelihood strategies and initial asset endowments, and the role of cooperatives and development interventions in creating important linkages between producers and international markets.

How did initial asset endowments and subsequent household changes determine smallholders' participation in high-value export markets? In short, did the access to certified-coffee markets help the poorest? The analysis presented here suggests that the institutions, interventions, and processes related to participation in certified-coffee markets did achieve a broader set of outcomes than merely accessing favorable prices, including building a sustainable and more competitive value chain, the building of more viable cooperatives, and building of specific assets by some of the poorest farming households. It was shown that all of these outcomes were important to creating a viable coffee value chain providing some livelihood improvements and even a pathway out of poverty for many of the households linked to it.

However, even a cursory examination of Table 3.6 shows that those with better initial asset endowments (that is, the LSL households) gained the most from the interventions and new opportunities accessed through Soppexcca. This conclusion, together with the evidence that the least well-endowed experienced the least asset building in absolute terms, suggests that a multiple threshold concept of asset endowments is likely to operate: that is to say, there are likely to be multiple thresholds, such as an upper threshold above which the better-off producers benefit little, an intermediate threshold above which producers can take advantage of the opportunities, and possibly a lower threshold below which the poorest may experience asset depletion resulting from development interventions that increase risk and vulnerability (Donovan and Poole 2013). The Soppexcca experience also shows that achievements do not come cheaply or quickly; they result from years of investments by coffee buyers, donors, and civil society, Soppexcca, and cooperative members.

Conclusions on economic and environmental sustainability are tentative because sustainability was not the focus of the study and changes will only be demonstrated over the long term.

This study—even using a reduced set of livelihood-asset indicators—highlights the challenges and dilemmas for poverty-reduction policies based on more intensive links to higher-value markets. It suggests a development strategy that recognizes the complexities and trade-offs among asset types that are by no means discrete, but often are complementary and sometimes antagonistic. The study highlights the important role that cooperatives play in building the capacities of the poor to participate in higher-value markets. It also suggests that cooperatives will benefit from greater attention to the consolidation of their internal governance mechanisms, as well as support in the design, implementation, and monitoring of cooperative-provided services. Finding viable solutions to the complex problems facing cooperatives and their members will require deeper engagement with stakeholders, including NGOs, buyers, and government agencies.

There are additional lessons: first, the notion of asset complementarities. For example, a clear conception of financial capital is important. Financial capital is more than income or credit arrangements. Working financial capital underpins investment in other livelihood assets, particularly natural and physical, such as fertilizer (for maintaining natural capital) and agricultural equipment and roofing (for physical capital). It is also an important entitlement mechanism to meet general household expenses and other human capital-building pathways such as educational expenses for children. Thus financial capital has two important characteristics: it is a means to an end rather than an end in itself; and it is fungible—actually it is a means to various ends. But while the provision of credit is of primary importance, it is not a panacea.

Other complementarities exist: contextual or idiosyncratic household constraints affect the capacity of smallholders to take advantage of new opportunities, for example, labor constraints that inhibit physical expansion of farms as well as the adoption of improved management practices. Investments involve strategic choices and often significant trade-offs between diverse livelihood activities, as well as risk of asset depletion and livelihood losses. For broader social objectives, interventions required will be more complex and involve a range of services that take into account asset trade-offs, particularly among the poorest. Heterogeneity and complexity thus make intervention targeting a serious ethical necessity.

Second, because of complementarities and trade-offs, projects and interventions must not merely address the weakest links in the chain, through interventions directly targeting specific weaknesses such as the provision of finance or technical assistance. Programs and policies must reflect a more holistic approach to value-chain enhancement, specifically addressing the underlying constraints and capacities of smallholders: land tenure, credit collateral, small scale, labor constraints, technological change, principles and practice of cooperative action, and enhancement of business skills, all within a framework of environmental, social, and economic sustainability.

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## CONTRACT FARMING IN DEVELOPING COUNTRIES: THEORY, PRACTICE, AND POLICY IMPLICATIONS

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Nicholas Minot and Bradley Sawyer

### Introduction

Small farmers<sup>1</sup> in developing regions face a number of constraints that limit their productivity. First, they lack information about production methods and market opportunities, particularly for new crops and varieties. Often farmers are familiar with subsistence crops and perhaps a few widely-grown cash crops, but they have less experience with high-value commodities for which market demand is growing rapidly. Second, even with sufficient information about profitable investments, small farmers often lack the necessary financial reserves to invest in new crops, and their lack of collateral limits their access to credit. This constrains their ability to make profitable investments in tree crops or other crops that have expensive input requirements. Third, farmers operating near subsistence are understandably risk averse. They often prefer to assure themselves of a minimum supply of food before expanding production of cash crops for an uncertain market.

Contract farming has attracted the interest of researchers and policymakers because it has the potential to solve several of these constraints simultaneously. Contract farming may be defined as agricultural production carried out according to a pre-planting agreement in which the farmer commits to producing a given product in a given manner and the buyer commits to purchasing it. Often, the buyer provides the farmer with technical assistance, seeds, fertilizer, and other inputs on credit, and offers a guaranteed price for the output (Eaton and Shepherd 2001). This definition excludes post-planting agreements in which traders merely agree to purchase the harvest. Although more common than pre-planting agreements, this type of arrangement does not involve the provision of inputs, credit, or technical assistance,

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1 A *small farmer* is defined as one who relies primarily on family labor with modest or only occasional use of hired labor. In most countries, this definition corresponds to farms of 3–5 hectares or less.

nor can it influence production decisions, so it is less interesting from a development perspective.

Large farmers have better access to credit, better information about production and marketing methods, and greater tolerance of risk. However, these advantages are offset by the higher costs and lower motivation of hired laborers compared to family members. Thus, contract farming can be seen as a way to combine the advantages of large-scale production (improved access to credit, better production methods, and tolerance of risk) with the strengths of small-scale production (lower implicit labor costs and improved incentives).

Although reliable estimates are not available, international trends in agriculture suggest that the prevalence of contract farming may well be increasing in developing countries. The growth of high-value agriculture, the expansion of agricultural processing, the consolidation in the retail food sector, and the increased demand for quality and food safety are all driving the need for vertical coordination in agricultural supply chains (Jaffee 2003; da Silva 2005; Gulati et al. 2006).

However, the impact of contract farming is a subject of debate. Among proponents, contract farming is seen as a solution to the problems of information, credit, and market risk that small farmers face in commercial production. They see contract farming as facilitating the integration of small farmers into commercial agriculture, leading to income growth and poverty reduction. Critics, on the other hand, see contract farming as a way for large firms to take advantage of the land and poverty of small farmers, paying them less than the minimum wage and effectively taking control of their farms. The integration of small farmers into commercial agriculture is seen as a negative trend, leading to higher risk, indebtedness, and income inequality (Little and Watts 1994; Singh 2002).

In light of this controversy, it is worth reviewing the experience of contract farming in developing countries. More specifically, this chapter has four objectives:

- to describe the economic rationale for contract farming as a way to organize agricultural production,
- to examine the conditions under which contract farming is likely to make economic sense and to emerge as a marketing institution,
- to review the empirical experience with contract farming in developing countries, emphasizing its impact on small farmers in African countries south of the Sahara, and

- to identify ways to promote contract farming when they contribute to an efficient and equitable system of agricultural market institutions.

We examine the economics of contract farming, showing that it is one form of vertical coordination that solves the problem of matching supply and demand under certain circumstances. We then describe the conditions under which contract farming is likely to emerge, based on the type of buyer, the type of commodity, and the policy environment. We then review the empirical evidence regarding the impact of contract farming on farmers in developing countries, including both the effect on participating farmers and the likelihood that small farmers will be incorporated into contract farming schemes. Finally, we summarize the findings and identify some policy implications.

## **Economic Rationale for Contract Farming**

All markets require some form of vertical coordination—that is, matching of supply and demand between different participants in the marketing channel, such as farmers, processors, wholesalers, and retailers. If a farmer intends to sell some of their maize harvest, he or she needs to know what kind of maize is in demand, where and when to sell it, and what price it is likely to sell for. Similarly, a large-scale maize miller in the capital city needs to know what kind of maize will be available for purchase, where to buy it, time of harvest, and how much it will cost. This type of vertical coordination problem exists throughout the marketing channel, for example between processors and wholesalers and between wholesalers and retailers, but the focus here is on the relationship between farmers and the buyer of the agricultural output.

### **Economics of Vertical Coordination**

Transaction cost economics explains relations between buyers and sellers in terms of the costs of carrying out transactions, including finding a buyer, negotiating a price, delivering the commodity, and obtaining payment, as well as the risks associated with the transaction, including the risk of being cheated (Grosh 1994. Williamson 2000). Four problems exacerbate the cost of completing a transaction:

- **Imperfect information:** Because of imperfect information, sellers must spend time finding potential buyers and negotiating the price. Often the seller has more information about the quality of the product, but the buyer has better information about the market demand.

- Limited ability to process information: Even if the buyer and seller had all the relevant information, they would not have the time or capacity to analyze it thoroughly.
- Dishonesty: The buyer and seller can never fully trust each other since each has some short-run incentive to misrepresent the truth and violate the terms of their agreement.
- Asset specificity: The risks of opportunistic behavior are even greater when the buyer or seller must invest in assets that are only useful for carrying out a transaction with the other party (Williamson 1983). After farmers invest in a crop (particularly a tree crop), their negotiating position is weakened if there is only one buyer (or just a few) in the area.

Delgado (1999) shows that contracted commodities often have high transaction costs in production and/or marketing. More specifically, these commodities tend to be characterized by labor-intensive production, complex input requirements, perishability, high value–weight ratio, and economies of scale in marketing but not production.

Although transaction costs are often seen as problems for the farmer, they affect traders and processors as well. Buyers cannot trust sellers to describe the quality and quantity of their product and are often forced to physically inspect it before purchase. If a processing plant is designed to handle just one commodity, the processor is locked into the sector by asset specificity and is dependent on a steady supply of the raw material. This problem is probably less severe for buyers than for farmers, however, because there are often many suppliers, making collusion difficult.

Formal and informal economic institutions are designed to address these problems by facilitating communications, disseminating information, developing trust, and punishing dishonest behavior. Examples include repeated transactions with trusted partners, informal codes of conduct, grades and standards, trade associations, credit bureaus, and (when the stakes are high enough) the legal system.

These institutions, however, cannot eliminate all costs and risks associated with carrying out a transaction, particularly in developing countries where the legal system and other institutions are less well developed. As discussed in the next section, transaction costs also help to explain the types of vertical coordination in the markets of different agricultural commodities.

### **Types of Vertical Coordination in the Agricultural Sector**

Often farmers sell in *spot markets*, in which transactions between buyers and sellers do not involve any commitments outside the transaction itself. In this case, coordination of supply and demand with respect to quantity, quality, and timing occurs only through the price. If the commodity is nonperishable, there is less need to coordinate the timing of sales; if the commodity is widely grown, there is no need to coordinate the location of delivery; if the production methods are well known and use few inputs, there is no need for the buyer to provide credit or technical assistance; and if the commodity has only small variations in quality, there is no need to coordinate the supply and demand of quality attributes. Thus, spot markets work well enough (and are the norm) for staple cereals and pulses, as well as fruits, vegetables, and livestock products destined for traditional domestic channels, where consumers are less quality sensitive.

Sometimes, spot markets are not able to achieve the necessary degree of vertical coordination, and an agreement (formal or informal) is needed. *Contract farming* allows a higher level of coordination between farmers and buyers regarding the methods by which the commodity is produced, the timing and location of delivery, and the characteristics of the commodity, such as variety, color, size, moisture content, and so on. Of course, contracts involve costs for both farmers and buyers. The buyer must draft a contract, educate potential farmers about the terms of the contract, sign up participants, monitor compliance with the contract, and develop a strategy for enforcing the contract. The farmer makes a commitment to sell to a buyer at a given price and gives up some autonomy in production decisions. The Section “Conditions under which Contract Farming Makes Sense” (below) discusses the conditions under which the benefits of contracting are likely to exceed the costs.

The tightest form of vertical coordination is *vertical integration*, in which agricultural production and processing are carried out within the same company. Instead of buying raw materials on the open market (spot markets) or negotiating agreements with a group of farmers (contract farming), the company purchases or leases farmland and hires farmworkers to produce the crop. Clearly, the company has more control over how the product is grown and harvested when it owns the land and hires the labor, but farmworkers are paid by the day, so they are less motivated than independent farmers and require closer supervision. In addition, it is more costly to adjust the level of output when the firm produces on its own land (Eaton and Shepherd 2001).

In practice, there are many forms of vertical coordination that do not fit neatly into this three-part classification system. Cooperatives and producer

organizations may play a role in helping to match supply and demand, either as part of a contract-farming scheme or in the context of spot markets (Coulter et al. 1999). Nongovernmental organizations, local government officials, or donor-funded projects sometimes act as intermediaries, trying to link farmers with agricultural processors or exporters by providing technical assistance, establishing standards, and/or providing credit to farmers (Bolwig, Gibbon, and Jones 2009; Delgado et al. 1999). Some processors grow the crop on their own land *and* purchase from contract growers.

### **Types of Contract Farming**

There are several ways to classify contract-farming schemes. First, there is the degree of formality in the contract itself. In some cases, the contract is little more than an oral agreement between a farmer and a buyer. At the other extreme, the contract is a formal written document that specifies input use, production methods, minimum quality standards, and purchase price. Formal contracts are more commonly offered by large processing or exporting firms, particularly when purchasing from medium- to large-scale farmers.

Second, contract farming schemes can be classified by the types of commitments made between buyer and seller. In a seminar article on contract farming, Mighell and Jones (1963) classify contract farming schemes into three categories:

- A *market-specifying contract* describes the terms of the sales transaction with regard to price, quantity, timing, and product attributes.
- In a *resource-providing contract*, the buyer also provides agricultural inputs and technical assistance on credit.
- The third type is the *production-management contract*, which specifies the manner in which the commodity is to be grown, such as the planting density, use of pesticides, and timing of harvest.

In practice, however, many contracts combine elements of all three types. For example, the contract may specify the production methods and the terms of sale, as well as providing inputs to farmers on credit (Martinez 2002).

A third dimension in contract farming is the way the price is determined and paid. In some cases, the price is fixed at planting time by the buyer. If the market price is higher, side-selling may occur (a farmer violates the terms of the contract by selling some or all of their harvest on the market). Conversely, if the market price is lower, the buyer may be tempted to purchase its supplies from the market rather than the contracted farmers. To avoid problems of

side-selling and side-buying, contract-farming schemes sometimes rely on formula pricing, in which the buyer agrees to pay a price based on a market price, usually the market price plus a percentage premium. Some contracts have split payments, in which the buyer makes two or more payments to the farmer.

## **Conditions under which Contract Farming Makes Sense**

Under what conditions will contract farming be profitable for both growers and buyers? Here, we discuss the role of three factors: the type of buyer, the type of commodity, and the type of destination market.

### **Type of Buyer**

Setting up a contract-farming scheme involves large fixed costs: the buyer needs a team of field agents who negotiate terms with farmers, distribute inputs, provide technical assistance, and collect the product. As a result, contracting is generally not worthwhile for traditional wholesalers or other small- and medium-scale buyers. Rather, the buyers in a contract-farming scheme are more likely to be large-scale processors, exporters, or supermarket chains.

Another advantage of larger-scale buyers is that they have access to capital, knowledge about production methods, and market information that farmers may not have. This provides an incentive for them to contract with farmers as a way of providing credit, technical assistance, and market guarantees.

In addition, buyers with large capital-intensive processing plants have more incentive to contract with farmers because they need a steady and reliable flow of raw materials to maintain a high capacity-utilization rate. This is particularly true if the plant purchases a large share of the locally available product, since there is more risk of supply shortfalls owing to weather or changes in the market.

### **Type of Agricultural Commodity**

As discussed above, if a product is homogeneous and nonperishable, if quality is easily observed, and if farmers are familiar with the production methods and market requirements, then transaction costs are low. In this case, there is no need to incur the costs associated with contracts so that spot markets will be more efficient. These factors explain why spot markets are the standard form of vertical coordination between farmers and buyers in the markets for staple grains, starchy root crops such as cassava, and pulses. Even perishable fruits and vegetables, when widely grown and intended for rural consumption,

are usually sold on the spot market, although there are often informal relationships between farmers and buyers which may serve some of the functions of formal contracts.

More vertical coordination is required, however, for commodities with the following characteristics:

- *Economically important quality variation.* Vertical coordination is more likely if consumers are willing to pay a premium for a variety or attribute that will cover the additional cost of producing it and the cost of vertical coordination. Farm-level investments in human capital (skills), physical capital (assets), or specialized inputs are required to raise quality. In this case, vertical coordination is needed to provide producers with the incentives and the means to make those investments.
- *High value-bulk ratio.* If the per-kilogram value of the crop is high, then a given percentage premium for higher quality is more likely to cover the incremental cost of contracting.
- *Perishability.* Not all perishable goods are produced under contract, but perishability means that farmers and buyers need to coordinate the timing of harvest and delivery, thus increasing the incentive for some form of vertical coordination. In addition, a farmer's bargaining power is seriously weakened once the product is harvested unless there is a contract (or a personal relationship) that ensures a fair price.
- *Technically difficult production.* If buyers can reduce the cost of production with technical expertise, specialized inputs, or credit, then vertical coordination is useful in transferring these resources to farmers. The buyer may also provide inputs on credit to farmers who may not have the liquidity to purchase inputs at planting time.

In the choice between contracting and vertical integration, an important factor is *scale complementarity*, which is the degree of similarity of the economies of scale in production and processing. If both production and processing have significant economies of scale (and large plots of land are available for purchase or lease), then processors and exporters are more likely to vertically integrate into direct agricultural production (Minot 1986).

Similarly, if both production and processing can be done on a relatively small scale, then vertical integration is again feasible. However, if there are large economies of scale in processing but no economies of scale in production,

it is more likely that the processor will source their raw materials from independent farmers.

### **Type of Destination Market**

The third factor is the destination market. The more quality-sensitive the final market and the more demand there is for food safety, the greater the incentive for vertical coordination to increase control over the production process. The same commodity may be sold on the spot market for local, rural consumers and grown under contract farming schemes for urban supermarkets and exporters. Some researchers argue that tighter food safety standards in the United Kingdom are creating incentives for horticultural exporters in Kenya to switch from small-scale contract farmers to large-scale contractors and vertically integrated operations because it is difficult for the exporter to monitor and document the production practices of many small-scale farmers (Dolan and Humphrey 2000). In Shandong Province, China, apples for export to Japan are grown by vertically integrated orchards–packing houses, apples for sale to urban supermarkets are often grown under contract, and farmers sell apples for local consumption to wholesalers in spot markets (Hu 2005).

Another example in which the same commodity is grown with and without vertical coordination depending on the destination market is organic food production. For example, although rice is rarely grown under contract, organic rice production is often organized under a contract-farming scheme (Setboonsarng, Leung, and Cai 2006).

A third example is seed production. Seeds must be grown under carefully monitored conditions to minimize the risk of seed-borne diseases and avoid mixture with other seed. Seed companies typically use contract farmers, particularly for the later generations of seed multiplication, to reduce the costs of production and achieve larger volumes. Farmers would be reluctant to take these additional measures unless they were assured of a price premium above the price of the food crop (Simmons, Winters, and Patrick 2005).

### **Experience with Contract Farming**

In this section, we look at the experience of contract farming. First, we discuss the patterns of contract farming in developing countries. Second, we review studies that attempt to assess the impact of contract-farming schemes on farmers who participate. Finally, we summarize studies that provide information on the types of farmers who participate in contract-farming schemes, particularly on whether poor farmers can benefit from contract farming.

### **Prevalence of contract farming in developing countries**

How common is contract farming in developing countries? In the cotton-growing countries of western Africa, the proportion of farmers involved in some form of contract farming (including government-managed schemes) is relatively high. In Benin, one of the countries most dependent on cotton production, about one-third of the farmers grow cotton and are, thus, involved in contract production (Minot and Daniels 2005). In Kenya, the proportion may be more than 25 percent because of the large number of contract producers of tea and vegetables (Jaffee 1994). However, most inventories of contract-farming schemes in individual countries identify only four to eight schemes, each of which has between several hundred and several thousand contract farmers (see Dannson et al. 2004). Given that most developing countries have more than one million farm households, this suggests that in many countries, the proportion of farm households involved in contract farming is probably in the range of 1–5 percent. Table 4.1 summarizes the results of several studies that estimate the share of rural households involved in contract farming (using various definitions).

### **Patterns of Contract Farming by Commodity**

As discussed above, the prevalence of contract farming tends to vary significantly across commodities as a result of differences in perishability, quality sensitivity, economies of scale in production and processing, and other factors. However, as will be evident, there is a fair amount of diversity in the forms of vertical integration within each commodity because of differences in the buyer, the destination market, and the policy environment.

- *Horticulture.* Fruits and vegetables that are destined for local consumption in unprocessed form are generally sold through traditional market channels (assembler–wholesaler–retailer) without contractual agreements. However, horticultural production for export often commands specific requirements regarding quality, quantity, timing, or production methods which can only be met through a contractual relationship. Similarly, processors who produce (for example) tomato paste and fruit juice often contract the production of their raw materials to ensure that quality standards are met and to stagger production. Examples include contract farming of vegetables for export in Kenya (Jaffee 2003), Madagascar (Minten, Randrianarison, and Swinnen 2009), Senegal (Swinnen and Maertens, 2007), China (Miyata, Minot, and Hu 2009), and Latin America (Swinnen and Maertens 2007). In most of these cases, the horticultural

**TABLE 4.1** Estimates of the prevalence of contract farming in developing countries

Country	Source	Estimated prevalence of contract farming
Kenya	Jaffee (1994), based on inventory of contract-farming schemes	About 25 percent
Benin	Minot and Daniels (2005), based on a stratified random sample of 899 farm households	34 percent (includes only contract cotton growers)
Uganda	Stratified random sample survey of 1,440 rural households carried out in 2012–2013	5 percent had a contract with a buyer (either pre-planting or pre-harvest)
Ethiopia	Stratified random sample survey of 3,000 rural households carried out in 2012	0.2 percent had pre-planting contracts, 2.0 percent had pre-harvest contracts, and 2.2 percent had any contract
Ghana (northern)	Stratified random sample survey of 1,290 rural households in northern Ghana carried out in 2010	3 percent had a contract with a buyer (either pre-planting or pre-harvest)
Vietnam (four provinces)	Stratified random sample survey in four provinces of Vietnam in 2011	5 percent had pre-planting contracts with buyer of main crop, 13 percent received an advance payment from buyer
Kenya, Madagascar, Mali, Mexico, Morocco, Nicaragua, and Senegal	Losch, Fréguin-Gresh, and White (2011), based on nonrandom surveys in seven countries with a total sample of 7,200 households	7.4 percent of households had any type of contract, including post-planting informal agreement with buyer

Source: Authors.

products were being produced for export and contracted by a processor or exporter.

- *Tobacco*. This crop is suitable for small-scale production because it is labor-intensive and requires careful attention to maintain quality. At the same time, tobacco production requires good seed, lime, fertilizer, and drying facilities, which are beyond the means of many small farmers. Virginia tobacco has greater economies of scale because of the need for flue-curing facilities. Small-scale production of tobacco under contract is practiced in Malawi (Agar and Chiligo 2008), Madagascar (Barrett et al. 2012), India (Singh 2002), Thailand (Singh 2005a), Indonesia (Simmons, Winters, and Patrick 2005), and Chile and Guatemala (Swinnen and Maertens 2007).
- *Sugarcane*. The economies of scale in sugar processing mean that sugar mills are typically fairly large. Sugarcane is highly perishable and must be delivered to the mill within 1–2 days of harvesting. Given the very low value–bulk ratio, sugarcane must be grown relatively close to the sugar mill

to reduce transport costs. The two dominant forms of vertical coordination in sugar production are large-scale plantations owned by the refinery and contract farming. In developing countries, these two forms are often combined in the form of a nucleus estate with outgrowers. Examples of contract farming of sugarcane can be found in Malawi (Agar and Chiligo 2008), Thailand (Eaton and Shepherd 2001), Indonesia (Simmons, Winters, and Patrick 2005), India (Singh 2005b), and Guatemala and Nicaragua (Swinnen and Maertens 2007).

- *Cotton*. In many developing countries, state-owned enterprises managed cotton marketing and exports that provided cotton seed, fertilizer, and extension services to farmers on credit. In Cameroon, Chad, Mali, and Senegal, a state enterprise with a legal monopoly on cotton marketing and exports remains. However, in Burkina Faso, Côte d'Ivoire, Ghana, and Mozambique, the cotton sector has been liberalized, but regulations give local monopolies to the private cotton gins. The local monopoly (or concession) makes it easier to ensure repayment, thus facilitating contract farming and the provision of inputs on credit (Tschirley, Poulton, and Labaste 2009). There are also examples from outside Africa, including India (Singh 2005b; Barrett et al. 2012) and Thailand (Singh 2005b).
- *Tea*. This crop is produced both on large-scale plantations and by small farmers. Gresh (1994) argues that contract farming is almost essential for small-scale tea production because of the perishability of the leaves and the reluctance of farmers to invest in perennial crops without some assurance of a market. The Kenya Tea Development Agency (KTDA) is a former state enterprise which was privatized in 2000. By 2009, the KTDA had 54 tea factories and 562,000 contract tea growers (Mbadi 2010). Contract production of tea can also be found in India (Singh 2005b), South Africa (Kirsten and Sartorius 2002), Zimbabwe (Eaton and Shepherd 2001), and Vietnam (Saigenji and Zeller, 2009).
- *Coffee*. This crop is sometimes produced on large-scale plantations, notably in Brazil, but often by smallholders, particularly in Africa south of the Sahara and in Vietnam. There are few documented cases of contract farming in coffee. Coffee cooperatives have played a major role in organizing production in several countries such as Cameroon, Ethiopia, and Uganda, although market liberalization has reduced their role (Tilahun 2007; Dannson et al. 2004). A review of contract farming in Malawi could not find any cases of coffee being contracted (Agar and Chiligo 2008).

Similarly, an inventory of Latin American contract-farming schemes did not include any examples of coffee (Swinnen and Maertens 2007). One case of contract farming in coffee involves an exporter of organic coffee in Uganda (Bowlig, Gibbon, and Jones 2009). The fact that tea is often contracted while coffee is not may be related to the larger economies of scale in tea processing. Coffee processing is generally carried out by small traders and cooperatives with fewer means and less ability to organize contract production.

- *Seed*. Early generations of new varieties are multiplied on farms owned by seed companies or agricultural research institutes, but the later generations in the process are often grown by contract farmers. The contracts are used to ensure that farmers use appropriate practices to maintain seed quality and purity (Simmons, Winters, and Patrick 2005; Kumar et al. 2010).
- *Grains for breweries*. Large-scale brewers need a steady supply of sorghum, maize, and/or barley. In addition, they may require a variety that is different from what farmers would grow for the local market or for home consumption. In this case, contracting helps coordinate farmer supply to meet processor demand (Swinnen and Maertens 2007).
- *Poultry*. Although not widely documented in Africa south of the Sahara, commercial poultry production in Asia is often carried out on a contract basis. Large poultry or feed companies contract medium-scale farmers, providing them with chicks, feed, and technical assistance, and buying the broilers when they reach maturity (Birthal, Gulati, and Joshi 2005; Simmons, Winters, and Patrick 2005; Ramaswami, Birthal, and Joshi 2006).
- *Dairy*. Commercial smallholder dairy production is often organized either by cooperatives or by private processors using contract producers. Vertical coordination is needed because of the perishability of milk, the economies of scale in processing, and the need for processors to ensure a steady flow of raw material. In India, milk marketing has traditionally been organized by state-supported cooperatives. Recent economic reforms have allowed the emergence of private processors, both local and international, who contract with small producers (Birthal et al. 2008). The melamine food safety scandal in China resulted in policy changes to encourage dairy farmers to bring their cattle to centralized production facilities where quality could be better monitored, a system which could be considered contract production

(Mo et al. 2012). Contract dairy production has also been studied in Vietnam and Tanzania (Chapter 11; Hill, Temu, and Torero 2012).

- *Rubber*. Indonesia, Malaysia, and Thailand are the largest rubber producers in the world (FAO 2011b). Contract production of rubber in Malaysia represents one of the largest schemes in the world, with more than 100,000 farm households. On a smaller scale, contract farming is also used to produce rubber in western and central Africa. Rubber is grown by outgrowers, usually linked to a nucleus estate. The contract provides credit for the high cost of raising the trees to maturity, which may take seven years. Outgrowers have lower yields than the estates, but they can more easily adjust during periods of low prices because they grow other crops and do not depend exclusively on rubber income (Baumann 2000; Brüntrup and Peltzer 2006).
- *Oil palm*. Similar to rubber production, the largest oil palm producers are Indonesia, Malaysia, and Thailand, though it is also grown widely in Colombia and West Africa (FAO 2011b). It is often grown on nucleus estates with outgrowers. Newer high-yielding varieties respond well to weed control and regular maintenance, shifting the advantage from smallholders to estate production (Baumann 2000). Cahyadi and Waibel (2013) report that 40 percent of Indonesian oil palm is grown by smallholders, many of whom produce under contract.

This section confirms that contract farming schemes have been organized to grow a wide range of commodities, particularly high-value commercial crops to be purchased by large-scale processors or exporters and destined for a quality-sensitive market. It is worth noting that, apart from seed production, there are few cases of contract production of staple grains. For example, Reardon et al. (2014) carried out farm surveys in Bangladesh, China, India, and Vietnam and found “nearly zero contracting by mills of farmers.”

### **Impact of Contract Farming on Participating Farmers**

Economic logic would suggest that well-informed farmers will not voluntarily enter into contracts with buyers unless they believe there will be benefits. However, the actual impact may be negative because of misperceptions or lack of information. If the contract-farming scheme involves tree crops or other transaction-specific investments, farmers may be locked into an arrangement that is not beneficial. Finally, contract farming may bring benefits to the

farmers who make the decision, but have negative effects on other members of the household or the community.

Early reviews of the literature concluded that most studies suggest that farmers benefit from contract farming because it provides them with inputs on credit, technical assistance, and often a guaranteed price, allowing them to produce a higher-value commodity than would otherwise be possible (Glover 1984; Minot 1986). Little and Watts (1994) provide a more skeptical view of the benefits of contract farming based on a set of seven case studies of contract farming in Africa south of the Sahara. These studies focus on conflicts between farmers and the contracting firms, the imbalance of power between the two parties, intrahousehold tensions over the division of labor and new revenue, and increasing rural inequality. Similarly, Porter and Phillips-Howard (1997) conclude that contract farming generally raises farmer incomes, but may also cause social problems.

More recent studies use farm surveys to compare income and other outcome variables for contract farmers and other similar farmers. Most of these studies use econometric analysis to control for differences in farm size, education, and other observable characteristics that might explain income differences. Some of them use instrumental variables approaches to control for selection bias, since contract farmers may be different from other farmers in ways that are not easily observable, such as industriousness or management skill. Table 4.2 summarizes the results of studies of the impact of contract farming on crop revenue or farm income.

The weight of evidence suggests that successful contract-farming schemes generally raise the incomes of farmers who join them. The range of income gains associated with contract farming is from -49 percent to +700 percent, but most of the cases fall between 25 percent and 75 percent. The cases where contract farming does not generate benefits for farmers, in terms of either higher income or more stable income, are often short-lived as the scheme collapses.

### **Participation of Small Farmers in Contract Farming**

Even if farmers benefit from their contractual relations with processors and exporters, there is the issue of whether small farmers can participate in contract-farming schemes. Some critics of contract farming argue that firms tend to work with medium- and large-scale farmers (Little and Watts 1994; Singh 2002). If so, contract farming may be an interesting institutional mechanism for vertical coordination, but it would have less relevance for poverty reduction strategies. In fact, by contributing to income inequality, it may exacerbate tensions between the social groups in rural areas.

**TABLE 4.2** Studies examining the impact of contract farming on income or revenue

Study	Location	Commodities	Results
Little and Watts (1994)	Africa	Various	Case-study analysis of several schemes. Concludes that incomes increased for a moderate to high proportion of farmers, but highlights range of problems including conflicts between farmers and the contracting firms, the imbalance of power, intrahousehold tensions, and rural inequality
Porter and Phillips-Howard (1997)	Africa	Various	Review of contract farming. Finds that farmer incomes were raised from contracting but that there are possible problems caused by lack of control over production, intrahousehold conflict, income inequality, and power
Singh (2002)	India	Vegetables	Review of various schemes. Focuses on problems of power imbalance between farmers and firms, violation of terms, and social differentiation, but also finds higher incomes and satisfaction with participation in contract-farming schemes
Warning and Key (2002)	Senegal	Groundnut	Treatment-effects model used to estimate impact on income. Participation increases gross agricultural revenues 56 percent over the average for noncontracting farmer
Simmons, Winter, and Patrick (2005)	Indonesia	Poultry, maize, and rice	Contracting was associated with improved returns to capital for poultry and maize seed, but not for rice seed. Contract farmers had a 71 percent increase in gross margin for seed maize and 160 percent increase in gross margin for broilers over sample average
Birthal, Gulati, and Joshi (2005)	India	Dairy, vegetables, and poultry	Most dairy and vegetable farmers would prefer to grow under contract, but most poultry farmers would not. Contract poultry growers tend to be less experienced and leave scheme when they become more experienced
Ramaswami, Birthal, and Joshi (2006)	India	Poultry	Based on an instrumental variables (IV) regression analysis, contract poultry growers earn 36 percent more per kilogram per production cycle than independent growers. Also, contract growers had lower variability in gross margins across production cycles
Birthal et al. (2008)	India	Dairy	Contract dairy production is more profitable than independent contract production, mainly because of the lower transaction costs associated with contract production. A treatment-effects model suggests that participation in contract production increases net revenue more than 80 percent compared to the average
Bolwig, Gibbon, and Jones (2009)	Uganda	Coffee	Positive revenue effect for contract farmers compared to a control group of noncontracting farmers. With full-information maximum likelihood (FIML) estimation, the average effect is a revenue increase of 75 percent in net coffee revenue relative to the counterfactual of nonparticipation
Miyata, Minot, and Hu (2009)	China	Apples and green onions	Treatment-effects model finds a 38 percent increase in income associated with contract farming. In the case of apple production, the additional income is largely attributed to higher yields, while in the case of green onions, the prices received by contract farmers were higher than those received by noncontract growers

Study	Location	Commodities	Results
Saigenji and Zeller (2009)	Vietnam	Tea	Propensity score-matching approach used to control for effect of observable characteristics. Study finds that participation in contract tea production raises household income by 40 percent above that of similar noncontract farmers
Jones and Gibbon (2011)	Uganda	Cocoa	Contract participation increased real net cocoa revenue by 58–168 percent, depending on the econometric model used
Bellemare (2012)	Madagascar	Vegetables, fruit, and grain	Results indicate that a 1 percent increase in the likelihood of participating in contract farming is associated with a 0.5 percent increase in household income. This implies that the average effect has an upper limit of 50 percent of income. The study also found that participation increases income from noncontract crops and from livestock production
Freguin-Gresh, Anseeuw, and D'Haese (2012)	South Africa	Fruit, vegetables, and poultry	Contract farmers benefit from higher incomes, better access to services and resources, and opportunities to participate in new markets. Study finds a sevenfold increase in income, significant at 5 percent level. However, contract farming is not widespread and mostly involves the better-off farmers
Cahyadi and Waibel (2013)	Indonesia	Palm oil	Results show that while contract farming has a significant positive effect on smallholder income overall, it discriminates against poorer smallholders. Estimates that contract participation increased net household income by 60 percent (significant at the 10 percent level)
Dedehouanou, Swinnen, and Maertens (2013)	Senegal	Horticulture	Results of a survey indicate that horticultural farmers producing under contract report higher levels of happiness than those not under contract
Narayanan (2014)	India	Gherkins, papaya, marigold, and poultry	Participation in contract farming estimated to have increased profits of gherkin farmers by 21 percent, papaya farmers by 32 percent, poultry farmers by 150 percent. Contract farmers in marigold earned 49 percent lower profits than they would have outside the scheme

Source: Authors.

Other things being equal, firms would generally rather work with a small number of larger farmers than a large number of small farmers. The transaction costs associated with negotiation, technical assistance, the monitoring of quality, and collection of harvest would certainly be less if the firm works with a smaller number of larger farmers.

However, all other factors are not equal. Family labor used by small farmers has a lower implicit wage rate than the wage laborers hired by medium- and large-scale farmers. Also, family labor is better motivated than hired laborers to respond to problems such as disease or pest attack as they occur during the crop cycle. According to Birthal, Gulati, and Joshi (2005), firms

in India often found it more convenient to contract with smallholders (1) to reduce the risk of crop failure by spreading production, (2) to achieve higher quality when intensive management is required, and (3) to reduce labor costs because of the lower implicit wages of family labor. Cooperatives and other types of farmer organizations can serve as intermediaries, reducing the cost to the buyer of dealing with a large number of small farmers.

A number of studies compare the characteristics of contract and non-contract farmers in terms of farm size, assets, and experience, as an indicator of the pro-poor impact of contracting (Table 4.3). Several studies find that contract farming favors larger farmers (see Wang, Zhang, and Wu 2011; Guo, Jolly, and Zhu 2005).

Other studies find little or no difference between contract and non-contract growers (Warning and Key 2002; BIRTHAL, Gulati, and Joshi 2005; Miyata, Minot, and Hu 2009). Indeed, there are cases where contract farmers tend to be smaller or less experienced. Presumably, they use contracting as a way to learn the business. Eventually, having acquired some experience, they leave the scheme to become independent growers. This was the case in studies of contract farmers in Costa Rica (Saenz and Ruben 2004), poultry growers in India (Ramaswami, BIRTHAL, and Joshi 2006), and poultry growers in Indonesia (Simmons, Winters, and Patrick 2005).

A few studies give examples of buyers shifting from small- to large-scale farmers or the reverse. Minot and Ngigi (2010) describe the evolution of several contract-farming schemes in Kenya, including one (Del Monte pineapple) that gave up on contract production and shifted to vertically integrated plantation production. As discussed earlier, green bean exporters in Senegal switched from small-scale contract production to large-scale contract production (Maertens and Swinnen 2009). International tomato processors in Mexico first contracted with large growers but then involved small growers—partly because, as a lucrative market for fresh tomatoes developed, firms found it increasingly difficult to enforce contracts they had with larger growers (Key and Runsten 1999).

These findings confirm that the comparative advantage of small farmers is not a static concept, but it can change as farmers and buyers experiment and learn from experience.

### **Challenges Facing Contract Farming**

Although numerous studies confirm that contract farmers gain from participation, the studies also reveal frequent problems in these schemes. In fact, there is a relatively high rate of failure for contract-farming schemes in

**TABLE 4.3** Studies examining small farmer participation in contract farming

Study	Location	Commodities	Results
Key and Runsten (1999)	Mexico	Tomato	Large tomato processors from the United States first contracted with large growers in Mexico, but later shifted toward small growers
Warning and Key (2002)	Senegal	Groundnut	Asset ownership is not a significant predictor of contract participation
Minot and Ngigi (2010)	Côte d'Ivoire, Kenya	Horticulture	Describe the evolution of several contract-farming schemes in Kenya, including one (Del Monte pineapple) that gave up on contract production and shifted to vertically integrated plantation production
Maertens and Swinnen (2009)	Senegal	Green bean	Green bean exporters in Senegal switched from small-scale contract production to large-scale contract production
Saenz and Ruben (2004)	Costa Rica	Chayote squash	Study of contract farming in Costa Rica found that younger, less-experienced growers were more likely to grow under contract
Simmons, Winters, and Patrick (2005)	Indonesia	Poultry, maize, rice	Irrigation, age of head of household, and education were all found to be positive indicators of participation in contract farming across three sites in the country
Guo, Jolly, and Zhu (2005)	China	Fruits, vegetables, tea, livestock	Specialization and commercialization along with distance from market and government support are shown to predict the likelihood that farmers engage in contract farming
World Bank (2006)	China	Fruits, vegetables	A fruit and vegetable exporter in China that started producing its own horticultural products on company land and later shifted to smallholder contract production
Birthal, Gulati, and Joshi (2005)	India	Dairy, poultry, vegetables	Experience and non-farm income are found to be significant indicators of contract farming for the dairy, vegetable, and broiler industries
Miyata, Minot, and Hu (2009)	China	Apples and green onions	A probit model for the participation in contract farming shows no preference for larger farmers
Wang, Zhang, and Wu (2011)	China	Vegetables	Risk attitudes are found to be a significant determinant of contract farming, with more risk-tolerant farmers preferring contracts
Narayanan (2012)	India	Vegetables and poultry	Surveys of contract and noncontract farmers for various commodities find that participation is determined as much by location as household characteristics
Cahyadi and Waibel (2013)	Indonesia	Palm oil	Migrant status, household head age, plot size, and time since farm establishment are all significant predictors of participating in contract farming
Narayanan (2013)	India	Vegetables and poultry	Survey of 822 farmers reveals significant attrition in contract-farming schemes over time. Poor farmers from marginalized social groups are more likely to exit than other farmers, although some depart voluntarily

**Source:** Authors.

developing countries. This is particularly evident in Kenya, which has a history of contract farming going back to the colonial period. Reviews of the evolution of contract-farming schemes in Kenya reveal a high rate of turnover as schemes collapse and new ones are launched (Jaffee 1994; Minot and Ngigi 2010). Similarly, Sartorius, Kirsten, and Masuku (2004, 89) note “the high level of failure of small-scale farmer contract farming projects in developing countries.” Singh (2002) provides a list of numerous contract-farming schemes in India that failed for one reason or another.

One policy constraint on contract farming is legal restrictions on direct contact between farmers and agribusiness firms, such as processors and exporters. These regulations are intended to protect farmers from being exploited by large companies. The effect, however, is to force processors to vertically integrate and produce their own raw materials, to purchase from large-scale commercial farms, or to purchase from cooperatives. Birthal, Gulati, and Joshi (2005) list a number of regulatory constraints that impeded the establishment and growth of contract-farming schemes in India.

Another perennial problem with contract-farming schemes is the high cost of dealing with large numbers of dispersed contract farmers. This is particularly true when the company distributes inputs, provides credit, and organizes the collection of the crop. Sartorius, Kirsten, and Masuku (2004) argue that this is one of the main reasons why companies often prefer to work with larger-scale farmers. One solution is to have another organization to act as intermediary between the company and the farmers. An NGO, a donor-funded project, or a cooperative may help organize farmers (Narrod et al. 2009; Coulter et al. 1999). In China, village leaders sometimes serve as intermediaries between the company and contract farmers. They recruit contract farmers, explain the terms, and help enforce loan repayment and product delivery (Miyata, Minot, and Hu 2009).

One of the most common problems in ongoing contract-farming schemes is *side-selling*, the sale of contracted output to other buyers. Farmers try to sell to other buyers to take advantage of a better price or to avoid repayment of inputs they received on credit. Since the contracts are generally not legally enforceable,<sup>2</sup> the only leverage the firm has is to refuse to work with the farmer in the future. Coulter et al. (1999) list a number of approaches that have been taken to reduce default: group lending, information sharing among buyers, incentives for repayment, good communication, and close monitoring.

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2 Although the contract may be legally binding in theory, it is often not worthwhile to either party to bring a case to court given the high costs relative to the value in dispute.

As an example of the second point, when cotton markets were liberalized in Benin, the government established a clearinghouse for information on farmers who are producing cotton and receiving inputs on credit. This information makes it easier to punish both the farmer who violates the terms of their contract and the buyer who knowingly purchases cotton from growers who have contracts with other companies. By tightening up on farmer default, the system of input credit has been preserved (Goreux 2003).

A related problem is that when market prices fall below the contracted price, the processor may be tempted to import or purchase from the open market instead of from contract growers. Although the company may be under pressure to respect the terms of the contract, it can impose strict quality standards on the contractors to avoid purchasing from them at the agreed price. The main leverage that farmers have is to withdraw from the scheme or to bring the case to local officials for intervention. Several studies have shown that third-party certification can address this problem (Chapter 11; Hill, Temu, and Torero 2012).

## **Conclusion**

Contract farming is defined as agricultural production that takes place under a pre-planting agreement between the farmer and the eventual buyer. It is mostly likely to be economically justified when the buyer is a large processor, exporter, or retail chain; when the commodity has a high value–bulk ratio, is perishable, and/or is not widely grown; and where the destination market is willing to pay a premium for attributes that are not easy to obtain through spot markets. In practice, this means that contract farming will be most suitable for fruits and vegetables for quality-sensitive markets; commercial dairy and poultry production; and cash crops such as tea, tobacco, sugarcane, and cotton. Contract farming is generally not suitable for grain production, except in the case of seed, organic grains, barley for large-scale breweries, or niche grain products for export.

Econometric analysis can be used to evaluate the impact of contract farming on household income, but it is important to take into account the fact that contract farmers may differ in other respects (such as education, farm size, or industriousness) from other farmers. Across the 20 econometric studies of the impact of contract farming, the estimated increase in income ranged from –49 percent to 600 percent, but most of the studies found an increase in income of between 25 percent and 75 percent. This is not surprising given that contract-farming schemes which do not provide higher incomes (or some

other benefit such as more stable income) to participating farmers are likely to lose farmers and eventually fail.

The evidence suggests that in many cases companies are willing to work with small farmers, but some crops have economies of scale that favor medium- and large-scale farmers. Numerous studies have found that farm size was not a significant determinant of participation in a contract-farming scheme, and several more found that contractors preferred smaller farmers. On the other hand, some studies have found that contract farmers were larger than average. Commodity and policy differences may partially explain the contrasting results. Finally, contractors may shift their strategy over time as they gain experience or as market conditions change, and these shifts can go in either direction.

One of the most common problems in contract farming is side-selling, when farmers sell to other buyers to avoid repaying loans or simply to obtain a better price. In addition, there are numerous cases of companies who are unable or unwilling to pay the negotiated price and use quality standards to evade their commitments. Third-party certification is one promising way to address this problem. A third problem is the high cost of working with large numbers of small farmers, though this problem can be ameliorated with the use of farmer organizations or other intermediaries. Because of these problems, there is a relatively high rate of failure in contract-farming schemes.

A major limitation of contract farming is that it is only appropriate for high-value commodities being sold to large-scale buyers for quality-sensitive markets. For most developing countries, the proportion of farmers involved in contract farming is probably in the range of 1–5 percent. Furthermore, it is unlikely that contract farming can be scaled up to reach the majority of small farmers who produce grains and other staple foods.

The fact that most contract farming schemes raise the income of participating farmers and that small farmers are often (but not always) able to participate suggests that governments should create a policy environment that facilitates the formation of contract-farming schemes, particularly when they incorporate small farmers. In particular, the following policy goals should be considered.

*Improve the investment climate:* Contract-farming schemes are usually organized by large-scale processors, exporters, or supermarket chains. Thus, an investment climate that facilitates private investment in agribusiness sectors is a necessary precondition for the development of private contract-farming schemes.

*Legalize direct firm–farm contracts:* The government can facilitate contract farming and other forms of vertical coordination by removing legal

restrictions that prevent firms from buying directly from farmers in some countries. The government's role should be to ensure that both parties in an agreement understand and accept the terms.

*Develop effective grades and standards:* The establishment of grades and standards that are easy to implement and that reflect attributes demanded by consumers will facilitate communication and negotiation between buyers and farmers, and among traders. It will also make it easier for buyers to establish contracts with farmers, given that quality control is often a contentious issue.

*Facilitate farmer organizations and other intermediaries:* Local officials and extension agents can play a role in allowing and even promoting the development of intermediary organizations that reduce the transaction cost associated with dealing with a large number of small farmers.

*Promote public-private partnerships in extension:* If extension services have the flexibility to provide services on behalf of the contracting firm and the incentives to serve small farmers, it reduces the cost to the firm of working with small farmers.

*Promote competition:* One of the best approaches for limiting the power of contracting companies is to allow or promote competition among firms. Policymakers should be cautious about responding to requests from agribusiness firms for a regional monopsony. At the same time, it is important to recognize that competition makes it easier for farmers to avoid repayment of input credit. It may be possible to enforce repayment without stifling competition, such as by creating credit clearing houses and forming professional bodies with codes of conduct.

*Provide mediation services:* One of the most common problems in contract farming is violation of the contract. If the market price rises during the agricultural season, farmers are tempted to sell to other buyers, particularly since doing so means they can avoid repaying the input credit. On the other hand, if the market price falls, the buyer is tempted to procure raw materials on the open market and/or apply quality standards more strictly. Government officials, particularly extension officers, sometimes play a role in mediating between contract growers and the buyer. Alternatively, they could help organize a nongovernmental mediation board with members acceptable to both sides.

*Enforce contracts:* The government should explore alternative approaches to enforcing contracts, particularly between buyers and farmers. This could take the form of establishing small-claims courts or collecting and disseminating information on noncompliance on the part of both farmers and buyers. Providing better information about noncompliance will increase the

incentives for farmers and firms to comply and help each party avoid high-risk business partners.

It is likely that contract farming will expand in developing countries as local diets shift away from cereals and staple root crops, as markets link small farmers with quality-sensitive markets in the major cities and abroad, and as the share of agricultural output that is processed increases. The policy measures discussed above can help facilitate this shift toward more structured market channels that give farmers the opportunity to benefit from changing demand. However, contract farming is only one component in an agricultural strategy to raise incomes and reduce rural poverty. Efforts to promote contract farming should not distract from investments in rural infrastructure, agricultural research and extension, market information systems, and social safety nets, all of which have broad-based impact on rural livelihoods.

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## **PART 3**

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# **Integrating Agricultural Innovation and Inclusive Value-Chain Development**



## INTEGRATING AGRICULTURAL INNOVATION AND INCLUSIVE VALUE-CHAIN DEVELOPMENT: INTRODUCTION<sup>1</sup>

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André Devaux, Claudio Velasco, and Matthias Jager

### Summary

Six chapters examine efforts to promote innovation in value chains for beef cattle, dairy, potatoes, and other commodities in Africa south of the Sahara, the Andean region of South America, the Middle East, and South-East Asia. Virtually all began as research to boost farm-level productivity. However, as the importance of marketing issues became apparent, the approaches evolved to embrace inclusive value-chain development (VCD). Three of the chapters deal with general issues of linking agricultural innovation with VCD and emphasize the importance of integrating the two approaches. The other three chapters focus on the use of multistakeholder platforms to foster innovation, value-chain coordination, and governance, highlighting the crucial roles played by facilitators in platform formation, operation, and evaluation; the tensions that need to be managed; and the dynamic nature of platforms, innovation, and VCD processes. The latter highlight the need for adaptive management and learning-oriented evaluation that supports decisionmaking.

### Introduction

Agricultural development is taking place in the context of rapid urbanization and increasing market integration, as supermarkets and food processors transform agrifood value chains throughout the developing world. The term *value chain* is shorthand for the sequence of interlinked agents and markets that transforms inputs and services into products with attributes for which consumers are willing to pay. While the growth of agricultural markets and the development of value chains create opportunities for many producers,

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<sup>1</sup> The guide reviewed here, UNIDO (2011), is part of a toolkit of value-chain development for understanding and diagnosing value chains. See [www.unido.org/fileadmin/user\\_media/MDGs/IVC\\_Diagnostic\\_Tool.pdf](http://www.unido.org/fileadmin/user_media/MDGs/IVC_Diagnostic_Tool.pdf)

smallholders face numerous challenges. They may have a comparative advantage in producing labor-intensive crops for high-value markets, but they frequently have limited access to the technical information, training, new inputs, and new technologies that could improve their efficiency and add value to their production. Additionally, smallholders frequently have limited access to land and capital, which limits their ability to invest in productive assets and expand their supplies. They often have weak relationships with market agents, service providers, and policymakers; limited basic knowledge of the market system; and limited information on market conditions and prices, market entry requirements, and consumer preferences. Because each smallholder sells only a small amount of produce, the costs of assembling, handling, and transporting their produce is high relative to that of larger-scale operators. In some cases, such as for specialty coffee farmers, the additional transaction costs to enter specialty markets are not compensated by the premium price paid.

Recognizing the challenges that smallholders face in high-value markets for agricultural products, many donor agencies and nongovernmental organizations (NGOs), and some governmental agencies, have begun to promote inclusive value-chain development (VCD)—seeking to make positive changes in value chains to extend or improve productive operations and generate environmental and social benefits, such as poverty reduction, income and employment growth, and gender equity (UNIDO 2011, 1).

Research is often confused with innovation, but there are important differences between them. Whereas research focuses on generating new knowledge, and technology development aims to create a supply of new production methods, innovation is concerned with the practical use of new knowledge. As Barnett (2004, 1) states, innovation involves “the use of new ideas, new technologies or new ways of doing things in a place or by people where they have not been used before.”

Interactive social-learning processes involving researchers and economic actors are crucial for ensuring that applied research generates useful new knowledge that is put into practical use. Since research organizations have traditionally worked in isolation from the end users of their technologies, institutional innovations that strengthen patterns of interaction between researchers and economic actors are crucially important for strengthening innovation systems.

An innovation system can be defined as “a network of organizations, enterprises, and individuals focused on bringing new products, new processes, and new forms of organization into social and economic use, together with the institutions and policies that affect their behavior and performance” (World

Bank 2007, xiv). The ability to interact constructively and work in new ways is crucial for the innovation performance of groups. Recent studies of agricultural innovation highlight the utility of the value-chain concept as unit of analysis and focus of interventions aimed at stimulating innovation and developing innovation capacity (World Bank 2007, 24). Thus, attention should not be directed at individual value-chain participants such as producers, but at the overall supply-chain capacity and the degree to which the chain in its entirety can compete.

One approach for promoting innovation is to enable other actors to innovate and to strengthen their interactions, through innovation brokering or facilitation (Klerkx, Hall, and Leeuwis 2009). This is often accomplished by working with multistakeholder platforms, which Chapter 8 (Thiele et al.) defines as “a space of interaction among different [types of] stakeholders who share a common resource and interact to improve mutual understanding, create trust, define roles, and engage in joint action.” The same authors distinguish between innovation platforms, which bring processors, traders, farmers, and other market-chain actors together with R&D organizations to foster commercial, institutional, and technological innovation; and market chain governance platforms, which bring farmers and service providers together to address governance issues related to the value-chain coordination and farmer empowerment.

Whereas networks of innovators are commonly found wherever innovation takes place, multistakeholder platforms are usually established by external interventions that seek to stimulate innovation or improve value-chain coordination. These interventions, such as the Participatory Market Chain Approach (Chapter 7), commonly seek to promote collective action—voluntary action taken by a group to pursue common interests or achieve common objectives—and to pass platform leadership to local groups.

Another way of promoting inclusive innovation within individual trading relationships between (formal or informal) producer groups and private-sector firms as buyers has been promoted through the LINK methodology (Lundy et al. 2014).

Despite the increased interest in inclusive VCD, most agricultural research and development (R&D) projects still promote technological innovation at the farm level, and pay scant attention to marketing and other important constraints related to postharvest practices, processing, and value addition at farm or local level. Different teams, with the common goal of improving smallholders' welfare, often design and implement different types of intervention—some focused on promoting innovation in smallholder production practices and

others focused on VCD. However, significantly, few interventions seek to integrate work on both innovation systems and value chains. The chapters in Part 3 of this book show how more holistic approaches, embracing both agricultural innovation and inclusive VCD, can generate greater benefits for smallholders, and illustrate how such approaches can be implemented in practice.

The six chapters in Part 3 present cases from Africa, Asia, and Latin America, where agricultural innovation systems and value-chain approaches have been integrated, and they identify remaining challenges and unresolved issues. All of these chapters deal with issues of combining innovation systems and value-chain approaches. The first three chapters focus on the interface between technical R&D work and VCD, and highlight the importance of a systems view of innovation that accords importance to both supply and demand factors. The remaining three chapters focus more specifically on the role of multistakeholder platforms in fostering innovation and inclusive VCD.

All the chapters present examples from either the potato or livestock sector, but this does not mean that these sectors are more conducive to work with platforms or other approaches for stimulating innovation and improving market coordination than other sectors. Similar work has been carried out with coffee, peppers, dairy, and other market chains (Mayanga et al. 2012; Lundy et al. 2014; Devaux et al. 2013). However, at the time of producing the present book, these cases had not yet been analyzed in peer-reviewed publications. Work on value chains, in collaboration with private actors and NGOs, has not been a priority for use of core funds in CGIAR. The work reported on here, with livestock and potatoes, benefitted from long-term support from donors that pressed the centers for concrete results from applied R&D efforts.

## **Complementarity of Innovation Systems and Value-Chain Approaches**

Chapters 5, 6, and 7 explore the complementarity of innovation systems and value-chain approaches. Chapter 5 (Ayele et al.) analyzes the strategies and results of programs hosted by the International Livestock Research Institute (ILRI) to improve farmers' welfare in Ethiopia, Syria, and Vietnam by integrating fodder production into their livestock systems. While fodder was an entry point for the innovation process, major improvements required that broader value-chain issues be addressed in a more holistic manner. The authors highlight the value of a national innovation policy and of government support for improving livestock farmers' access to agricultural services, including credit and technological support.

Chapter 6 (Stür, Troung Tan Khanh, and Duncan) analyzes how smallholders in Vietnam were able to transform an extensive traditional livestock production system into a more intensive one, taking advantage of the growing urban demand for high-quality meat. They highlight several factors that contributed to this transition, including a convincing technological innovation, a system-oriented approach with emphasis on capacity strengthening, development of a coalition of local actors supporting the transformation process, and having external and local support over a sufficiently long period of time (a decade in this case).

Chapter 7 (Devaux et al.) analyzes the work of the International Potato Center's (CIP) Papa Andina regional network in Bolivia, Ecuador, and Peru. This work sought to capitalize on the genetic diversity of native potatoes grown in remote mountainous areas, as well as on the social capital and local knowledge of the smallholders who have cultivated them for centuries—assets that are often undervalued. An action–research approach, known as the Participatory Market Chain Approach (PMCA), was developed, which engages smallholders, market agents, researchers, and agricultural service providers to jointly identify market opportunities and to foster the commercial, technological, and institutional innovation needed to exploit these opportunities. This approach, developed and first applied in potato value chains in the Andes, has now been shared, tested, and applied successfully in other value chains and other regions (Mayanja et al. 2012; Horton et al. 2013).

In these three chapters, interventions evolved from an early focus on improving production technology to broader systems approaches aimed at improving both production and marketing. CIP's work in the Andes originally centered on developing a regional research agenda and the transfer of production-related technology. ILRI's work in Ethiopia, Syria, and Vietnam originally centered on improving livestock productivity on small farms. As efforts evolved from research and technology transfer to facilitation of innovation processes, program implementers broadened their engagement with a range of stakeholders involved in production, marketing, and service provision. Over time, participatory approaches for agricultural technology development were complemented with innovation systems and VCD approaches for identifying and exploiting potential marketing opportunities. Growing markets and commercial innovations stimulated technological and institutional innovation. The cases often involved formation or strengthening of farmer groups. In Vietnam, farmer groups were established for joint learning and skill development, as well as to strengthen farmer engagement in the value chain. Farmer groups facilitated the work of extension agents and, in time, helped reduce

transaction costs and improve profitability. The extension service played a key role in facilitating learning and innovation processes, which linked researchers, farmer groups, input suppliers, traders, credit agents, and a social bank.

In the Andes, where extension services and other local government agencies are weaker, NGOs have often filled the gaps by facilitating interactions among farmers, market agents, service providers, and input suppliers. However, the unstable funding of NGOs can jeopardize the reliability and sustainability of their support.

The experiences analyzed in these three chapters highlight the importance of having competent facilitation to engage diverse stakeholders in group processes, keep the group focused on joint learning for market innovation, and develop cohesion within the group. There is a delicate balance between pushing ahead to achieve quick results and taking the time to develop local capacity and leadership. In Vietnam, local leadership and ownership were crucial for achieving significant and durable results. The Vietnamese case also illustrates how informal local coalitions can be effective in stimulating innovation—perhaps more effective than more formalized and centralized organizations.

The cases show that for R&D organizations to contribute to inclusive VCD, they need to develop their own capacity to facilitate collective action involving stakeholders with different, often conflicting, interests. R&D organizations also need resources to work off the experimental station and the flexibility to respond quickly to opportunities and challenges that arise unexpectedly. Funding for off-station activities from bilateral donors has often proven critical for the success of VCD initiatives.

The chapters illustrate the emergent nature of innovation and VCD processes, and the time needed to strengthen and then utilize the capacities needed to foster changes in production and marketing practices, and to foster collective action for innovation among the diversity of actors involved in the value chain. The cases reviewed in this section all relate to work that took place over 5–10 year periods, and these are all still considered “work in progress.” Papa Andina invested in new institutional arrangements to build bridges between poor farmers and market intermediaries, and build trust through regular interaction. Although this type of institutional investment is time-consuming and the results are often intangible, it can make the difference between inclusive and exclusive development (Meinzen-Dick, Devaux, and Antezana 2009).

The work carried out triggered innovation processes that continued after the original projects finished. Large-scale impact has required that local actors continue to innovate long after the projects finished. Creative imitation

processes—in which early innovations are copied and improved upon in minor ways—are pathways to impact that merit more careful study in future (Horton and Samanamud 2013).

## **Role of Multistakeholder Platforms in Promoting Innovation and Inclusive Value-Chain Development**

Chapters 8, 9, and 10 focus on the role of multistakeholder platforms in promoting innovation and inclusive VCD.

Differences in the attributes of value chains, participating actors, and institutional arrangements have led to the emergence of two types of platform—one focused on innovation and the other on value-chain governance and coordination. Analyses of work in the Andes (Chapter 8; Cavatassi et al. 2011) indicate that platforms that bring stakeholders together around value chains can result in new products, processes, norms, and behaviors that benefit poor farmers in ways that would not have been achieved otherwise.

A number of studies have addressed issues of platform organization, but few have studied how platforms shape innovation processes. Chapter 9 (Kilelu, Klerkx, and Leeuwis) attempts to unravel the role of platforms in supporting innovation, through an in-depth study of a smallholder dairy-development program in Kenya. The findings indicate that innovation processes produce numerous tensions and unexpected effects, and that intermediation and facilitation are crucial for resolving tensions. Innovation platforms require adaptive management that is supported by monitoring for continuous learning.

Dynamic innovation processes and differences in interests, capacities, and power present challenges for platform facilitators. Based on group reflection on their own personal experiences facilitating innovation platforms, Chapter 10 (Swaans et al.) discusses key issues that are critical for effective platform facilitation.

These chapters suggest five sets of general issues related to the types and roles of platforms, platform facilitation, platform sustainability, platform dynamics, and gender issues.

### **Types and Functions of Platforms**

Chapter 8 (Thiele et al.) identifies two types of platforms, which play different roles in innovation and VCD. *Innovation platforms* bring traders, processors, supermarkets, researchers, and others together with farmers and their associations to foster the creation of new market opportunities through

commercial, institutional, and technological innovation. Dror et al. (2016) analyze experiences with innovation platforms for agricultural development in Central Africa, Ethiopia, India, Kenya, and Uganda. Value-chain governance platforms are structured around a geographically delimited supply area, meshing small farmers and service providers, and primarily addressing market-governance problems in assuring volumes, meeting quality and timeliness constraints, as well as empowering farmers.

A single platform may facilitate both innovation and chain governance, and many of the cases analyzed in this book involve platforms that have played both roles. The roles and functions of innovation platforms have been more thoroughly studied than those of value-chain governance platforms.

Chapter 9 (Kilelu, Klerkx, and Leeuwis) notes that platforms may serve as “innovation intermediaries,” with the following functions:

- *Demand articulation*: Identifying innovation challenges and opportunities as perceived by the various stakeholders.
- *Institutional support*: Facilitating and advocating institutional change.
- *Network brokering*: Identifying and linking different actors.
- *Capacity building*: Strengthening and incubating new organizational forms.
- *Innovation-process management*: Coordinating interactions and facilitating negotiation and learning among different actors.
- *Knowledge brokering*: Identifying needs and mobilizing knowledge from different sources.

Chapter 8 (Thiele et al.) identifies additional roles for multistakeholder platforms in VCD that create space for social learning and joint innovation. They can also perform governance functions within the value chain, improving coordination of business activities and reducing transaction costs. Finally, a platform can perform advocacy functions and promote policy changes that can advance VCD.

In the cases analyzed in the three chapters, platforms triggered processes that produced new products, production processes, norms, and behaviors that could not have been achieved otherwise and that benefitted poor farmers. The clearest evidence of impact comes from the platforms in Ecuador (Cavatassi

et al. 2011). By 2007, some 1,483 tons<sup>2</sup> of potato from 260 ha were marketed through the platforms by smallholder farmers (average landholding 2.6 ha). Platform farmers obtained an average yield 33 percent higher than nonparticipants. Although their input costs were also higher, their profit was approximately four times greater, thanks to the higher yield and a 30 percent higher selling price. Secondary indicators suggest that the linking to the platforms also contributed to better management of pesticides and promoted social capital, from the Farmer Field School training that accompanied implementation of the platforms.

The scale, sequence, and timing of impacts on farmer livelihood differed among the cases. In Ecuador, platforms concerned with value-chain coordination and governance generated quicker benefits than innovation platforms because they were oriented toward existing market opportunities that could be exploited quickly. In the longer run, innovation platforms produced greater benefits because private market-chain actors drove innovation processes that produced more pervasive and sustainable impacts.

### **Platform Facilitation**

Effective facilitation is frequently identified as critical for the success of innovation platforms. Based on reflection on experiences in Africa south of the Sahara, Swaans et al. identify the following issues for facilitation:

- The dynamic and evolving nature of platforms
- Power dynamics
- Gender equity
- External versus internal facilitation
- Sustainability of the process
- Issues of scale
- Monitoring and evaluation.

The other authors identified similar challenges for facilitators in Asia and South America.

Who is best placed to play the role of innovation facilitator? In the cases examined, professionals based in international organizations generally initiated innovation processes and initially played the role of innovation facilitator

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2 *Tons* always refers to metric tons.

or broker. However, as innovation platforms generally aim to build sustainable innovation capacity and support local actors in working as a self-organized and self-managed innovation system, handing over the task to local innovation brokers must be a central part of the process. It is essential to build up a cadre of local facilitators who can continue and expand the efforts. This aspect remains a challenge, which some capacity-building initiatives are tackling. In Africa south of the Sahara, the Forum for Agricultural Research in Africa (FARA) has started undertaking such capacity-building activities. In addition, the Kenya Agricultural Research Institute (KARI) and the Australian Centre for International Agricultural Research (ACIAR) have recently developed an initiative to train people from national research organizations across Africa in the facilitation of innovation platforms. These examples should be analyzed for possible adaptation and application in other contexts.

### **Platform Sustainability**

Questions related to funding and sustainability of innovation platforms are discussed in the three chapters. An economic analysis of multistakeholder platforms in Ecuador reported significant benefits for smallholders and high rates of return on the resources used (Cavatassi et al. 2011). But assuring long-term funding for platforms continues to be a challenge, in part due to the intangible nature of benefits. In the cases analyzed, support from local or national government helped ensure platform sustainability. In some cases, the platforms evolved into other forms of organization, such as farmer associations, where participating farmers contribute to the association management costs paying a tax based on the incomes generated through the sales of products. Chapter 10 (Swaans et al.) mentions the case of the Sub-Saharan Africa Challenge Programme, through which 36 platforms have been set up throughout Africa, and many have become established within the local or district government administrations. Support to farmers from local policymakers has strengthened the platforms.

### **Platform Dynamics**

In the analysis of the role of innovation platforms, Chapter 9 (Kilelu, Klerkx, and Leeuwis) identifies several tensions in relation to using platforms as a tool to stimulate innovation. The authors raise the question of whether all innovation platforms should have a similar composition in terms of diversity of participants and governance structure, or should also differ according to different types of outcomes (such as strengthening value-chain interaction, raising

farm-level productivity, and livelihood improvement) and the different levels of operation (such as platforms aiming to develop innovative solutions to problems, and platforms aiming to scale up such solutions).

Platforms should not be seen as a development tool for executing a preconceived plan, but rather they should be arenas for strengthening capacities and sharing knowledge to provide critical information to help deal with the complex and dynamic nature of agricultural innovation. Chapter 10 (Swaans et al.) highlights how the agenda of innovation platforms, and in turn the composition of relevant actors, evolved over time. Flexibility in facilitation of the innovation process and the management of platform dynamics was vital to ensure that the platform focused on appropriate and evolving issues for achieving impact. While innovation brokers can be provided with how-to guidelines for facilitating the innovation process, it is much more complicated to equip them with the skills to manage change. It is important that facilitators have a clear understanding of the need for flexibility and have the skills to work in an iterative way with relevant actors to achieve desired outcomes.

This flexibility and need to adjust to changes can be in conflict with the relatively rigid R&D agenda of R&D organizations. For R&D organizations to contribute effectively to innovation processes, they need new skills and resources. Retooling themselves to play these new roles is likely to pose major challenges for many of them.

Facilitators of innovation platforms often struggle to develop appropriate monitoring and evaluation (M&E) formats. Traditional R&D approaches have a tendency to use a linear M&E model based on an assumption that change can be planned, easily identified, and controlled (Prasad Pant 2010). In the context of research for development, M&E has two broad objectives: (1) to generate evidence on the effectiveness of innovation platforms; and (2) to promote joint learning and guide course corrections. But, in practice, innovation brokers often do not consider M&E as part of their role.

### **Gender Issues**

A review of research-for-development projects in Africa south of the Sahara (Chapter 10) found that women were frequently underrepresented in innovation-platform processes. Few women participate in platform meetings, which in certain locations may reflect the wider cultural context. Platform facilitators and members may fail to take into consideration the constraints that women face in attending and being able to actively participate in platforms because of their family responsibilities. Women's abilities to participate may

depend on the timing and location of meetings, the multiple demands on their time, and social expectations.

Even if women are present in platform meetings, they may not be able to voice their views. The same situation is observed in the Andes. This can result in platforms prioritizing issues that either do not reflect women's concerns, or could have a negative impact on them. For example, the Nile Basin Development Challenge innovation platform working on fodder development did not consider the extra demands on female labor and time that new interventions required. In the Andes, it was also observed that women's opportunities for participation in collective-action processes like the PMCA and the potential benefits needed to be addressed more systematically.

## **Policy Implications**

Most agricultural R&D efforts still emphasize the supply side—providing smallholders with improved inputs (seeds, fertilizer, and pest-management practices) and production-oriented services (agricultural extension, information, training, and credit). However, to achieve significant and lasting impacts, these production-oriented efforts need to be complemented with demand-side efforts that improve links between smallholders, market agents, and consumers (Chapters 6 and 7).

For R&D organizations to contribute more effectively to inclusive VCD, they need to develop their own capacity. In particular, they need new skills and resources to facilitate collective action involving stakeholders with different, often conflicting, interests (Chapters 1, 7, and 9). The work of FARA and KARI in Africa south of the Sahara to build brokering skills should be analyzed for potential application in other contexts (Chapter 10).

Innovation platforms that bring together diverse value-chain stakeholders can contribute to the development of new products, processes, norms, and behaviors that may not otherwise have been achieved (Cavatassi et al. 2011; Chapter 8).

Initiatives that promote agricultural innovation and inclusive VCD need two distinct types of M&E:

- reflexive monitoring that provides rapid feedback on early results and changes in the operating environment, to support adaptive management (Chapters 1 and 9), and
- comprehensive impact assessment that provides credible evidence of costs and benefits of the intervention (Chapters 7, 11, and 12).

Women's interests, requirements, and constraints need to be carefully considered when platforms are designed, managed, and evaluated. Tools to integrate gender perspectives into agricultural value-chain interventions need to be tested and validated (Chapter 14). This is one objective of the CGIAR Research Program on Policies, Institutions, and Markets' value chain research team. It is also important to keep in mind that since gender relations are deeply entrenched in local cultural norms, transforming them may be beyond the scope of collective-action processes for VCD, especially if they are operating for only a short time.

## **Knowledge Gaps and Priorities for Future R&D**

From the chapters in Part 3 of this book, the following knowledge gaps and priorities for future research emerge:

- *Monitoring and evaluation.* M&E has generally been weak in platforms and other initiatives that promote innovation and inclusive VCD, and many authors identify M&E as a priority area for future applied research (see, for example, Chapters 2, 8, 9, 12, and 13). Research is needed both to draw lessons from experiences in this field and to identify good practices in other sectors that have potential for improving monitoring that supports adaptive management and systematic assessment of the impacts of inclusive VCD interventions. These issues are dealt with in greater detail in Part 4.
- *Theories of action and change.* The theories and assumptions that guide interventions to promote innovation and inclusive VCD are seldom well articulated or tested. Applied research on the action and change models that guide interventions—be they explicit or implicit—is essential to provide better guidance for the design, implementation, and evaluation of future interventions (Horton et al. 2013).
- *Scaling up and institutional sustainability.* Research is needed to explore: the effectiveness of different arrangements for facilitating innovation and inclusive VCD in different contexts; how to scale up successful pilot efforts; and how to sustain them in local institutional structures after international projects are phased out (Chapters 7 and 8; Cavatassi et al. 2011).
- *Gender.* Applied research would be useful to systematize and draw lessons from experiences with using a gender lens in designing, operating, and

evaluating the outcomes of interventions for promoting inclusive VCD (Chapter 14). Future research should respond to the question: What does improved gender equity or participation in the value chain mean in terms of economic and social benefits and environmental performance at household, enterprise, community, and the overall value-chain levels?

- *Engaging large private firms.* Large private firms are increasingly important in agricultural value chains and they could play useful roles in interventions to promote inclusive VCD. However, it has often been difficult to convince them to engage in the early stages of VCD. Applied research could usefully address such questions as—
  - When and how to most effectively involve large firms in inclusive VCD processes?
  - What roles could large firms most usefully play in different contexts?

Chapter 4 (Minot and Sawyer) usefully summarizes the state of knowledge on some of the issues related to contract farming. The LINK methodology can be used to measure and improve the degree of inclusivity in existing trading relationships between large buyers and producer groups (Lundy et al. 2014).

- *Capacity development for facilitation.* Facilitation is a critically important area for capacity strengthening. More research is needed to explore the effectiveness of different types of innovation brokers operating in different contexts, how their roles change over time, and how different brokering arrangements can be institutionalized so that innovation processes can be sustained after projects are phased out (Chapter 10).

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## ENHANCING INNOVATION IN LIVESTOCK VALUE CHAINS THROUGH NETWORKS: LESSONS FROM FODDER INNOVATION CASE STUDIES IN DEVELOPING COUNTRIES

Seife Ayele, Alan Duncan, Asamoah Larbi, and Truong Tan Khanh

### Introduction

In developing countries, livestock can be an important pathway out of poverty (FAO 2009; McDermott et al. 2010a; Rich et al. 2011). Over one billion people depend on livestock, which provide power and manure for crop production, contribute to food and nutritional security, and are a form of savings for many poor people. Livestock also make major contributions to the agricultural GDP, export earnings, and employment. According to the “livestock revolution” thesis (Delgado et al. 1999; McDermott et al. 2010a), the sector is driven primarily by rising incomes and urbanization in developing countries like China and India, where demand for products such as meat and milk has been soaring. However, livestock are also responsible for adverse impacts on land, water, biodiversity, and climate change (Steinfeld et al. 2006; FAO 2009). Despite the conflicting paradigms, many, including McDermott et al. (2006), argue that, given appropriate policies to address social and environmental effects, livestock provide opportunities for millions dependent on them.

There are, however, challenges to enhancing market success for livestock-dependent people, including fodder<sup>1</sup> scarcity and weak farm-to-market links (McDermott et al. 2010b; IFAD 2006). The micro evidence we generated from Ethiopia, Syria, and Vietnam shows that fodder scarcity is severe. For example, in Syria during the dry season (December to February) many farmers face 50–60 percent fodder shortfalls (Larbi, Hassan, and Abdullah 2010). Fodder shortages reduce productivity and production and, as we noted in Ethiopia, may also damage community relations by provoking conflict over

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<sup>1</sup> *Fodder* refers to plants grown for feeding animals. It includes *food–feed* crops, grown for human consumption but whose residues and by-products are fed to livestock; grass, legumes, and tree species (see Hall, Sulaiman, and Bezkorowajnyj 2007).

grazing lands. We found complex causes of scarcity, including limited and erratic rainfall, shrinking grazing lands due to competition for land for crops, and changing land-use patterns favoring urbanization and settlement.

Over the past four decades, research and development programs have looked into the fodder-scarcity challenge, with some success in developing and promoting food and feed crops like cowpea; and improved grasses, legumes, and fodder trees (Lenné and Wood 2004; Kristjanson et al. 2005; Franzel and Wambugu 2007; Horne et al. 2005). Despite these efforts, many researchers found “limited” evidence of adoption of fodder technologies (IFAD 2006; de Haan et al. 2006; Hall, Sulaiman, and Bezhorowajnyj 2007). Limited adoption was attributed, among other factors, to farmers’ limited knowledge of technologies and low technical support provided to them, low government priority given to fodder compared to staple crop technologies, and limited availability of fodder seeds (IFAD 2006). For Hall, Sulaiman, and Bezhorowajnyj (2007), fodder scarcity has less to do with a shortage of information or technology per se than with “capacity scarcity” to innovate. Addressing scarcity entails the development of an “innovation capacity,” which consists of “*the context specific range of skills, actors, practices, routines, institutions and policies needed to put knowledge into productive use*” (Hall 2005, 625). Innovation-capacity development comes under the rubric of an innovation system approach which stipulates innovation as an outcome of interactive learning in networks (World Bank 2007; Rajalahti, Janssen, and Pehu 2008).

This chapter is based on case studies drawn from the Fodder Adoption Project (FAP) (<http://fodder-adoption-project.wikispaces.com/>; Duncan et al. 2011) implemented in Ethiopia, Syria, and Vietnam from 2007 to 2010.<sup>2</sup> The FAP was motivated by the innovation-systems approach, and aimed at a better understanding of the factors and processes influencing fodder innovation (the successful introduction and integration of fodder technologies and related knowledge in livestock-production systems).<sup>3</sup> A small team consisting of a research scientist and support staff coordinated networks in each country to initiate and diffuse fodder innovation in nine learning sites (villages and districts): four in Ethiopia, three in Syria, and two in Vietnam. The chapter

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2 The International Livestock Research Institute (ILRI) acted as the implementing agency, on behalf of the CGIAR Systemwide Livestock Programme. It was administered by a consortium of centers: ILRI, International Center for Tropical Agriculture (CIAT) and International Centre for Agricultural Research in the Dry Areas (ICARDA). FAP in Syria concluded in 2011.

3 Besides fodder technological innovation, in some sites FAP also promoted organizational innovations such as formation of farmer groups and coordination of value-chain actors and activities.

synthesizes the lessons learned. It pays particular attention to documenting and analyzing innovation processes in different local and national contexts. This analysis highlights the importance of learning on farms and in networks, and that sustained improvement to fodder availability occurs when broader livestock value-chain issues are addressed.

The next section discusses innovation-system and value-chain approaches as tools of understanding, organizing, and implementing agricultural development initiatives. It also outlines the methodology of the study. The third section describes and characterizes the national and local innovation environments. The fourth section discusses the innovation processes and outcomes thereof. Focusing on a meat value chain, it also discusses the factors that enhance fodder innovation in a sustained manner. The fifth section draws lessons and provides the conclusions.

## **Contemporary Approaches to Agricultural Development and Study Methodology**

### **Innovation System and Value-Chain Approaches to Agricultural Development**

Along with Spielman, Ekboir, and Davis (2009), the World Bank (2007), and others, we understand (agricultural) innovation as a successful introduction and exploitation of knowledge and technologies for social and economic benefits. The use of such knowledge and technologies brings about positive changes in how people make or do things, and ultimately improves their livelihoods. The linear research–development–extension approach has been much criticized for being hierarchical, top-down, and supply-driven, and for its limited impacts on the generation and diffusion of relevant knowledge and technologies. The thinking behind the approach has been that scientific research is the driver of innovation, but often disregards different sources of knowledge and demand (see Lundvall et al. 2002; World Bank 2007; Rajalahti, Janssen, and Pehu 2008). The more recent paradigm for knowledge generation and use is the innovation-system approach (Lundvall et al. 2002; Clark et al. 2003; World Bank 2007; Rajalahti, Janssen, and Pehu 2008; Spielman, Ekboir, and Davis 2009), described as a network of private- and public-sector organizations whose interactions produce, diffuse, and utilize economically useful knowledge. For innovation-systems thinkers, innovation of different kinds (technical, institutional, etc.) follows a nonlinear process and uses multiple sources of knowledge. Networks coordinate and facilitate interorganizational

interactions and knowledge, and information flows; allow the exploitation of complementary capabilities; and open up opportunities for exploiting synergies within networks (Pyka and Koppers 2002; Howells and Edler 2011).

The “system” capacity depends on the “density and quality of relationships” between the innovation-producing and -using agents, and the support institutions (Altenburg, Schitz, and Stamm 2008). The more diverse the actors the better the opportunity to combine complementary capabilities. Interaction and learning also depend on actors’ “proximity”—including the physical distance, the institutional environment that shapes trust-based relationships, and actors’ capacity to absorb new ideas. The stronger the proximity, the better the flow of (particularly tacit) knowledge that cannot be coded and “transferred” (Boschma 2005; Clifton et al. 2010). However “more links” and “denser network ties” could also produce “lock-in failure,” where inward-looking tendencies block diverse and open relationships and stifle innovation (Boschma 2005; Clifton et al. 2010; Howells and Edler 2011). Facilitation by “intermediary” organizations also enhances networking and interaction, as such organizations, acting as brokers, help find advice and funds to support innovation (Klerkx and Leeuwis 2008). In the cases discussed here, the institutional environments provided a limited number and diversity of actors, and barely any network facilitators, making the demand for innovation-capacity development more challenging.

The innovation-systems approach assumes that learning in networks leads to learning by individual market-chain actors and farmers, producing innovation. Evidence from the case studies reported in this chapter shows that, before acceptance, farmers learn on-farm a great deal about the performance and suitability of fodder technologies to farming systems; and the sustainability of input and product markets. Johnson (1992) noted that of all types of learning (like imprinting or searching) the most economically worthwhile and useful in increasing the stock of knowledge is “learning by producing” or “learning by doing,” which we interpret to mean learning on-farm. Further relevant innovation capacities reside in networks and partnerships, in organizations, and in individuals (Ayele and Wield 2005). The chapter, therefore, links network- and farm-level learning arenas (with institutional support) as central to innovation.

The literature on value chains and innovation systems shows many common and complementary features (for example, Anandajayasekaram and Gebremedhin 2009). A value chain is understood to include all the actors and activities from production to consumption, and the dynamic relationships between actors involved in a chain (Rich et al. 2011; McDermott et al.

2010b). Key to both approaches is the mapping and characterization of actors and their interactions. As discussed above, an innovation-systems approach focuses on knowledge generation and use at a particular stage of a value chain, while the value-chain approach is more about value creation and market opportunities and linkages across a chain. With few exceptions (such as Anandajayasekeram and Gebremedhin 2009; McDermott et al. 2010b), an integrated innovation-system and value-chain approach to developing, implementing, and evaluating agricultural-development initiatives has received limited attention among researchers and practitioners, arguably resulting in suboptimal outcomes. Fodder is important, but only as a single input in livestock production, hence sustainable return to improved fodder depends on the efficiency of a whole value chain. We argue that an integrated approach provides, first, a better framework to address market failures such as high transaction cost, insufficient market information, and the exercise of market power that are inherent in the smallholder livestock system (Rich et al. 2011). Second, it allows for the optimization of gains from innovations in interrelated inputs and services. In relation to the latter, for example, McDermott et al. (2010b: 156) cite 300 percent gains to smallholders due to combined use of breed and feed improvements (which otherwise would not have been achieved).

### **Study Methodology**

The case studies reported in this chapter are described and analyzed against the backdrop of the above conceptual literature and an integrated innovation-systems and value-chain approach. The innovation-systems framework emphasizes, among other things, the totality of actors and factors required to bring about innovation and growth (World Bank 2007). Following this framework, the study identifies and characterizes the main actors in the study sites, such as knowledge and technology providers and users; their roles; interaction among actors; and their habits and practices that influence joint learning and innovation. It also evaluates the enabling environment for fodder innovation and livestock development. It describes and analyzes FAP's fodder-innovation processes, and the capacities developed and technological options introduced and adopted. Using the value-chain tool (Kaplinsky and Morris 2001; McDermott et al. 2010b), the study identifies and assesses site-specific livestock-production value-chain activities and actors and their roles, production quality standards, and opportunities for improving the chain. The tool is employed to evaluate the integration of fodder innovation into smallholder livestock production, and the linking of the latter with markets. The chapter

uses empirical data collected from six of the nine learning sites over 2009–10 from multiple sources, including extensive semi-structured interviews with FAP county-team members, partners, and participating farmers; and FAP internal reports (three learning sites, one from each country, were not covered in the analysis as insufficient data emerged at the time of fieldwork). It also draws on close observation of actors' interactions and learning.

## **Background to Fodder Innovation Case Studies**

### **FAP Origin and Approach**

The idea for the FAP originates from debates in 2001–2002 among multi-disciplinary researchers on ways of addressing fodder scarcity (Lenné, Fenandez-Rivera, and Blümmel 2003; de Haan et al. 2006). At about the same time, the International Livestock Research Institute (ILRI) and partners began developing project ideas for implementation in countries where a large number of people depend on livestock. This led to the design and implementation of the Fodder Innovation Project in two phases over 2002–2009 in India and Nigeria ([www.ilri.org/ilrinews/index.php/archives/tag/fodder-innovation-project](http://www.ilri.org/ilrinews/index.php/archives/tag/fodder-innovation-project)). FAP followed in 2007. As an approach, FAP country teams focused on three levels of interaction and learning, innovation, and diffusion: farm, district, and region/national levels. First, farmer and farm-level learning were considered central for improvement of livestock production, which generally happens at farm level, with farmers learning by themselves and from each other, testing and integrating new ideas within existing practices. Second, where a network of actors was weak or nonexistent, strengthened actor networks at district level were thought to enhance the innovation processes and outcomes. Finally, engaging higher-level (regional or above) policymakers in dialogs over fodder and livestock matters was also thought to improve the enabling environment for innovation, such as improved policy on fodder-seed production and distribution.

### **Innovation Environments in Different National Contexts**

Table 5.1 provides selected country indicator data for Ethiopia, Syria, and Vietnam. In Syria, livestock (predominantly sheep) contribute 34 percent to the agricultural GDP (Shomo et al. 2010). Some 85 percent of the country receives less than 350 mm rain per year. The humid areas, accounting for 15 percent of the country, receive more than 350 mm rain per year. Across Syria, grazing provides the most important source of fodder for

ruminants, but the supply of fodder is insufficient and seasonal (Shomo et al. 2010). In contrast to Syria, Ethiopia is largely high tableland, highlands above 1,500 meters comprise 43 percent of the country, while the rest of the country consists of lowlands where pastoral and agropastoral systems dominate. The maximum mean annual rainfall reaches 2,000 mm in the southwestern parts of the country, while the lowest mean annual rainfall is below 250 mm in the northeastern and southeastern lowlands. Agriculture is the mainstay of Ethiopia. It accounts for 43 percent of the country's GDP and employs 85 percent of the labor force. Its livestock population consists of over 50 million cattle and over 45 million sheep and goats. Livestock also provide power and manure in crop production.

Vietnam's agriculture and forestry sectors are main sources of livelihood for the rural poor who accounted for 74 percent of an estimated 86 million people in 2008. The country has two fairly equal dry and wet seasons, and the central highlands (including FAP learning-site area, Ea Kar district in Daklak province) altitude ranges from 300 m to 2,000 m above sea level; rainfall is in the range 1,500–2,000 mm per year. While keeping pigs is important nationally, many Vietnamese farmers also keep cattle (Khanh et al. 2009). The FAP Vietnam team estimates 40 percent fodder shortage during February and March; and 20 percent during November and December.

The structure and authority of different levels of governments in the three countries vary, with implications for the emerging innovation architectures. For example, unlike in Syria or Vietnam, Ethiopia has autonomous regional states that have the power to determine their social, economic, and cultural affairs. Likewise, NGOs have more visibility, particularly in the implementation of development projects, in Ethiopia than in Syria and Vietnam. While livestock development is largely a private activity, governments in all three countries play a role in providing animal health and extension services. In all three countries, the role of the private sector in generating and diffusing agricultural technologies is limited. Fueled by growing urbanization and incomes, all three countries have been enjoying a growing domestic and foreign market for livestock products. In Vietnam and Syria, livestock development has been supported by a relatively developed infrastructure including roads (see Table 5.1). The national environment (agricultural, ecological, and institutional factors) guided the FAP teams to select partners and learning sites.

### **Partner and Learning Site Selections**

In selecting learning sites, FAP in Ethiopia focused on market opportunities for livestock products and agroecological and socioeconomic challenges

**TABLE 5.1** Basic indicators of Fodder Adoption Project (FAP) countries

Indicator	Ethiopia	Syria	Vietnam
Total land area (km <sup>2</sup> ) <sup>a</sup>	1,104,300	185,180	329,310
• Arable land (percentage of land area) (2007) <sup>a</sup>	13.0	26.5	21.3
Human population (total, millions) (2008) <sup>b</sup>	81	21	86
• Rural population (%) (2005) <sup>a</sup>	84.0	49.4	73.6
Gross domestic product (GDP) (US\$ million) (2008) <sup>b</sup>	26,487	55,204	90,705
Value added as percentage of GDP (2008)			
• Agriculture	43	20	20
• Industry	13	35	42
• Services	45	45	38
Gross national income per capita (US\$) (2008) <sup>b</sup>	280	2,090	890
GDP average annual growth rate (2000–2008) <sup>b</sup>	8.2	4.4	7.7
Road density (km of road per 100 km <sup>2</sup> ) (2000–2006) <sup>a</sup>	3.6	51.6	71.7
Livestock population (total in millions) (2009) <sup>c</sup>			
• Cattle	50.88	1.08	6.10
• Goats	21.96	1.51	1.48
• Sheep	25.98	12.38	–
• Pigs			27.63

Sources: <sup>a</sup> World Bank (2009); <sup>b</sup> World Bank (2010); and <sup>c</sup> FAO (2011).

to improve food security. First, the team identified a key collaborating partner running the Improving Productivity and Market Success (IPMS)—a project located within ILRI operating in ten pilot learning *woredas* (districts) across Ethiopia. It selected four IPMS learning sites (two highland *woredas*, Ada'a and Atsbi Woberta, and two from the lowlands, Alamata and Mieso). Alamata and Atsbi Woberta *woredas* are in Tigray Regional State, in northern Ethiopia, where livestock productivity is severely affected by fodder shortages caused by frequent droughts. Mieso and Ada'a are located in Oromia Regional State. In Mieso, livestock are major contributors to livelihood. The area is semiarid, and frequently affected by water shortages and drought. Ada'a is close to the capital Addis Ababa and has fairly developed industry and infrastructure; it has access to relatively large market opportunities for its produce, notably the cereal crop teff. It has a growing smallholder dairy-production system with strong milk-marketing and farmers' service cooperatives, but limited and erratic rainfall and expanding urbanization have been reducing traditional sources of fodder such as open grazing lands. The *woredas* thus provided the setting for the emerging innovation networks. Within each *woreda*,

learning sites were narrowed down to one or more *kebeles*—farmers’ neighborhood associations—where 50 or more willing participant farmers (who owned livestock and land, and who tend to be model farmers and opinion leaders) were experimenting with new fodder options. At the national level, a fodder platform was set up, consisting of stakeholders from Oromia and Tigray regional states, federal government units, NGOs, and donor organizations, to deliberate on relevant policy matters and ways of up-scaling successful practices.

The FAP team in Syria started with a consultation process at the national level for identifying potential partners. The Ministry of Agriculture and Agrarian Reform (MAAR) became its core partner. With MAAR support, a national project-inception workshop was held to engage a wider set of stakeholders in FAP implementation. The inception workshop also constituted a Steering Committee led by the head of the MAAR Extension Directorate. Province- and site-selection criteria were: high livestock population density (notably sheep); rainfed and mixed crop–livestock systems that allow the application of different fodder technologies of tree crops and food–feed crops; and experiences of relevant departments in livestock production and extension. As in Ethiopia, farmer selection focused on their willingness, and ownership of livestock and land. The innovation architecture consisted of (1) a national steering committee—to provide leadership and a mechanism for scaling up and replicating lessons in other sites; (2) three innovation networks—El-Bab (Aleppo province), Salameih (Hama province), and Tel Amri (Homs province)—to engage farmers, develop and implement options, and monitor and evaluate outcomes; and (3) on-farm experimentation and learning. At all levels, consideration was given to ensure the participation of women and of policymakers.

Unlike in Syria and Ethiopia, the Ea Kar site in Vietnam was a continuation of previous research for development projects: Forages for Smallholders Project (2000–2002), and Livelihood and Livestock Systems Project (2003–2005). Key players in both projects were the International Center for Tropical Agriculture (CIAT), Tay Nguyen University (TNU), and the National Institute of Animal Husbandry (NIAH). In partnership with the district extension and agriculture and rural development workers, the projects developed forage technologies with smallholder farmers in Daklak province, and succeeded in introducing and evaluating a variety of fodder options such as napier grass (Khanh et al. 2009). Building on experiences from these projects, in 2007 FAP inherited the existing network of actors, and focused on the strengthening of value-chain actors, including extension, research, traders,

and government. The country team also established a new site, Ky Anh in Ha Tinh province. As an approach, the FAP team started with key volunteer farmers who had land and animals, and were able to organize hired or household labor to work on their farm. Around each key farmer, a fodder group, composed of at least ten farmers, was set up to identify and introduce fodder options and jointly evaluate performance.

The preceding description of learning sites and partner selection, and the innovation architectures that emerged showed no regularity and varied from top-down to bottom-up approaches. It showed the various ways of organizing innovation networks in different socioeconomic, institutional, and agro-ecological contexts. Selected sites also showed varied conditions: in Syria they started anew, in Ethiopia they piggy-backed on an ongoing project, and Ea Kar in Vietnam they built on previous projects that ran for over five years. Appreciating these differences, our next aim is to understand whether networking enhanced learning and innovation (the following analysis and discussion does not include Atsbi Wobera, Ethiopia; Tal Amri, Syria; and Ky Anh, Vietnam learning sites, as insufficient data emerged at the time of fieldwork).

## **Results: Developing Innovation Capacity and Fodder Options**

### **Developing Innovation Capacity**

As the innovation systems approach would suggest, FAP teams and partners diagnosed relevant policies, institutions, and infrastructure; and actors and their roles, attitudes, and practices. Participatory assessment of farmers' needs, causes, and extent of fodder scarcity were also conducted; and with FAP facilitation a set of actors were engaged to "respond to the fodder challenge." Table 5.2 shows that, besides farmers, seven or more actors were involved in networks in Ethiopia, but the number and diversity of actors were fewer in Syria and Vietnam. Despite encouraging policies, there was an element of mistrust among some government officials in all three countries of organizations operating for "private gain." As they often "come and go," the continuous participation of nonlocal NGOs in networks was also seen as uncertain. Government departments for agriculture and rural development feature in all networks, providing infrastructure for disseminating knowledge and information, and supporting learning on farms. They are, however, insufficiently resourced and have a "limited culture of collaboration." Any engagements in collaborations were guided by official directives and plans,

**TABLE 5.2** Summary of actors' networks, actors' roles, and interactions by sites

Actor name and type, scope of operation, and degree of interaction in network in 2010	Core activities
<b>Ada'a, Ethiopia</b>	
Ada'a Dairy Coop (private) <sup>a</sup>	Milk collection, processing, and marketing
Cooperative Promotion Office (govt.—regional) <sup>b</sup>	Information dissemination
Crop Grow (private) <sup>b</sup>	Production and marketing of feed- and foodcrops
Debre Zeit Agricultural Research Centre (government—federal) <sup>a</sup>	Research, evaluation, and training
Eden Field Agri Seeds Enterprise (private) <sup>a</sup>	Producer and supplier of forage/fodder seeds
Ethiopian Meat & Dairy Technology Institute (government—federal) <sup>a</sup>	Training, source of improved breeds
FAP—ILRI: Fodder Adoption Project—International Livestock Research Institute (international research) <sup>a</sup>	Network facilitation, providing access to planting materials, and joint learning; research
IPMS—Improving Productivity and Market Success Project (ILRI—Government of Ethiopia—international research) <sup>a</sup>	Research for development (R4D); facilitate access to information and knowledge
Land O'Lakes (NGO) <sup>b</sup>	Training, technology transfer
Office of Agricultural & Rural Development (government— <i>woreda</i> ) <sup>a</sup>	Seed multiplication and distribution; extension and training
Farmers <sup>a</sup>	Testing and joint evaluation of fodder technologies
<b>Alamata, Ethiopia</b>	
Abergelle Livestock Int. Trading Plc (private) <sup>a</sup>	Cattle fattening, supply of farm inputs; training
Ethiopian Sheep and Goats Project (NGO) <sup>a</sup>	Research and extension
FAP—ILRI (international research) <sup>a</sup>	Network facilitation, providing access to planting materials, and joint learning; research
IPMS (ILRI—Government of Ethiopia) <sup>a</sup>	R4D; facilitate access to information and knowledge
Office of Agricultural and Rural Development (government— <i>woreda</i> ) <sup>a</sup>	Training and technical support, seed multiplication
Alamata Agricultural Research Institute (government— <i>woreda</i> ) <sup>a</sup>	Research, technical backstopping
World Vision Ethiopia (NGO) <sup>a</sup>	Provision of bull service and fodder seeds
Farmers <sup>a</sup>	Testing and joint evaluation of fodder technologies
<b>Mieso, Ethiopia</b>	
Adami Tulu Agricultural Research Centre (government—regional) <sup>b</sup>	Research; supply of forage seeds; training
FAP—ILRI (international research) <sup>a</sup>	Network facilitation, provide access to planting materials, and joint learning; research
Food Security Office (government—regional state) <sup>b</sup>	Support seed multiplication (including paying for laborers)
IPMS (ILRI—Government of Ethiopia) <sup>a</sup>	R4D; facilitate access to information and knowledge

Actor name and type, scope of operation, and degree of interaction in network in 2010	Core activities
Melakassa Agricultural Research Centre (government—federal) <sup>b</sup>	Research; supply fodder seeds; technical backstopping
Office of Pastoral and Rural Development (government— regional state) <sup>a</sup>	Fodder-seed multiplication and distribution; extension; training; coordination, monitoring, and evaluation
<i>Woreda</i> Administration Council (government) <sup>a</sup>	Follow-up and guidance; link to higher offices
Farmers <sup>a</sup>	Testing and joint evaluation of fodder technologies
<b>Salameih, Syria</b>	
Aga Khan Foundation (international NGO) <sup>a</sup>	Rural development, extension, technology transfer
FAP–ICARDA (International Centre for Agricultural Research in the Dry Areas) (international research) <sup>a</sup>	R4D; facilitation of joint learning, providing access to planting materials; training
Office for Agricultural Research (government—provisional) <sup>a</sup>	Research and evaluation
Office for Extension and Animal Resources Administration (government—provisional) <sup>a</sup>	Extension
Farmers <sup>a</sup>	Testing, joint evaluation of technologies and practices
<b>El Bab, Syria</b>	
FAP–ICARDA (international research) <sup>a</sup>	R4D; facilitation of joint learning, providing access to planting materials; training
Office for Agricultural Research (government—provisional) <sup>a</sup>	Research and evaluation
Office for Extension and Animal Resources Administration (government—provisional) <sup>b</sup>	Extension
Farmers <sup>a</sup>	Testing, joint evaluation of technologies and practices
<b>Ea Kar, Vietnam</b>	
FAP–International Center for Tropical Agriculture (international research) <sup>a</sup>	With TNU, coordinated FAP Vietnam activities, provide technical support
Tay Nguyen University (TNU, national university) <sup>a</sup>	Research, capacity development, technical support, facilitate stakeholder interaction
National Institute of Animal Husbandry (government—national) <sup>b</sup>	Link to national policymaking
District Extension (government—district) <sup>a</sup>	Facilitation and evaluation of on-farm testing and dissemination of technologies and information
District Agriculture and Rural Development (government—district) <sup>a</sup>	Dissemination of technologies, liaise with policymakers
Farmers and farmer fodder groups <sup>a</sup>	Testing, joint evaluation of technologies and practices; participate in meat value chain
Small and large cattle traders (various contributions)	Buy cattle, provide market information, etc.

**Source:** Authors.

**Notes:** <sup>a</sup> An “active” actor that participates in more than 50 percent of all meetings, and provides input such as technological knowledge on fodder innovation and livestock development to a network; <sup>b</sup> A “moderately active” actor that is a member of a network, but not a regular and active participant.

hence slow to respond to other actors' needs. National and international research organizations were also drawn into the networks as knowledge and technology providers or capacity developers, but some were wary of getting bogged down in "development work" that might adversely impact on their capacity to produce "public goods" (publications) and maintain their reputation in research. While the vision to improve the livelihoods of smallholder farmers united the different actors, collaboration was also hampered by a lack of network facilitators. The FAP teams took the facilitation role and embarked on various types of innovation capacity development.

#### **STRENGTHENING WEAK INTERACTOR TIES**

Before networking began, there were either "no" or "weak" actor interactions because of a limited culture of collaboration and trust, or lack of facilitators. However, networking allowed regular meetings (on average four times a year in networks) where actors discussed fodder scarcity, policy and market issues, as well as their potential contributions. Less formal and more frequent one-to-one and small-group meetings were also reported across the sites. Actors made cross-site and within-site visits, and participated in fodder field days, etc., which facilitated information and knowledge exchanges. These efforts paid off, and by 2009 and 2010 actor interactions significantly improved from largely "no" or "weak" to "strong" and "moderately strong" interactions (Table 5.2).

#### **FILLING ORGANIZATIONAL GAPS**

Where the local institutional landscape did not provide actors with necessary capabilities, actors were nonetheless brought into networks from further afield (for example, Eden Field in Ada'a, and Adami Tulu and Melkassa research centers in Mieso).

#### **STRENGTHENING FODDER-SEED SUPPLY SYSTEM**

Where capacity to produce fodder seeds was weak or nonexistent, farmers and development agents were trained. A series of one- to three-day training sessions was given on fodder-seed multiplication, evaluation, etc. for 562 participants in Ethiopia (Duncan et al. 2010); 50 in Syria (Larbi, Hassan, and Abdullah 2010); and 115 in Ea Kar and Ky Anh sites in Vietnam (Anh et al. 2010).

### INTERACTING WITH POLICYMAKERS TO IMPROVE POLICIES

Besides regular interactions with policymakers, FAP teams produced training and communication materials like guide booklets, videos, and posters to inform actors of their activities and document lessons for replication in other areas of the respective countries. In summary, networking helped relevant knowledge and information flows, strengthening and coordinating complementary capabilities for joint learning and innovation.

### On-Farm Learning and Implementing Fodder Options

The purpose of the networking described above was to foster learning and produce innovation. Table 5.3 shows that, supported by the respective networks, farmers in all the learning sites selected and implemented novel technological solutions. Before acceptance, farmers experimented and learned about the performance and suitability of improved fodder options for farming conditions; the need for (re)allocation of resources like land and water; and sustainability of seed supply. Fodder innovation was thus found

**TABLE 5.3** Fodder options implemented by learning sites

Learning site	Key technological interventions	Participating farmers			Area planted (ha, estimated)		
		2008	2009	2010	2008	2009	2010
Ada'a (Ethiopia)	Oats–vetch, maize–lablab, napier, alfalfa; pigeon pea, sesbania, and fodder beets	44	84	204	11	21	51
Mieso (Ethiopia)	Cowpea, lablab, pigeon pea, napier, and alfalfa	40	80	160	10	20	40
Alamata (Ethiopia)	Cowpea, lablab, alfalfa, napier, pigeon pea, sesbania, Rhodes, buffel grass, and Panicum	20	20	35	5	5	9
Salameih (Syria)	Barley, common vetch, narbon vetch, and grass pea for grain, straw, or hay production; integrating forages into olive-tree systems to improve feed and soil productivity; vetch grain-based mixed rations for dairy production and lamb fattening	67	187	188	28	109	384
El-Bab (Syria)	Various combinations of barley, common vetch, narbon vetch, and grass pea (as in Salameih above)	5	67	107	15	92	191
Ea Kar (Vietnam)	Various types of green fodder, mainly napier, Pennisetum hybrid/VA06 and guinea grass	n/a	n/a	> 3,100	n/a	n/a	n/a

Source: Authors.

through interactive learning in networks and on farm. The new technologies fitted farmers' food–feed requirements (for example, by combining food and feed crops in areas of food scarcity: maize–lablab, cowpea), or rainfed versus irrigation options, seasonal availability, performance, or ease of intercropping requirements. The number of adopting farmers and area planted grew fast, particularly in Ada'a, Salameih, and Ea Kar, where actors' interaction was much more consistent and on-farm technical support was provided by FAP. Following experimentation with a basket of options, farmers adopted fewer but more suitable and high-performing fodder options (typically oats–vetch in Ada'a, and cowpea in Mieso and Alamata).

Fodder availability improved for innovating farmers. Some farmers were storing enough fodder to sustain the shortage season. Farmers also consistently stated that improved availability of fodder increased productivity and production: quantity and quality of milk increased; and small and large ruminants were fattened in shorter time. In Ethiopia, animals are sources of draught power, hence improved fodder also positively impacted crop production. Farmers also noted that the increase in production was consumed on farm, improving the food and nutritional requirements of households, and/or sold on the market, improving their income. However, it was clear to the stakeholders that the sustainability of fodder availability and the derived benefits depend on factors such as the dynamics of networking and joint learning, availability of complementary innovations that optimize returns, and access to market opportunities and linkages.

Several key developments promised sustainability to the emerging networking and joint learning culture. For example, coached by FAP teams, extension workers, who gained network-facilitation skills, showed an interest in incorporating the innovation-systems approach in their routines to facilitate the networks as FAP exited. To this end, Ea Kar's experience in farmer organization and fodder management was used in the new Ky Anh site with considerable progress made in fodder adoption in a shorter period (Anh et al. 2010). Moreover, improved fodder technologies were increasingly reaching nonparticipating farmers around the sites; for example, a Syrian farmer was noted to have been copied by seven farms in his neighborhood. Interviewees were confident that the political support for fodder innovation would continue. For example, a senior Syrian government official showed interest in “building on [FAP's] successful experiences in upcoming projects.” The Eden Field Agri Seed Enterprise has been expanding across Ethiopia, becoming a viable fodder-seeds supplier. That said, uncertainties remain—due to high turnover of staff in the Ethiopian public sector, it was

unsure whether “key individuals capable of network facilitation will remain in their positions.”

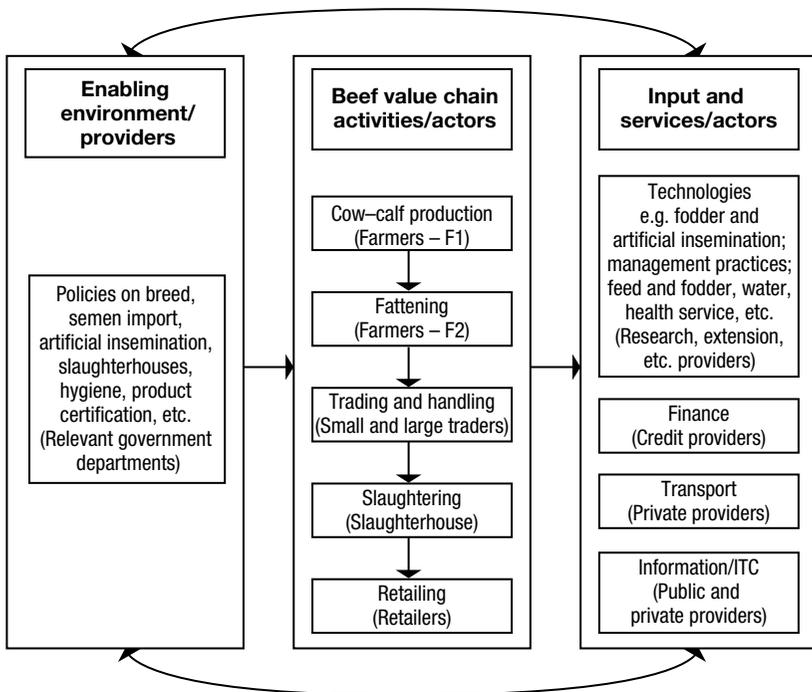
In Mieso and Alamata in particular, farmers operate in weak livestock value chains, which, according to the partners, could undermine the sustainability of fodder availability: “some farmers may have been growing fodder but progress so far has not been life changing to them nor can be guaranteed to sustain.” These farmers were “feeding improved fodder to low milk or meat producing animals” as improved breeds were hardly available. Consequently, the productivity gain was significant but limited (farmers reported increase in milk production from around 1.5 to 2 liters per cow per day). The “surplus milk” from these sites did not get to the market for lack of milk-collection points and access to market. However, farmers sold animals to local consumers and traders but at a “low price,” as they lacked information on market price or they faced high transaction costs or limited marketing skills to sell animals in distant cities.

In response to these and similar challenges, FAP teams identified the respective livestock value chains for potential interventions, but progress was mainly seen in the more established Ea Kar site (see below). In Syria, taking advantage of the growing market opportunity, many FAP-participating farmers were fattening and selling sheep on an existing local market. A formal coordination of value-chain actors such as traders, transporters, and slaughterhouses was not pursued due to limited project time and inadequate expertise in value-chain organization. Faced with similar limitations, in Ethiopia chain-linkage developments showed modest progress only in the market-opportune Ada’a site. The Ada’a Dairy Cooperative has been experiencing falling milk supplies largely due to shortages of fodder. The Cooperative’s interest in the fodder network was derived from the prospect of increasing milk supply from farmers participating in FAP. Many farmers claimed that improved availability of fodder boosted milk production and sale, some farmers earning as much as 1,000 birr (around US\$60) per month. However, as many of the farmers keep local breeds, yield was lower. The FAP network responded to this issue by catalyzing the procurement of small numbers of crossbred cows by farmers with the support of the District Department for Agriculture and Rural Development over 2009–2010. Below, the Ea Kar case is discussed separately for the exemplary approach taken to address the above challenges and develop a thriving meat sector.

**Integrating Fodder Innovation in a Meat Value Chain: Experience from Ea Kar, Vietnam**

According to Stür and Khanh (2010), Ea Kar’s conventional value chain was characterized as farmers growing and selling all types and sizes of animals at local markets without being able to meet the growing demand for quantity and quality of meat. Through FAP-participating farmers, two production lines emerged: farmers with less potential to keep animals for fattening (labeled F1 in Figure 5.1) started a “cow–calf” production system to raise crossbred calves for sale. The second system was beef production where farmers (F2 in Figure 5.1) fatten and sell animals. The FAP Vietnam team worked by steps to strengthen the meat value chain (Stür and Khanh 2010): first, fodder was planted to stimulate farmers’ interest in increasing productivity. Realizing that they were occasionally paid twice as much for their fatter cattle on the local market (compared to conventionally raised animals), farmers adopted a “buy thin—sell fat” strategy. Second, new

**FIGURE 5.1** Simplified meat value chain, Ea Kar, Vietnam



Source: Authors.

markets were identified and developed for fat cattle in provincial urban centers such as Buon Ma Thuot. This led to producing and marketing meat for city markets and restaurants. Third, chain actors negotiated and introduced standards to ensure that fattened animals would be less than three years old, more than 300 kg at slaughter weight, and generally healthy. To meet the standards, farmers improved their animals' feed and fodder intake, shelter, and health services. They kept information on each animal's weight, breed type, and health conditions. These measures helped farmers receive better and relatively stable prices. Handlers were able to make direct and regular contacts with farmers and were able to purchase animals on farm; they in turn sold the animals to large traders and slaughterhouses. The government provided support in areas such as breed improvement and regulation of meat slaughterhouses.

By the end of 2010, the Ea Kar meat value chain was growing (Stür and Khanh 2010):

- 44 farmer clubs were established in the district with a focus on cattle production, and 3,100 households (30 percent of cattle producers in the district) planted forages;
- 532 households were fattening cattle for urban markets, and 800 households produced crossbred calves;
- 3 farmer clubs had contracts with city traders, and cattle and beef were sold to local, provincial, and several other city markets across the country.

FAP's approach started impacting on the livelihoods of many participating farmers in Ea Kar. One of the fodder groups in the district is in Ea Kmut commune, located in the neighborhood of Ea Kar town. The fodder group had 13 household members in 2009, and each household was fattening, on average, 32 animals per year (eight animals per three-month cycle). After covering their costs, farmers on average made a net US\$69 per month or US\$828 per year (according to the farmers, income from sale of fattened animals made up about 70 percent of their total income). The income was spent on farmers' basic needs and children's education, and the head of the farmer group noted a "bright future for beef production" in his commune. Farmers in Ea Pal commune were also able to benefit from the applied approach. However, they were facing some challenges like poor access roads and inadequate water to grow forage all year round. Ea Pal commune farmers noted that it was difficult to sell the animals on time for lack of easy reach to markets, and small traders were colluding with large traders to cut prices. Like farmers in Ea Kmut

commune, they noted that raising capital to buy and fatten animals was also a major problem:

yes we earn more money now from fattening than two years ago ...  
but our capacity is still limited to raise capital as high as 10 million  
Vietnamese dong [about \$520] to buy an animal. We don't get bank  
credit because of tight collateral conditions (head of farmer fod-  
der group).

At the time of data collection (2009–2010), FAP partners were looking into these challenges. Despite the challenges, FAP Vietnam team and partners stressed that the approach helped produce rewarding and sustainable outcomes; and that the technological options and institutional arrangements introduced fit the local context and met local needs, and were supported by the local and national governments. As summed up by Stür and Khan (2010), in 2010 the Ea Kar learning site was changing from “traditional” cattle management to a “refined” cattle-production system, where farmers moved from feeding animals on naturally available resources to planted forage, from free grazing to confined animal keeping, from extensive production to defined production like fattening, and from production not linked to markets to market orientation.

## Discussion

More, and increasingly diverse, actors would provide the ideal complementary capabilities for innovation, but the real world of the case studies presented networks with a limited number and heterogeneity of actors, and the networks had to be triggered and facilitated through an external research-for-development project. Actors outside the “current systems” were drawn in and different types of capacity were developed. Sustained interactive learning in networks, and on farm, brought about fodder innovation in all sites. The integration of improved fodder in production processes also resulted in promising productivity gains, with improvements in farmers’ food and nutrition, as well as income.

The study reported in this chapter shows that fodder technological innovation is sustainably enhanced when linked with other innovations and market-oriented activities that optimize productivity. Testimony to this was the Ea Kar learning site, where a thriving meat value chain emerged. Key features of the success are worth stating here. First, once fodder innovation was found, dynamics were built into networking for continuous learning and

innovation. To make fodder innovation more rewarding, it was integrated into interrelated innovations (notably breed and animal management) and value-chain activities. Benchmarks were developed for keeping and fattening animals so that quality was consistent, and this helped farmers earn better value for their produce. Second, a new organizational innovation—a farmer group—was created to learn and innovate, and to support farmers' engagement in markets. Small and isolated farmers often suffer, therefore farmer groups became key instruments to improve marketing efficiency and profitability by reducing transaction costs. The need and organization of such groups, however, cannot be legislated as it depends on the value chains that innovating farmers are in (meat, dairy, or the species they keep), farm sizes, availability of infrastructure, etc. In summary, the Ea Kar site demonstrated that fodder innovation triggered technological and socioeconomic changes where actors' behavior were changing from an isolated to a more collaborative and interactive learning and innovation, where interrelated innovations were incorporated in production processes, and where smallholder farming was changing from extensive and subsistence-based farming toward an intensive and market-oriented business.

Some of the factors that influenced innovation outcomes relate to time and contexts—notably whether learning sites were started anew or built on previous projects. Sites with more favorable conditions (such as those where the facilitators or partner organizations have worked before, and where there are good prospects for market development) produced more successful results than those with less favorable conditions. In Ea Kar, it took more than five years for farmers to learn about potential benefits and risks of fodder technologies, and effectively engage in markets. This suggests that, as underlined in studies involving science and technology partnerships (Chataway et al. 2006), time and patience, and the necessary support are required to take success from simply producing inputs to the level of meeting long-term objectives like improving livelihoods. Another key lesson was that farmers select and deselect fodder options appropriate to them based on technical, socioeconomic, and agroecological criteria. Fodder options attuned to farmers' local contexts led to successful adoption. Hence it is critical to understand farmers' needs and constraints, and support them to have a range of technological options to deal with the challenges they face. As FAP concludes, the innovation capacity developed in the networks and on farm is likely to support farmers to select and adopt fodder and related livestock technologies. Transferring lessons beyond learning sites and countries,

however, entails making necessary adjustments to fit into farmer circumstances and local and national contexts.

The present study highlights the importance of policy for innovation in value chains. For example, meat production was expensive for some farmers in Vietnam and might require credit. The supply of improved breeds of cattle and milk-collection points were inadequate in Ethiopia. Where such constraints prevail, governments need to support innovations and livestock-based businesses by facilitating the provision of credit, improved breeds, etc. Second, due to market manipulation by some cattle traders, some farmers were selling animals for less than market prices, therefore governments and other stakeholders need to step in and prevent such destructive behavior. Third, networking is best facilitated by local and dedicated “intermediary” organizations (Klerkx, Aarts, and Leeuwis 2010), but this seems a long way off in the sites studied—hence public investment is required to support local NGOs and public organizations to develop facilitation capacity. Finally, the weak and often missing actor in local networks was the private sector, hence governments should nurture the sector so that it plays its due roles, particularly in disseminating agricultural knowledge and technologies.

## Conclusion

The study shows that fodder innovation is successfully triggered and integrated in livestock production by actors interacting and learning in networks, and on farm. However, fodder is one among many inputs in livestock production. The success of fodder innovation, and for that matter innovation in other livestock technologies, depends on other inputs, institutions, and markets. The key lesson is that fodder can be an entry point, but real improvement occurs when broader value-chain issues are addressed in a holistic manner.

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## TRANSFORMATION OF SMALLHOLDER BEEF-CATTLE PRODUCTION IN VIETNAM<sup>1</sup>

Werner Stür, Truong Tan Khanh, and Alan Duncan

### Introduction

This chapter addresses the question “Can smallholder livestock production systems in developing countries be transformed to take advantage of the increasing demand for meat?”, a question that has been posed by many authors (for example, Tarawali et al. 2011). On the basis of a case study that followed smallholder cattle development in Ea Kar, a district in the central highlands of Vietnam, over a ten-year period, it analyzes the contributions to sustainable intensification of smallholder livestock production made by technology interventions, market linkages, private-sector development, participatory research and farmer group-based approaches, capacity strengthening, local coalitions, and innovation platforms.

Livestock production is considered to be an important pathway out of poverty for the rural poor in developing countries (for example, Kristjanson et al. 2010) and worldwide 1 billion poor people depend on livestock for their livelihoods (McDermott et al. 2010). Livestock are living assets contributing to nutrition, food security, and building wealth. The increasing consumption of meat in some developing countries, related to rising household income and rapid urbanization, has been well documented (for example, Delgado 2003). In Vietnam, per capita meat consumption rose at an average annual growth rate of 4.1 percent from 11 kg in 1980–1982 to 28 kg in 2001–2003, confirming Vietnam as one of the developing countries where the predicted “livestock revolution” is taking place (Pica-Ciamarra and Otte 2011). While much of this increase can be attributed to increased consumption of pork,

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1 The authors thank all the stakeholders and project partners involved in this study for sharing their experiences and enthusiasm for smallholder cattle development. They also acknowledge the donors who supported research into cattle development in Ea Kar: the Asian Development Bank for funding from 2000 to 2005, and the International Fund for Agricultural Development from 2007 to 2010.

consumption of beef has been predicted to almost double between 2001 and 2020 (Quirke et al. 2003).

This rising demand for beef presents poor livestock producers with significant opportunities to increase the benefits gained from their livestock and raise income through increasing livestock sales. However, at the time of this publication, there have been few documented examples of smallholder farmers being able to take advantage of these opportunities. This chapter describes one such example in which smallholder families in Vietnam, whose livelihood was based on small, diversified crop–livestock farms, were able to change from being traditional “cattle keepers” to becoming market-oriented “cattle producers” within a relatively short time span. A series of small research-for-development projects provided interventions that both catalyzed and supported this development (Table 6.1).

The case-study location was Ea Kar district, Daklak Province, Vietnam and the study covers the period from 2000 to 2010. Data and information presented are based on information extracted from project reports and presentations, interviews with key informants, and primary data collected during the Fodder Adoption Project; these include adoption surveys in 2007 and 2010, and market studies in 2004 and 2008. The chapter describes the changes in production, marketing, and innovation capacity, analyzes the key factors that were instrumental in enabling this transition, and draws lessons on the changing needs for intervention strategies at different stages of the intensification process.

## **Site Description, Research Process, and Methods**

### **Description of Ea Kar**

Ea Kar is one of the 13 districts of Daklak Province in the Central Highlands of Vietnam. It is well connected by sealed road to Buon Ma Thuot (1.5 hours by car), the provincial capital of Daklak, and to Nha Trang (2.5 hours by car) on the main coastal north–south route. The landscape is undulating and partially mountainous. At the time of the study, 40 percent of the total land area of 104,000 ha was used for agriculture and 52 percent was declared forest (Daklak Statistics Office 2008). Agriculture accounted for 65 percent of the district’s GDP, and more than 80 percent of Ea Kar’s population depended on agriculture for their livelihood. Smallholder families subsisted by growing a diverse range of foodcrops, livestock, and fish for home consumption and sale to generate family income. Farm sizes were small for upland agriculture

**TABLE 6.1** Research projects implemented in Ea Kar, Daklak, Vietnam, 2000–2010

Project title	Forages for Smallholders Project-2 (FSP-2)	Livelihood and Livestock Systems Project (LLSP)	Enhancing livelihoods of poor livestock keepers through increasing use of fodder (Fodder Adoption Project, FAP)
Period	2000–2002	2003–2005	2007–2010
Countries included	Southeast Asia regional project including Vietnam	Southeast Asia regional project including Vietnam	Ethiopia, Syria, and Vietnam
Donor	Asian Development Bank (ADB)	Asian Development Bank (ADB)	International Fund for Agricultural Development (IFAD)
Implementing agency	<ul style="list-style-type: none"> <li>International Center for Tropical Agriculture (CIAT) in collaboration with national partners.</li> <li>In Ea Kar: Tay Nguyen University (TNU), the National Institute of Animal Science (NIAS), and the Ea Kar extension office (DEO)</li> </ul>	<ul style="list-style-type: none"> <li>CIAT in collaboration with national partners. In Ea Kar: TNU, NIAS, DEO, and commune extension workers</li> </ul>	<ul style="list-style-type: none"> <li>International coordination by the International Livestock Research Institute (ILRI) on behalf of the System-wide Livestock Programme of the CGIAR.</li> <li>In Ea Kar: implemented by CIAT, TNU, NIAS, DEO, district government, and commune extension workers</li> </ul>
Objective in Ea Kar	Developing and integrating forage technologies for smallholder farmers	Improving livestock production through forage-based feeding systems	Building innovation capacity for fodder and cattle development
Activities	<ul style="list-style-type: none"> <li>Participatory evaluation of forage varieties with individual farmers in several villages</li> </ul>	<ul style="list-style-type: none"> <li>Developing improved feeding systems with farmer groups</li> <li>Up-scaling of forage-based feeding systems to more villages in Ea Kar</li> </ul>	<ul style="list-style-type: none"> <li>Facilitating the involvement of a broad range of stakeholders in cattle development</li> <li>Improving market linkages</li> <li>Building stakeholders' capacity for cattle production and marketing</li> </ul>
Outputs and outcomes	<ul style="list-style-type: none"> <li>Farm-grown forages, grown on farmers' own land and used to supplement cattle, adopted by participating smallholder farmers</li> <li>Adoption of forage technologies by more than 2,000 farmers in Ea Kar, and move toward stall-fed cattle fattening (buy thin, sell fat)</li> </ul>	<ul style="list-style-type: none"> <li>Improved cattle productivity and increased income from forage-based cattle production</li> </ul>	<ul style="list-style-type: none"> <li>Changed cattle-production system from traditional "cattle keepers" to market-oriented "cattle producers"</li> <li>Adoption of forage technologies by more than 3,000 farmers and adoption of market-oriented cattle fattening and breeding by more than 1,300 farmers in Ea Kar</li> </ul>

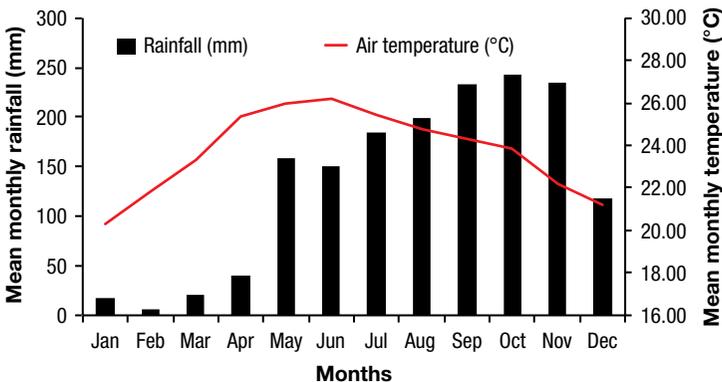
Source: Authors.

with an average land area of 1.3 ha. The main crops grown were hybrid maize and cassava; coffee and fruit trees were cultivated on the most fertile soils (16 percent); paddy rice was grown in valleys and other flat areas (12 percent); and a range of other annual upland crops were also cultivated. Crop yields

were constrained by low soil fertility (with the exception of small pockets of fertile red basaltic soils, 16 percent of agricultural land) and a cool dry season from January to April (Figure 6.1). From 2003 to 2009, the mean annual rainfall was 1,605 mm, varying from 950 mm in 2004 to 2,230 mm in 2005.

Most rural households raised several livestock species, including pigs, poultry, and cattle, and some households had small fish ponds. Traditionally, cattle had been used for draught power and asset accumulation, and many smallholders now raised one to three cattle as part of a diversified smallholder livelihood. Cattle were raised to preserve cash: farmers bought cattle whenever cash was available and sold animals when funds for major expenses were needed. Thus, cattle were a cash reserve rather than a way of generating regular income for the family. Farmers grazed cattle on grass, herbs, and shrubs growing along roadsides, fields, and waterways, and in nearby forests. In intensively cropped lowland areas, farmers supplemented grazing with freshly cut native grasses and crop residues such as rice straw. There were two main problems with this type of production system: (1) feed supply was insufficient for good animal growth, as animals were unable to find enough fodder on heavily grazed or utilized land; and (2) cattle management was labor-intensive, as grazing needed to be supervised in cropping areas and hand cutting of short, native grasses was time consuming. This situation has resulted in thin animals with poor reproductive performance and a low meat yield at slaughter. Animals, therefore, were sold at local markets for local consumption only. For traders to access urban markets, cattle

**FIGURE 6.1** Mean monthly rainfall and air temperature in Ea Kar, 2003–2009



Source: Daklak Statistics Office (2007, 2008, 2009).

needed to be in a much better condition and this could only be achieved if farmers changed the way they raised, produced, and marketed cattle.

### **Research Process**

Three research projects contributed directly to cattle development in Ea Kar (Table 6.1). The nature and focus of these projects gradually changed over the ten years and this evolution provided insights into the types and sequencing of interventions required at different stages of the innovation process.

Based on earlier research by CIAT that had identified forage varieties suitable for different agroecosystems in Southeast Asia (Stür et al. 2002), the Forages for Smallholders Project (FSP, 2000–2002) introduced a range of promising forage varieties and evaluated these with individual smallholder farmers in three villages in Ea Kar, using a farmer-participatory approach. The Livelihood and Livestock Systems Project (LLSP, 2003–2005) continued working with these farmers to develop new, improved feeding systems that combined and integrated the new fodder resource—the farm-grown forages—with the existing feed resources. A key intervention was the fattening of thin cattle before sale to achieve a higher sale price. Farmers provided *ad libitum* fodder to stall-fed cattle for 1–2 months, adding 25–50 kg of liveweight to animals before sale. Later, supplemental feeding using cassava meal, rice bran, and other farm-grown crops and crop by-products was also introduced to further improve the growth rate of cattle, and feeding systems were then tailored to different production systems such as cattle fattening and cow–calf production. As the project progressed, activities expanded to more villages and communes, and scaling up became a focus of the project. Increasingly, the project worked with farmer groups rather than individual farmers and engaged with local organizations such as farmers’ and women’s unions. Extension tools, such as cross-visits, field days, and farmer training, were facilitated and implemented by extension workers who had received training by project scientists. In 2004, the LLSP conducted a rapid cattle-market appraisal that brought farmers and traders together to discuss constraints and opportunities for improving marketing of cattle from Ea Kar. Commencing in 2007, the Fodder Adoption Project (FAP, 2007–2010) drew on innovation-systems thinking (World Bank 2006) and engaged with a wide range of stakeholders, strengthening capacity of local stakeholders to improve smallholder cattle production and marketing in Ea Kar. The project combined participatory approaches to developing and extending agricultural technologies (for example, Horne and Stür 2003) with an innovation-systems approach (for example, World Bank 2006; Hall et al. 2007). The focus of activities was on stimulating farmer

links to urban markets, improving the efficiency and quality of cattle production to enable farmers to access these markets, and building capacity of local stakeholders for sustainable cattle development.

## Methods

The results presented are based on information gathered from reports, presentations, and publications of the FSP, LLSP, and FAP projects, and primary data collected during the LLSP and FAP projects. These include the results of adoption surveys in 2007 and 2010, and market studies in 2004 and 2008.

The first adoption survey was conducted in September 2007 and aimed to interview all farmers who were growing forages in Ea Kar. District and commune extension workers visited all communes and villages in Ea Kar and interviewed commune officials, village heads, and other key informants on forage development in their village, and assembled a list of households that had adopted forages (adopters). The extension workers arranged visits to all adopters and one adult household member was interviewed using a simple one-page structured questionnaire. The questionnaire included questions on basic household information, crops and livestock resources, and planting of managed forages. In 2010, a second adoption survey was carried out in two stages: first, the survey team interviewed commune officials, village heads, and other key informants in each of the 15 communes (and 259 villages) where forage and cattle development was known to have taken place, to determine the number of households with cattle and the type of production systems used (that is, traditional grazing, use of farm-grown forages, fattening of cattle, cow-calf production, or mixed production systems). The team then randomly selected a subset of 54 households for a more detailed survey, which elicited detailed information on adoption, management, and productivity of forage and cattle production. The selection process was in two stages: first, the team randomly selected 5 of the 15 communes; second, they randomly selected 54 households from the list of households engaging in cattle production in these communes. Data were summarized and analyzed using a spreadsheet.

The first cattle-market study was carried out in 2004 (Khanh et al. 2004). During the study, key informants were interviewed. Separate group discussions with local government representatives, cattle producers, and traders were facilitated during which each group discussed the history of cattle development and marketing, identified current stakeholders in the market chain, mapped market chains, and discussed constraints and opportunities for improving cattle marketing. The outcomes of the discussions were reported at feedback workshops with all stakeholders. A second market study was carried out in 2008. This study used the Rapid Market Appraisal (RMA) method developed for agricultural

commodities (Wandschneider et al. 2007). The main components of the RMA were:

- interviews with key informants;
- collection of secondary data;
- group discussions with three farmer groups representing different cattle-production systems (traditional extensive grazing, stall-fed cow-calf production, and cattle fattening);
- group discussions and individual interviews with eight small and four large traders in Ea Kar;
- interviews with relevant district authorities;
- interviews with individual traders and other stakeholders involved in the market chain at the three main destination markets of Buon Ma Thuot, Da Lat City, and Ho Chi Minh City where most of the cattle from Ea Kar were sold; and
- a feedback meeting with all stakeholders in Ea Kar to discuss the results of the market study and explore opportunities for improving cattle production and marketing.

The field surveys (data collection, interviews, and group discussions) were conducted between 15 June and 15 September 2008. Destination market surveys were carried out in December 2008. The LLSP and FAP projects facilitated participatory market studies taking farmer-club leaders, local traders, and local government representatives to possible destination markets to observe operations and discuss market opportunities with traders, slaughterhouse operators, and meat-market stakeholders, and develop linkages with urban markets. Details of this study have been published separately (Khanh and Stür 2012). Building capacity of researchers and extension workers in participatory research, forage, animal nutrition and feeding systems, market studies, and innovation systems approaches was an integral part of the research projects.

## Results

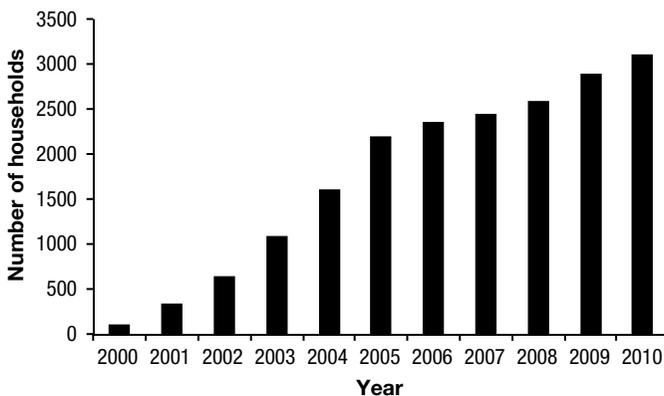
The system changes relating to cattle development in Ea Kar will be presented in three parts: (1) intensification of cattle production, (2) accessing new markets, and (3) institutional and stakeholder dynamics.

## Intensification of Cattle Production

### FODDER PRODUCTION AND USE

In 2000, the FSP introduced the concept of farm-grown fodder production to smallholder farmers in Ea Kar by introducing a range of forage grasses and legumes that were likely to be well adapted to local conditions. The notion of growing fodder for their cattle on their own land was a novel idea for farmers used to exploiting common-property resources to feed their animals. Despite this, farm-grown fodder was rapidly adopted by farmers, with the highest adoption rates occurring from 2003 to 2005 (Figure 6.2). By 2010, more than 3,100 farm households, or 31 percent of all households with cattle, had adopted fodder production (Figure 6.2, Table 6.2). When interviewing farmers who had recently started growing forages about the reasons for adopting forage production, they invariably listed labor savings and improved body condition of their animals as the main reasons for growing forages. They commented that they now had a ready fodder resource next to their house and it took only a few minutes to cut feed for their cattle; they no longer needed to send family members to herd cattle for long periods, contradicting the often-held view that zero grazing is more labor demanding; and they could also keep their cattle close to their house. In 2005, a small study comparing cattle-production labor use of 27 fodder-crop adopters and 20 nonadopters in Ea Kar showed that, on average, adopters spent 3 hours per day while

**FIGURE 6.2** Farmers growing fodder in Ea Kar, 2000–2010, for the FSP (Forages for Smallholders Project, 2000–2002), LLSP (Livelihood and Livestock Systems Project, 2003–2005), and FAP (Fodder Adoption Project, 2007–2010) projects



Source: FAP adoption surveys in 2007 and 2010; District Extension Office (pers. comm.) for other years.

**TABLE 6.2** Fodder adoption in Ea Kar, 2007 and 2010

Characteristic	2007	2010
Total number of smallholders in Ea Kar (HH)	31,690	31,800
HH with cattle (percent)	34.0	31.6
Mean number of cattle per HH growing forages (cattle/HH)	3.2	4.3
HH with fodder production (HH)	2,407	3,101
Fodder adoption rate of HH with cattle (percent)	22.3	30.9
Average size of fodder area per HH (m <sup>2</sup> )	887	1,309

**Source:** Fodder Adoption Project (FAP) surveys, 2007 and 2010.

**Note:** HH = households.

nonadopters spent 6.8 hours per day looking after their cattle. The return to labor was US\$0.73 per hour for adopters and \$0.16 per hour for nonadopters. While this was only a snapshot, it confirmed the assertion by farmers that labor savings were a major factor driving fodder adoption.

The main fodder crops selected and grown by farmers in Ea Kar were the grasses *Panicum maximum* “Simuang,” *Pennisetum purpureum* “Napier,” and a *Pennisetum* hybrid “VA06,” with smaller areas of the grasses *Paspalum atratum* “Terenos” and *Brachiaria* hybrid “Mulato 2,” and the legume *Stylosanthes guianensis* “CIAT184.” Grasses rather than legumes were adopted more frequently by farmers as grasses produced higher fodder yields than legumes, and quantity of fodder (rather than quality) was the first concern of farmers. During the first few years, most farmers grew only small areas, 100–200 m<sup>2</sup>, as they evaluated the potential of forages. Later adopters immediately grew larger areas, 500–1,000 m<sup>2</sup>, which were sufficiently large to impact animal growth positively. By 2007, the average fodder area per farm was 887 m<sup>2</sup> and by 2010 it had increased to 1,309 m<sup>2</sup> (Table 6.2). Farmers grew fodder crops on land that had previously been planted with other crops such as coffee, maize, or cassava, often on land marginal for crop production. The preference for grasses also had the advantage that these could be propagated vegetatively from cuttings and rootstocks, which eliminated the need for developing a seed-supply system. The researchers promoted sale of (rather than provision of free) planting material, which enabled early adopters to sell small amounts of planting material to other farmers who also wanted to evaluate farm-grown fodders, and this provided an extra incentive for early adopters. For new farmers, the cash investment needed was small as they could start with only a few plants for multiplication and then produce their own planting material.

Forage productivity was high, as almost all farmers applied manure recycled from cattle pens and small amounts of inorganic fertilizer, usually nitrogen fertilizer, to their forage crops. Also, farmers managed forages in the same way as they did foodcrops: they grew forages in rows and cut and carried the fodder to animals to maximize forage productivity. Most farmers irrigated at least part of their fodder area during dry periods, mainly using existing irrigation equipment purchased for coffee production. The average size of 1,309 m<sup>2</sup> of forage-production area was sufficient to produce fodder for fattening of two cattle at any one time.

The intensive fodder production had few negative impacts. At the end of the study in 2010, households had committed only 10 percent of their farm area to fodder production, which allowed them to continue to use most of their agricultural land for crop production and other livestock activities, and so maintain diversified agricultural production. Fodder crops were cut frequently and so produced little or no seed that could potentially grow as a weed in unwanted situations. There was no evidence of invasive tendencies of the forages grown as fodders. The application of manure ensured that nutrients contained in cut fodder were replaced and productivity of fodders and soil fertility were maintained.

Adoption of forage production among different communes in Ea Kar varied considerably, ranging from 1 to 95 percent of farms with cattle (Table 6.3). Uptake was less common for farmers living in remote communes such as Cu Lang and Cu Bong, and more common for those living in communes with easy access to main roads and the district center, such as Ea Dar, Ea Mut, and Ea Pal. In community consultations, local stakeholders identified several factors that contributed to this differential adoption, including level of access to grazing lands, tradition of cattle grazing, poverty, and access to extension services. People in more remote communes tended to have easier access to grazing lands, so there was less pressure to find new feed resources; they tended to belong to ethnic-minority groups with a long history of cattle grazing; they were poor and had little access to credit to engage in cattle fattening; and they had limited interaction with the government extension services.

#### **INCREASE IN CATTLE POPULATION, AND CHANGE OF BREEDS AND MANAGEMENT**

Between 2003 and 2005, cattle population in Ea Kar almost tripled from approximately 10,000 to 29,000 animals and then remained at 25,000–28,000 animals from 2006 onwards (Daklak Statistics Office 2009). The two main cattle breeds raised by smallholders in Vietnam were native Yellow cattle with a mature bull weight of 200–250 kg and “Laisind,” a stabilized cross

**TABLE 6.3** Fodder adoption by commune, 2010

Commune	Distance from district town (km)	Distance from main road (km)	Farms with cattle	Farms with forages	Forage adoption (%)
Thi Tran (district township)	0	0	279	82	29
Ea Mut	5	0	538	262	49
Cu Ni	5	2	864	222	26
Cu Hue	8	3	587	175	30
Ea Dar	10	0	769	373	48
Ea Knop (secondary township)	10	0	389	177	46
Xuan Phu	10	5	539	102	19
Ea Pal	15	3	782	740	95
Ea O	15	5	793	232	29
Cu Prong	18	5	422	74	18
Ea Tyl	25	0	995	211	21
Cu Yang	25	3	548	201	37
Ea So (including Ea Sa)	25	5	994	159	16
Cu Lang	30	15	643	5	1
Cu Bong	35	10	900	86	10
<b>All communes</b>			<b>10,044</b>	<b>3,101</b>	<b>31</b>

Source: Fodder Adoption Project (FAP) surveys, 2007 and 2010.

of native Yellow cattle × Red Sindhi cattle, with a higher mature bull weight of 300–450 kg (NIAH 2007). The main cattle breed raised traditionally by farmers in Ea Kar was Yellow cattle. The Ea Kar district extension office estimated that, in 2000, the breed composition consisted of 80 percent native Yellow and 20 percent Laisind cattle. By 2007, the percentage of native Yellow cattle was 74 percent with the remainder made up mostly of Laisind cattle and a small percentage of crossbred cattle. Crossbred cattle (Laisind × exotic breeds such as Brahman or Droughtmaster) were the result of an artificial insemination (AI) program offered by the government. Breed composition changed dramatically from 2007 to 2010. By 2010, the percentage of native Yellow cattle had declined to 40 percent, while the percentage of Laisind and crossbred cattle had increased to 37 percent and 23 percent, respectively.

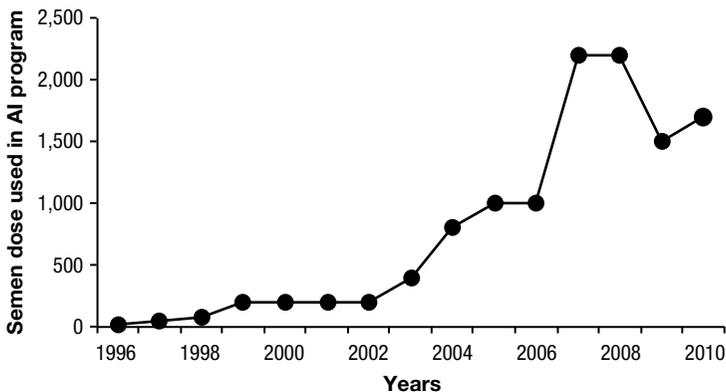
Growing their own fodder enabled farmers to raise cattle in pens for calf production. Farmers could control and manage breeding, which had previously been almost impossible when cattle were grazed on communal land.

When keeping cattle in pens, farmers could observe their animals more closely and could arrange AI and animal-health services more easily. AI, using exotic semen, had been offered by the district extension office from 1996, but was only taken up widely from 2003 onwards (Figure 6.3). The uptake of AI was relatively unrelated to the cost. AI was offered free of charge to all farmers until 2000. From 2001 to 2007, semen was still supplied free of charge, but farmers had to pay a small service fee for insemination. Since 2008, farmers have had to pay for both semen and insemination service themselves with charges ranging from US\$13 to \$18 for each successful insemination. While the jump in the cost of AI reduced demand in 2009, there were many farmers who were willing to pay for successful AI.

#### MOVING TOWARD SPECIALIZED CATTLE PRODUCTION

Farmers started to specialize in stall-fed cattle fattening and/or stall-fed cow-calf production using AI or Laisind bulls for breeding. Fattening cattle and cow-calf production in pens using farm-grown fodder was a relatively new concept for smallholder farmers. In 2003, only three farms experimented with cattle fattening. By 2010, some 525 farms were fattening cattle and all used farm-grown fodder (Table 6.4). In comparison to cattle fattening, the adoption of farm-grown fodder for cow-calf production was much lower and many farmers continued to use traditional grazing systems (Table 6.4). Of the farmers who adopted forages, many used farm-grown fodder as a supplement to grazing, though some moved to stall-fed cow-calf production with

**FIGURE 6.3** Semen doses used in the Ea Kar artificial insemination (AI) program, 1996–2010



Source: District Extension Office, Ea Kar (pers. comm.).

**TABLE 6.4** Cattle production systems and fodder adoption, 2007 and 2010

Production system	2007		2010	
	Households with cattle	Forage adoption (percent)	Households with cattle	Forage adoption (percent)
Cattle fattening	501	96	525	100
Cow-calf system	10,134	19	9,770	28
All farms with cattle <sup>a</sup>	10,614	23	10,044	31

**Source:** Fodder Adoption Project (FAP) surveys, 2007 and 2010.

**Note:** <sup>a</sup> Some farms operated both cow-calf systems and fattened cattle at the time of the survey, thus the total is smaller than the sum of the two production systems.

farm-grown fodders used as the main feed. The Ea Kar extension office estimated that, by 2010, more than 800 farms were practicing stall-fed cow-calf production using AI or Laisind bulls for breeding.

While the total number of farmers fattening cattle changed little between 2007 and 2010 (Table 6.4), there were other major changes in the production system (Table 6.5). By 2010, farmers had increased the number of animals fattened at any one time from averages of 1.5 to 3.9 animals per cycle; they fattened more Laisind and crossbred cattle; they fattened younger animals that required a longer fattening period; and achieved a higher slaughter weight and a higher weight gain. To achieve these weight gains, farmers fed cattle with fresh fodder *ad libitum* (approximately 32 kg of fresh grass per animal per day), and supplemented this with an average of 2.9 kg of farm-mixed concentrates consisting of maize, rice bran, cassava meal, and fish meal. Ingredients for concentrates were largely locally grown, often on farm or easily available from local sources. As farmers gained experience, they were able to modify supplement ingredients to match animal needs during different stages of fattening.

**TABLE 6.5** Cattle fattening characteristics, 2007 and 2010

Characteristic	2007	2010
Forage area (m <sup>2</sup> )	890	2,860
Number of cattle per fattening cycle	1.5	3.9
Percentage of native cattle breeds	74	8
Age of animal at start of fattening (months)	33	14
Length of fattening cycle (months)	2.5	4.5
Starting weight (kg)	229	252
Finishing weight (kg)	295	355
Daily weight gain (g/day)	670	770

**Source:** Based on cattle fattening survey, 2007 and Fodder Adoption Project (FAP) survey, 2010.

The research projects provided training in animal nutrition and feed formulation, and facilitated farmer-group experiments on low-cost feeding systems with locally available concentrate ingredients.

The production focus was also reflected in herd structure. In 2010 cows, heifers, and calves/young growing cattle accounted for approximately 80 percent of the cattle population. Most of the remaining cattle were being fattened for slaughter at the time of the survey. Many of the native cattle were sold as “calf beef” aged 12–18 months. A comparison with the 2007 adoption survey is not available as herd structure was not elicited in the 2007 survey; however, the 2010 data clearly indicate a herd structure consistent with a production rather than the traditional “savings” focus. It was observed that the use of cattle for draught purposes declined, while mechanized land preparation increased during the study period. Households that traditionally used cattle as a way of preserving capital found it harder to do so as access to grazing lands diminished, but alternative investments such as cattle fattening emerged at the same time.

#### ACCESSING NEW MARKETS

In the four years between 2004 and 2008, substantial changes occurred in the quantity and quality of cattle supplied to destination markets, and the way cattle were marketed from Ea Kar. In 2004, the vast majority of cattle produced in Ea Kar were sold for use in Ea Kar and nearby districts. Farmers sold cattle to small, local traders or, less frequently, directly to other farmers. Of the cattle they bought, traders sold 70 percent of the animals to other farmers for breeding or growing, and 30 percent for slaughter. By 2008, this situation had changed and 85 percent of cattle were sold for consumption in the urban markets of Ho Chi Minh, Da Lat, Nha Trang, and Buon Ma Thuot, and only 15 percent were consumed in Ea Kar (Table 6.6). Sourcing and marketing of cattle varied considerably among the different production systems (Table 6.6). Farmers who had specialized in cattle fattening bought young male crossbred or Laisind cattle and sold fat cattle directly to large traders. Farmers who specialized in stall-fed cow-calf production sold crossbred or Laisind calves and/or fattened these themselves for sale to large traders. Farmers using the traditional cow-calf production continued to sell mostly to small traders or directly to other farmers.

During the 2008 market study (Khanh and Stür 2012), large and small traders were asked to estimate the number of cattle sold for slaughter (off-take) from Ea Kar from 2004 to 2008. The traders estimated that off-take increased from 6,000 animals in 2004 to 17,000 animals in 2008. During the same period the cattle population increased only slightly, from 23,000 to

**TABLE 6.6** Marketing chain of cattle produced in Ea Kar, 2008

Production system	Stall-fed cattle fattening	Stall-fed cow-calf production	Traditional cow-calf production
Farmers	<ul style="list-style-type: none"> <li>• Bought crossbred and Laisind cattle for fattening</li> <li>• Sold cattle to large traders (100%)</li> </ul>	<ul style="list-style-type: none"> <li>• Occasionally bought cows for breeding and used AI</li> <li>• Sold Laisind and cross-bred calves and some farmers also sold fat cattle to large traders (50%), other farmers (40%), and small traders (10%)</li> </ul>	<ul style="list-style-type: none"> <li>• Seldom bought animals</li> <li>• Sold mainly native Yellow and some Laisind calves and mature cattle to small traders (75%) and other farmers (25%)</li> </ul>
Small traders	<ul style="list-style-type: none"> <li>• Bought cattle from traditional cow-calf producers (60%) and from stall-fed cow-calf producers (40%)</li> <li>• Sold fat cattle to large traders (70%) and calves and thin cattle to farmers (30%)</li> </ul>		
Large traders	<ul style="list-style-type: none"> <li>• Bought fat cattle from farmers (50%) and small traders (50%)</li> <li>• Sold fat cattle for slaughter to urban markets (75%), for slaughter in Ea Kar and sale as chilled meat to urban markets (10%), and for slaughter and local consumption in Ea Kar (15%)</li> </ul>		

**Source:** Modified from Khanh and Stür (2012), based on the cattle marketing study, 2008.

28,000 animals. This increased off-take indicated (1) a transition to regular sale of animals, (2) more efficient production systems, and (3) import of animals from other districts for fattening in Ea Kar.

Different destination markets had different criteria for accepting cattle for slaughter with stricter quality criteria in urban markets (Table 6.7). The two most important factors deciding acceptance and price were the live body weight and the body-condition score of cattle (score of 1–5; with 1 very thin

**TABLE 6.7** Cattle quality criteria of different markets, 2008

Quality criteria of cattle sold for slaughter in different markets	Ea Kar	Buon Ma Thuot	Nha Trang	Da Lat	Ho Chi Minh
Distance from Ea Kar (km)	0	67	125	222	407
Destination markets for cattle from Ea Kar (%)	15	35	10	20	20
Body condition score (1 = very thin; 5 = very fat)	Any	Any	First-grade chilled beef <sup>a</sup>	≥4	≥4
Live body weight (kg)	Any	Any	First-grade chilled beef <sup>a</sup>	≥300	≥300
Age (years)	Any	Any	First-grade chilled beef <sup>a</sup>	≤3	≤4

**Source:** Modified from Khanh and Stür (2012).

**Note:** <sup>a</sup> First-grade chilled beef = slaughter of cattle with good body condition (≥4) and young age (≤4 years) but using only prime cuts of the animals with the remaining meat being sold on local markets.

and 5 very fat). The third most important criterion was the age of animals. The markets in Da Lat and Ho Chi Minh City were looking for relatively young, heavy animals with a body condition score of 4–4.5. Animals that were too fat (body condition score of 5) were not encouraged, whereas in the local Ea Kar market all animals regardless of body condition were accepted.

Traders in Da Lat did not accept cattle that did not meet the quality requirements. In Ho Chi Minh City, traders accepted them but paid a lower price. In Vietnam, the farm price for cattle is based on the amount of lean meat on the carcass, as estimated visually by the traders and farmers. The traders and farmers agree upon the amount of lean meat on the carcass and multiply this amount by the price of beef sold at the market at that time. Traders in Ea Kar were willing to pay an extra VND200,000 to 500,000<sup>2</sup> per head (US\$10–30 per animal) for cattle meeting all quality criteria of the destination market. Competition among traders for buying good-quality animals was high. Farmers consistently reported that there were many traders who were willing to buy their fattened animals and they generally asked at least three traders to make offers for the animals they wanted to sell.

The price of beef sold in urban markets had increased steadily, despite the recent economic crisis, by an average of 9 percent per year from \$2.30/kg in 2000 to \$5.60/kg in 2010. Farmgate prices rose correspondingly and these relatively consistent price increases have been a major factor attracting farmers to engage in cattle production.

In 2009, for the first time, a farmer group entered into a group contract with a large trader to regularly supply high-quality cattle at agreed quantities and prices. Other farmer groups also entered into contracts with traders in 2010. Feedback from traders was that there was strong demand for high-quality beef in urban markets. Conversely, the market for smaller, native animals was less promising and prices paid for such animals were low. Currently, Ea Kar farmers supply only a fraction of the demand for quality meat in urban centers and there is ample opportunity for increasing supply.

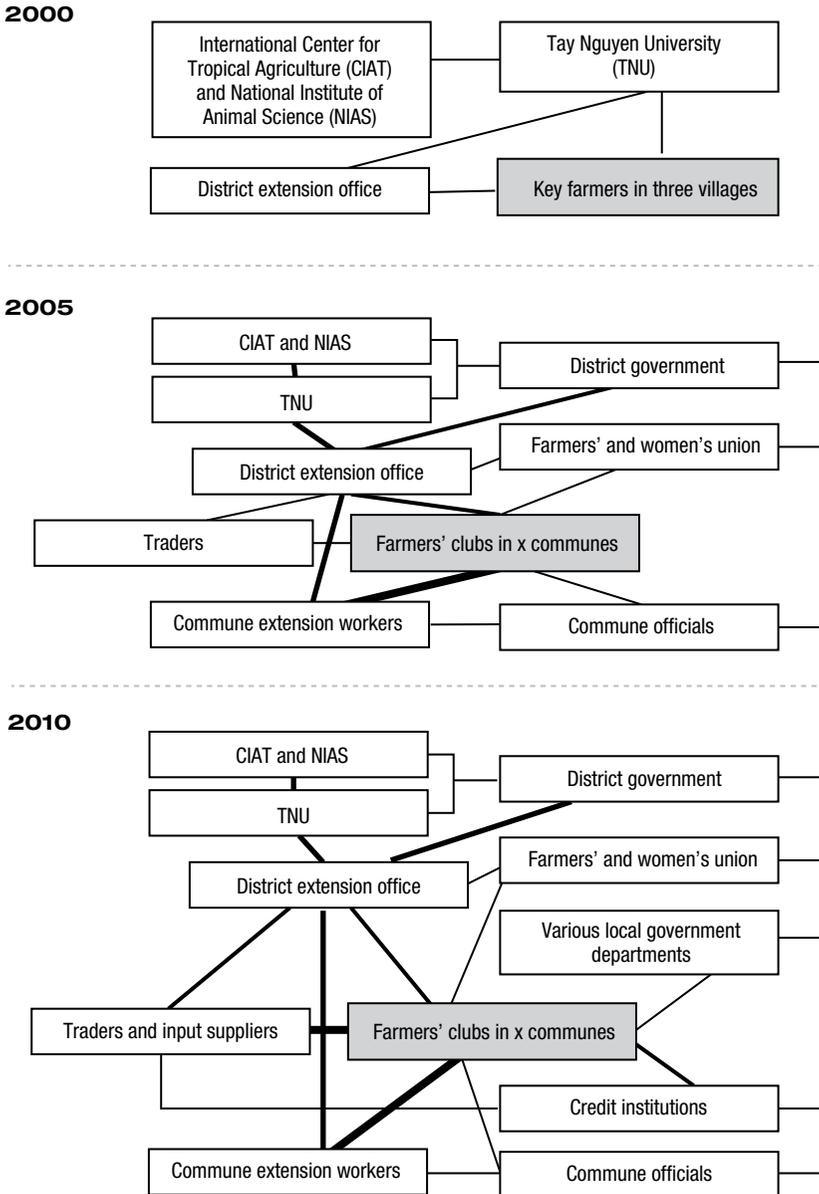
#### **INSTITUTIONAL AND STAKEHOLDER DYNAMICS**

As the focus moved from forage research (2000–2002) to developing feeding systems and extending forages to more farmers (2003–2005) and then to strengthening the capacity of stakeholders to improve cattle production and marketing (2007–2010), the number of stakeholders involved and their roles, interactions, and practices evolved (Figure 6.4).

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2 VND is Vietnamese Dong.

**FIGURE 6.4** Stakeholder linkages in 2000, 2005, and 2010 (the thickness of lines indicates the strength of interaction between stakeholders)



Source: Modified from Khanh et al. (2009).

In 2000, the process started with on-farm research involving a small number of farmers in three villages (Table 6.8). Researchers from Tay Nguyen University worked directly with farmers with the participation of district extension workers. As forage and livestock development expanded to more farmers and new communes, the number of stakeholders involved increased.

By 2005, the district extension office had become the communication and facilitation hub for forage and livestock development. The district government had recognized the importance of forage production as a means of enabling intensification of smallholder cattle production and provided political and financial support for cattle development. They also facilitated linkages with commune officials and farmers' and women's unions. By now, commune extension workers were actively involved as the main facilitators of interactions with farmers. Fodder and cattle development had spread to 51 villages in 10 communes (Table 6.8). Extension workers no longer worked with individual farmers, but had facilitated the formation of self-managed farmer clubs (that is, groups of 10–15 farmers interested in cattle development, usually located in a commune or a cluster of villages to enable easy participation) to facilitate extension activities, farmer training, and learning. Farmer clubs were regulated and managed by their members and included a broad cross-section of farmers including poor households. They were the central element in experimenting with new cattle-production systems and providing feedback to researchers, extension workers, and local government. Extension workers facilitated cross-visits between farmer clubs and asked experienced farmers to share their experiences with farmers from other, less-experienced clubs. Researchers continued to develop interventions for improving production

**TABLE 6.8** Geographic spread, extension workers, and farmer clubs involved in fodder and cattle development

Characteristic	2000	2005	2010
Number of communes with fodder and cattle development	3	10	15
Number of villages with fodder and cattle development	3	51	259
Extensionists involved in cattle development			
• at district level	1	3	3
• at commune level	3	10	30
Number of farmer clubs with a fodder and cattle development focus	0	25	43

Source: Authors.

systems, and provided training to extension workers and methodological support to the district extension office. Traders, who had participated in the 2004 market study, investigated access to larger provincial and urban markets, and developed linkages with large traders and slaughterhouse operators in destination markets.

By 2010, fodder and cattle production knowledge and practice had spread to many more villages and communes, and the number of extension workers and farmer clubs involved in these processes had increased considerably (Table 6.8). The number of stakeholders and the complexity of interactions had increased further (Figure 6.4). Traders, input suppliers (for example, AI), and credit institutions had become important stakeholders, interacting directly with farmers and farmer clubs, although the central role of the district extension office in facilitating interactions had continued. The district extension office ensured that traders, together with other key stakeholders, were consulted and invited to all meetings on how to improve cattle development. The role of researchers had continued to evolve into a more supportive rather than driving role for cattle development.

Researchers continued on-farm research on issues arising from the rapidly changing production systems, provided training, monitored and evaluated adoption patterns, and conducted market studies to provide local government and other stakeholders with data and information as a basis for decisionmaking. Farmer clubs had grown in size to an average of 20 (range 15–40) members. The district government had facilitated access to credit for cattle production through local credit institutions, and had investigated the establishment of more efficient market mechanisms in Ea Kar. Credit for cattle fattening was available through local banks for the more affluent farmers. Other farmers had limited access to credit provided they belonged to a farmer club that supported their application and provided training and support to the applicant. In collaboration with the Social Bank, the project successfully facilitated a “credit through traders” scheme that enabled poor farmers from ethnic-minority groups to engage in cattle fattening. For more details on this scheme see Khanh et al. (2011a).

## **Discussion**

The question “Can developing-country crop–livestock systems be transformed to address the increasing demand for meat or will integrated smallholder systems be replaced by intensive industrial production systems?” has been posed by many authors (for example, Tarawali et al. 2011; Udo et al.

2011). This case study shows that smallholder farmers in Ea Kar were able to convert from traditional cattle production to efficient market-oriented production and compete successfully in city markets with other suppliers. While this is only one example, the study contributes to a greater scientific understanding of development processes and provides an opportunity to draw general lessons.

The research projects that supported forage and cattle development in Ea Kar evolved from a purely technical focus on farm-grown forages to a broader systems perspective. Throughout the ten-year period, the research approach had a strong emphasis on participatory research that responded to farmers' needs and identified opportunities for research and development (described in greater detail in Horne and Stür 2005), nurtured partnerships and local decisionmaking, provided training and, apart from the initial period when forages were first introduced, considered both the supply and demand sides of cattle development. Many of these elements are encompassed in an innovation-systems perspective, which considers innovation as a complex interactive learning process involving multiple actors, institutions, and organizations with different roles, agendas, and practices (for example, Hall et al. 2003, 2007; World Bank 2006; Spielman et al. 2008). This also fits with Edquist and Hommen's (1999) point of view that a "systems-oriented view of innovation accords great importance to the demand side, rather than concentrating primarily, if not exclusively, on the supply side," this latter having been the hallmark of the linear innovation or technology supply push approach (Hounkonnou et al. 2012). In Ea Kar, the nature of interventions changed as the production system intensified from purely production interventions in the early years to mostly market-level interventions toward the latter part of the case-study period.

Many factors contributed to the transition to more market-oriented cattle production in Ea Kar. Strong market demand in urban centers as a driving force for livestock development has been well recognized (for example, McDermott et al. 2010; Tarawali et al. 2011) and clearly played a key role in this case study. Other contextual factors included the strong desire of Ea Kar farmers to improve their livelihood, the cohesive nature of the district extension service, the supportive district government, and the availability of technical expertise from Tay Nguyen University. However, prior to the start of the R&D effort, farmers and local traders had not been able to access these markets because the type of animal produced in the traditional production system was acceptable only in local markets with limited demand. The lack of fodder had been identified as a major constraint to cattle production in

participatory research with smallholder farmers, and the introduction of farm-grown forages enabled farmers to produce fatter animals and reduce labor inputs in cattle production by moving from grazing to stall-fed animals. Traders were only able to develop access to provincial urban markets once farmers were able to produce fatter animals following the introduction of fodder interventions, that is, farm-grown forages. The attribute of farm-grown forages to substantially reduce labor requirements for cattle production and improve educational outcomes of children previously employed in supervising grazing of cattle has also been documented by Maxwell et al. (2012).

The early impact of this innovation provided a vision for farmers, traders, and local government that catalyzed stakeholder interest and involvement in cattle development. Starting with a simple relationship involving researchers, farmers, and extension workers, with time, the stakeholder configuration expanded to include other actors such as local government planners, traders, and credit institutions. Biggs and Smith (1998) used the term “development coalition” to describe such loosely structured, opportunistic groups of actors and, in their analysis of two case studies, concluded that coalition-building was a key ingredient for successful technology development and dissemination. This conclusion was supported by Cramb (1999), who used an “actor-oriented perspective” to analyze adoption of soil-conservation methods by smallholders in the Philippines. He also emphasized that the interests of key actors had to converge sufficiently for them to allocate resources and efforts on working toward change. In the Ea Kar case study, this impetus was created by the success of farm-grown fodder emerging from participatory forage development. For farmers, cattle production became more profitable, local traders could see opportunities of accessing new markets, extension workers were successful in disseminating forages to more farmers, and local government realized that cattle development provided an avenue for raising incomes of smallholders. Interests converged, and forage and cattle development became a focus for the district.

The district extension workers stepped into the role of facilitator or broker of the loosely structured development coalition. Through this networking role they were able to connect farmers with information and the knowledge of other stakeholders such as traders, researchers, and credit institutions, thus becoming “innovation intermediaries” (Spielman et al. 2008; Poncet, Kuper, and Chiche 2010). An important aspect of the development coalition was its local facilitation that ensured local ownership of and responsibility for the process. External facilitation may not have resulted in the strong level of ownership and commitment that was apparent in this case. A feature of the

coalition was the strong mutual respect and friendship that developed among stakeholders and adherence to good partnership principles. Brinkerhoff (2002, 21) defined these as follows:

Partnership is a dynamic relationship among diverse actors, based on mutually agreed objectives, pursued through a shared understanding of the most rational division of labour based on the respective comparative advantages of each partner. Partnership encompasses mutual influence, with a careful balance between synergy and respective autonomy, which incorporates mutual respect, equal participation in decision making, mutual accountability and transparency.

There is currently a lot of interest in the use of so-called innovation platforms as catalysts for innovation in rural research-for-development circles. See, for example, a recent book bringing together a series of case studies from Africa south of the Sahara to draw out some lessons on their utility (Nederlof, Wongtschowski, and van der Lee 2011). The term “innovation platform” means different things to different people, but most would agree that such platforms represent a physical or virtual forum that brings together different stakeholders for joint learning and action. Innovation networks are also in vogue, and represent looser associations of stakeholders but still with the goal of catalyzing innovation. In the case study presented here, neither the stakeholders nor the facilitators consciously defined their activities as being part of a formal innovation platform. Yet, innovation capacity was certainly built and sustained through interactions among key stakeholders. Establishment of formal innovation platforms can raise expectations which are hard to meet and, in our experience, can soak up stakeholders’ time in diffuse meetings without concrete actions emerging. The current case suggests that an alternative approach to catalyzing innovation through ad hoc interactions among essential actors for specific purposes may be an alternative and less cumbersome means of stimulating innovation and may yield changes on the ground before expectations have been raised through convening of a formal platform with all the fanfare that involves. Further work to compare the utility of formalized platforms and looser networks would be useful (for some preliminary discussion on this see Ayele et al. 2012).

The district extension office actively promoted the formation of farmer clubs for forage and cattle production (that is, farmer interest groups) to facilitate interactions with farmers, maximizing learning among farmers and farmer clubs through cross-visits, field days, and training. Each club had only a small number of members (rarely more than 20–30 members within a village

or cluster of neighboring villages) and was self-regulated and managed—attributes that have been recognized as being important for farmer organizations (Markelova et al. 2009). Researchers supported cattle development through participatory research with selected farmer clubs, provision of information, and training, but their overall input into the innovation process reduced over time. Although farmer clubs were self-regulated and managed, they were formally recognized by the government and provided an opportunity for collective action and representation on local government forums. Initially, farmer clubs concentrated on production issues but, toward the end of the ten-year period of this case study, several farmer clubs had signed contracts with large traders from urban markets to supply groups of cattle on a regular basis. While collective action was not essential for accessing urban markets, as is the case for high-value products (for example, Kaganzi et al. 2009), it offered farmers certainty of demand and prices, and provided an additional linkage to urban markets and traders.

Once traders were linked to urban markets, feedback on the growing urban market demand for larger, heavier animals of a younger age catalyzed considerable changes to the production systems that required changes in breeds, AI, animal health, and other input services. Government provided transitional support for some of these services such as AI and animal health, but within a short period most of the services were provided by new, previously nonexistent, private-sector suppliers. The rapid change to crossbred animals has, to some extent, led to an ad hoc use of semen of different exotic breeds and there is an urgent need for a more sustainable breeding strategy, which requires capacity development and engagement of local government and private service providers (Rege et al. 2011). This example illustrates that the change process is not and may never be completed, requiring continued investment by and capacity strengthening of local stakeholders. The well-established linkage between local stakeholders in Ea Kar and researchers at Tay Nguyen University will be a sound basis for continued scientific support to the innovation process.

The rapid changes observed in Ea Kar had not taken place elsewhere despite interest by traders and local government to “export” Ea Kar’s live-stock development to neighboring districts (Khanh et al. 2011b). While some farmers in nearby areas had started to grow forages on their own farms based on what they had seen in Ea Kar, this had not resulted in widespread cattle development. Up-scaling needed to be supported through similar processes to those in Ea Kar, such as coalition-building and strengthening the capacity of local stakeholders, but made simpler and more rapid by having a convincing

example in Ea Kar that showed that it was possible for comparable smallholder farm families to produce high-quality cattle competitively.

## Conclusion

The key to successful smallholder cattle intensification in Ea Kar was the combination of (1) a convincing innovation—farm-grown fodder—that provided early benefits and a vision for farmers, traders, and local government; with (2) a participatory, systems-oriented innovation process, which took into account both production and marketing constraints and opportunities; (3) an emphasis on strengthening capacity of key stakeholders; and importantly (4) was locally owned and managed by a loosely structured coalition for cattle development. This example also illustrates the need for a sufficiently long time period to ensure that innovation processes are able to continue without external support. The development processes described in this study demonstrated the importance of coalition-building, but also the need for a stimulus for coalition formation, which, in this case, was provided by a promising intervention. The study also showed the need for a systems-oriented view that addressed important issues in the beef value chain as they emerged and for linking farmers to market actors to facilitate information flows and feedback mechanisms. Finally, the study showed the importance of building capacity of local stakeholders to facilitate and manage the innovation processes and so sustain the development effort.

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## COLLECTIVE ACTION FOR MARKET-CHAIN INNOVATION IN THE ANDES<sup>1</sup>

André Devaux, Douglas Horton, Claudio Velasco, Graham Thiele, Gastón López, Thomas Bernet, Iván Reinoso, and Miguel Ordinola

### Introduction

The Andean region of South America is characterized by extreme social and economic inequalities. It is estimated that more than 60 percent of Ecuador's rural population and nearly 80 percent of Bolivia's and Peru's are poor (CEPAL 2004). Poverty is especially prevalent in highland areas, where the potato is the main staple food and an important source of cash income. In areas over 3,500 meters above sea level, subject to frequent frost and drought, potatoes are among the few crops that can be grown. Over centuries, Andean farmers have developed more than 4,000 native varieties of potato. In Peru and Bolivia, most native potatoes are cultivated by semicommercial farmers for home consumption, barter, and sale in local markets. At lower altitudes, more commercially oriented farmers grow modern varieties employing pesticides, herbicides, and chemical fertilizers. In Ecuador, where growing conditions are generally milder, native varieties have almost entirely been replaced by new varieties introduced by national breeding and seed programs.

Agricultural development is taking place in the context of rapid urbanization and increasing market integration. Farmers are confronted with many new market challenges as well as opportunities. Urbanization and increasing participation of women in the labor force are leading to a dietary transition toward convenience foods, animal protein, fresh dairy products, and higher

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consumption of fresh fruits and vegetables. Packaged food sales and supermarket retail outlets are now found in most developing countries. Demand is also increasing for higher quality foods that meet ever-increasing standards of safety. Supermarkets are becoming major players in vertically integrated food-marketing systems. Consequently, the production practices and livelihoods of small Andean farmers are increasingly influenced by the demands of urban consumers, market intermediaries, and food industries (Reardon and Berdegú 2002; Wilkinson and Rocha 2006).

In contemporary agricultural markets, small farmers are often at a disadvantage in relation to larger commercial farmers who can supply larger volumes of quality-assured products, possess superior bargaining power, and have better access to information, services, technology, and capital. Small farmers' limited access to physical and financial resources restricts their ability to expand and invest in technologies that increase efficiency and add value to primary production. Small farmers also frequently have limited technical skills and poor access to information and training for improving their production practices. The limited market surplus of individual small farmers inflates marketing costs, increasing transaction costs and the per-unit costs of assembly, handling, and transportation. Small farmers also lack basic knowledge of the marketing system, current information on prices and market conditions, and bargaining power (Kruijssen, Keizer, and Giuliani 2009; Berdegú 2001).

Various approaches have been proposed to improve the prospects of small farmers in agricultural markets, including collective action via farmer organizations and cooperatives (Shepherd 2007). In the present chapter, we discuss two novel uses of collective action that involve not only small farmers but also market agents and agricultural-service providers. The Participatory Market Chain Approach (PMCA) and Stakeholder Platforms foster market-chain innovation in ways that benefit small farmers as well as other market-chain actors. The main intended outcomes of these types of collective action are commercial, technological, and institutional innovations. This differs from most cases of collective action described in the literature, which report on farmer organization for achieving economies of scale, enhancing small farmers' bargaining power, or improving the management of common pool resources. The new forms of collective action reported on here, involving diverse market-chain actors, researchers, and other agricultural service providers, have been developed by the regional research and development (R&D) network, Papa Andina, which operates in Bolivia, Ecuador, and Peru.

## **Perspectives on Collective Action and Innovation**

This chapter is concerned with the use of collective action to foster pro-poor innovation in market chains. Much has been written on farmer organizations for managing common pool resources, and for marketing and service provision. There is also a rapidly growing literature on innovation processes. However, the role of collective action in innovation processes has received little attention to date. In this section we review relevant literature on collective action and on innovation, and identify key factors that will later be combined in a framework for analyzing collective action in market-chain innovation processes.

### **Perspectives on Collective Action**

Collective action refers to voluntary action taken by a group to pursue common interests or achieve common objectives. In collective action, members may act on their own, but more commonly they act through a group or an organization; they may act independently or with the encouragement or support of external agents from governmental bodies, NGOs, or development projects (Meinzen-Dick and Di Gregorio 2004).

There is an extensive body of literature on the role of collective action in managing common pool resources such as forests, fisheries, grazing lands, and irrigation water. Agrawal (2001) presents an exhaustive literature review that identifies 33 “critical enabling conditions” that contribute to the sustainability of common property institutions. These fall into four main categories:

1. Resource-system characteristics (for example, small size, well-defined boundaries, predictability, low levels of mobility, and feasibility of storing benefits from the resource);
2. Group characteristics (for example, small size, shared norms, past successful experience with collective action [social capital], homogeneity of identities and interests, capable leadership, interdependence among group members, and low levels of poverty);
3. Institutional arrangements (for example, rules are simple and easy to understand, locally devised access and management rules, ease in enforcement of rules, and graduated sanctions for breaking rules); and
4. External environment (for example, external support for organization, low levels of articulation with external markets, governmental bodies that do not undermine local authority, and supportive external sanctioning institutions).

Ostrom (1999) identifies other factors that are important for institutional development, such as the feasibility of improving the resource and a low discount rate. Many authors emphasize the importance of social capital for the emergence and development of local organizations for collective action.

Based on a study of “associative peasant business firms” in Chile, Berdegue (2001) identified several factors that facilitate the emergence and development of collective action for marketing and value addition. These factors include: high transaction costs; policy incentives; presence of community groups and organizations, providing an important initial forum where alternatives can be discussed; support from external agents, such as NGOs or private extension firms; linkage to actors outside the rural community, providing access to external sources of information, expertise, and financial resources; embeddedness in the rural community, facilitating more effective and less-costly internal rules, decisionmaking processes, and procedures for monitoring and evaluation; establishment of rules that are consistent with market signals; and potential to differentiate members’ products through value addition.

Kruijssen, Keizer, and Giuliani (2009) discuss the importance of social learning for collective action in the context of smallholder market participation. Social learning is defined as the process through which groups of people learn, by jointly defining problems, searching for and implementing solutions, and assessing the value of solutions for specific problems (Koelen and Das 2002). Social learning brings about a shift from “multiple cognition” to “collective cognition.” Individuals involved in social-learning processes begin with quite different perceptions of their current situation and the potential for change; as they interact, they develop common, shared perspectives, insights, and values. Dialog and social learning foster collective cognition and social-capital formation, both of which are necessary for effective joint action. Social learning and social capital formation are also key features of innovation processes.

### **Perspectives on Innovation**

Whereas research focuses on generating new knowledge, and technology development aims to create a supply of new production methods, innovation is concerned with the practical use of new knowledge. As Barnett (2004, 1) states, innovation involves “the use of new ideas, new technologies or new ways of doing things in a place or by people where they have not been used before.”

The relationship between research and economic activity is not simple and linear but complex and interactive (Hall et al. 2001; Engel and Salomon 2003;

World Bank 2007). Interactive social-learning processes involving researchers and economic actors are crucial for ensuring that applied research generates useful new knowledge that is put into practical use. Since research organizations have traditionally worked in isolation from the end users of their technologies, institutional innovations that strengthen patterns of interaction between researchers and economic actors are crucially important for strengthening innovation systems.

An innovation system can be defined as “a network of organizations, enterprises, and individuals focused on bringing new products, new processes, and new forms of organization into social and economic use, together with the institutions and policies that affect their behavior and performance” (World Bank 2007, xiv). Four key sets of factors influence the performance of innovation systems: the external environment, the diversity of actors involved, the values and attitudes of the key actors, and the institutional arrangements and patterns of interaction.

Different factors can trigger innovation, including changes in policies, markets, and technology. Attitudes and institutions determine how individuals and organizations respond to such triggers. Behaviors that make organizations and policies responsive to stakeholders’ needs and interests can encourage innovation. Innovation is also stimulated by the interaction of individuals and groups with different backgrounds, interests, and perspectives. Hence, groups that are more diverse generally have a greater potential for innovation. Even though participants with different economic interests may initially be skeptical about the benefits of interacting, the values, attitudes, and patterns of interaction can change over time as a result of social learning, development of personal relationships, trust, and other forms of social capital. The ability to interact constructively and work in new ways is crucial for the innovation performance of groups.

Recent studies of agricultural innovation highlight the utility of the value-chain concept—a set of interconnected, value-creating activities undertaken by individuals and enterprises to develop, produce, and deliver a product or service to consumers—as a unit of analysis and focus of interventions aimed at stimulating innovations and developing innovation capacity (World Bank 2007, 24). Thus, attention should not be directed at individual supply-chain participants such as producers, but at the overall supply-chain capacity and the degree to which the chain in its entirety is able to compete.

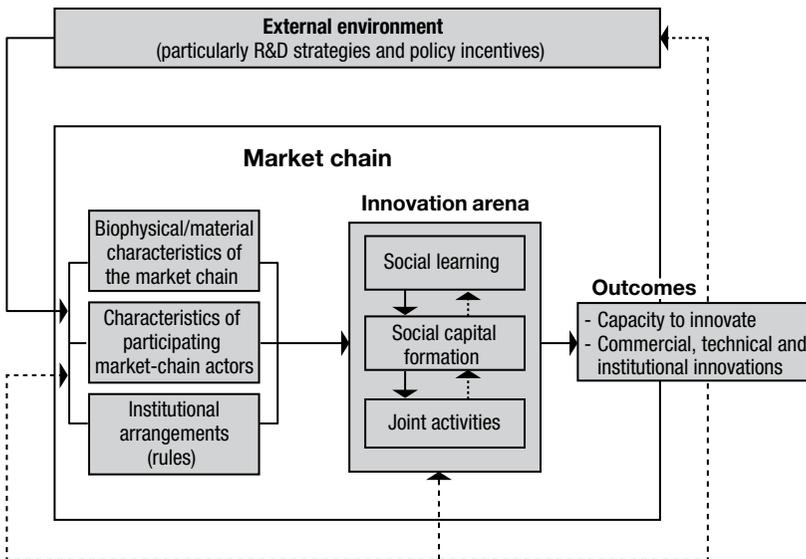
## Framework for Analyzing Collective Action in Market-Chain Innovation

Ostrom (2005) has developed a general framework for understanding institutions known as the Institutional Analysis and Development (IAD) Framework. It has three main components:

- the “action arena” in which participants interact,
- three groups of “exogenous variables” that influence the action arena (biophysical/material conditions, attributes of the community and rules), and
- the “outcomes” produced (Ostrom 2005, 15).

In developing a framework for analyzing collective action in market-chain innovation, we have built on the IAD framework and added the external environment component from Agrawal (2001) and World Bank (2007). To focus attention on important innovation processes, we have also added the components of social learning, social capital formation, and joint activities from Kruijssen, Keizer, and Giuliani (2009). The resulting Framework for Analyzing Collective Action in Market Chain Innovation is illustrated in Figure 7.1.

**FIGURE 7.1** Framework for analyzing collective action in market-chain innovation



Source: Based on Ostrom (2005, Fig. 1.2), Agrawal (2001), Kruijssen, Keizer, and Giuliani (2007), and World Bank (2007).

The central focus of attention in this framework is the innovation arena where social learning, formation of social capital, and joint innovative activities lead to the development of innovations. The innovation arena is influenced by four sets of exogenous variables: the external environment, biophysical and material characteristics of the market chain, characteristics of market-chain actors, and institutional arrangements. Based on the literature review reported in the previous section, particularly the works of Agrawal and Berdegúé, we have identified a number of factors in each of these four areas that are likely to influence collective-action processes and outcomes in the context of market-chain innovation (Table 7.1).

**TABLE 7.1** Exogenous variables that influence the emergence and outcomes of collective action in market chain innovation

<b>External environment</b>
<ul style="list-style-type: none"> <li>• “Trigger” for initiation of collective action</li> <li>• Support from external agents (such as research organizations, NGOs or governmental bodies) to stimulate innovation and facilitate group activities, and provide technical and institutional backstopping</li> <li>• Policy incentives for pro-poor market-chain innovation</li> <li>• Presence of community groups or organizations</li> <li>• Collective-action institutions at complementary levels (higher or lower).</li> </ul>
<b>Biophysical/material characteristics of the market chain</b>
<ul style="list-style-type: none"> <li>• Characteristics of the commodity (for example, perishability and production zones)</li> <li>• Current uses and consumer perceptions of intrinsic value</li> <li>• Potential to reduce transaction costs through market-chain innovation</li> <li>• Potential for product differentiation and value addition.</li> </ul>
<b>Characteristics of participating market-chain actors</b>
<ul style="list-style-type: none"> <li>• Participation of diverse market-chain actors and service providers</li> <li>• High levels of dependence on the market chain</li> <li>• Presence of social capital (norms, values, attitudes, and beliefs that predispose people toward collective action, as well as rules, procedures, precedents, and social networks)</li> <li>• Capable leadership within the market chain and in the farming community.</li> </ul>
<b>Institutional arrangements (rules)</b>
<ul style="list-style-type: none"> <li>• Effective social-learning processes, leading to development of collective cognition, social capital, and leadership capacity</li> <li>• Locally devised rules that are simple, easy to understand, easy to enforce, and consistent with market signals</li> <li>• Fair allocation of costs and benefits of collective action</li> <li>• Graduated sanctions for noncompliance with rules</li> <li>• Accountability/responsiveness of external agents to group members.</li> </ul>

**Source:** Based on Agrawal (2001, Table 2) and Berdegúé (2001).

In the resulting framework, the two major outcomes of collective action are strengthened capacity for innovation and commercial, technological, and institutional innovations. As indicated by the broken lines in Figure 7.1, these outcomes may influence the processes that take place within the innovation arena. For example, successful innovation may stimulate participants to invest more time and resources in joint activities. Over time, outcomes may also influence the four groups of exogenous variables. For example, successful innovation may predispose policymakers to support future programs involving collective action.

### **Papa Andina's Use of Collective Action to Foster Pro-poor Market-Chain Innovation**

Papa Andina was established in 1998 to promote pro-poor innovation in the Andean potato-based food systems. Financed mainly by the Swiss Agency for Development and Cooperation and other donors, and hosted by the International Potato Center, the network includes about 30 partners in Bolivia, Ecuador, and Peru. In each country, Papa Andina coordinates its activities with a “strategic partner” that plays a leadership and coordinating role in market-chain innovation: the Promotion and Research for Andean Products (PROINPA) Foundation in Bolivia, the Innovation and Competitiveness of the Peruvian Potato (INCOPI) project in Peru, and the National Potato Program of Instituto Nacional Autónomo de Investigaciones Agropecuarias (INIAP) in Ecuador. This network of partners reaches a growing number of poor rural households, currently estimated to be around 4,000. The PMCA is used to bring researchers together with other agricultural-service providers and market-chain actors, including small farmers, to promote pro-poor innovations.

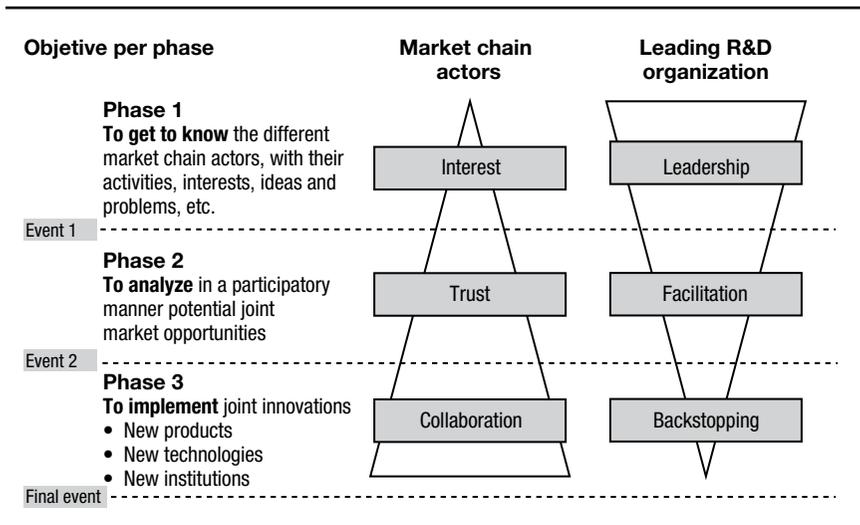
Interaction among the market-chain actors is crucial for market chain innovation. In 2000, we began experimenting with a participatory approach to stimulate agricultural innovation known as “Rapid Appraisal of Agricultural Knowledge Systems” (RAAKS). This approach, developed by Engel and Salomon (2003), brings diverse stakeholders together in a flexible, participatory process. Papa Andina began using RAAKS to foster pro-poor market-chain innovation for native potatoes. Based on RAAKS, through action research we developed two complementary approaches to enhance innovation: the PMCA and Stakeholder Platforms.

## The Participatory Market Chain Approach

In 2000, the INCOPA project began working with RAAKS to stimulate social learning, build trust, and foster joint actions among potato market chain actors. They added tools for product and market development, and renamed the approach as the “PMCA” (Bernet, Thiele, and Zschocke 2006). The PMCA has three phases, usually implemented over several months. An R&D organization initially leads planning, coordination, and facilitation. As the process advances, market-chain actors take on more responsibility, and the R&D organization shifts to a supporting role (Figure 7.2).

Phase 1 of the PMCA begins with a rapid market survey and ends with a workshop where market-chain actors meet supporting R&D organizations to discuss possible innovations. Phase 2 involves a series of group meetings and applied research to analyze market opportunities. A key goal of this phase is to build trust among participants. Phase 3 involves joint activities that seek to develop concrete innovations, which might be technical (for example, new products, production practices, or packaging) or institutional (for example, farmer associations, stakeholder platforms, or business arrangements such as contract farming agreements). The PMCA formally ends with a large public event where market-chain actors and service providers present their innovations and meet national policymakers, donor representatives, the media, and

**FIGURE 7.2** Three phases of the participatory market chain approach



Source: Bernet, Thiele, and Zschocke (2006).

other “VIPs.” After the formal closure, the R&D organization may be called on by specific actors or asked to backstop new institutions.

### **Stakeholder Platforms**

In the Andes, interactions among market-chain actors and service providers are frequently characterized by lack of trust, and successful public–private partnerships and alliances are rare (Hartwich and Tola 2007). Agricultural research organizations usually keep their distance from NGOs, farmer groups, and traders. The quest for market-led innovation made it necessary to look beyond the research community and build relationships with a broader range of public and private actors. Papa Andina employs stakeholder platforms to promote interaction, social learning, social capital formation, and collective activities involving diverse actors in innovation processes.

Stakeholder platforms have been established at different levels. Local platforms facilitate interactions between potato producers, local authorities, and service providers to empower small farmers, reduce marketing costs, and increase efficiency in service delivery. Market-chain platforms bring farmers’ associations together with traders, processors, supermarkets, researchers, extension agents, chefs, and others to foster pro-poor innovation. In some cases, platforms also serve as representative bodies for interaction with policymakers.

### **Illustrative Examples**

The following examples present cases from Peru and Bolivia, where the PMCA has been developed and refined, and from Ecuador, where attention has focused on stakeholder platforms for strengthening farmer organizations.

#### **PERUVIAN EXAMPLES**

In 2002, INCOPA initiated the PMCA in Peru with a market-chain survey. Results were discussed in a meeting of nearly 100 stakeholders, including potato producers, wholesalers, processors, supermarket managers, researchers, and professionals from NGOs and international agencies. Based on this survey, two cycles of PMCA were implemented, one for potatoes in general and one specifically for native potatoes.

Innovations resulting from the first cycle included: “Mi Papa” (a new brand of high-quality, fresh potatoes for the wholesale market), “Papy Bum” (a new native potato-chip product), and a series of online bulletins with daily information on wholesale prices and supplies for more than 20 types of potatoes. A national organization, Cadenas Agrícolas Productivas de Calidad (CAPAC-Peru), was established to promote marketing of high-quality

potato products, reduce transaction costs, and add value through innovation. Founding members included farmer organizations, NGOs, traders, and processors. Today [2009], CAPAC represents 22 core members including five farmer organizations with 600 members.

In the second PMCA application, several new actors joined the process to develop new native-potato products. CAPAC-Peru played a key role (Ordinola et al. 2007), and results included two new products: T'ikapapa and Tunta Los Aymaras.

T'ikapapa is the first brand of high-quality, fresh native potatoes sold in Peru's leading supermarkets. First marketed in 2004, sales grew from 14 tons<sup>2</sup> to over 70 tons in 2006. This has allowed more than 300 families in 10 high-land communities to obtain 10–30 percent above the going market price for native potatoes. An agroprocessing company, a member of CAPAC, owns the brand and contracts farmers to supply potatoes to the supermarket. CAPAC helps to organize small farmer groups to supply potatoes that meet market requirements. In 2007, INCOPA and its partners received a United Nations award for "Supporting Entrepreneurs for Environment and Development."

Tunta Los Aymaras is a brand of high-quality, freeze-dried native potatoes developed through a coalition of farmers' groups, local government agencies, NGOs, and a private service provider. Tunta is produced traditionally from native "bitter potatoes" by small farmers in the high Andes and has generally been restricted to traditional Andean markets. Through collective action, farmers' marketing and processing capacities were strengthened, quality norms developed, and market studies undertaken. A farmers' association, Consortium Los Aymaras, was created to market this new product, and it also owns the brand.

#### **BOLIVIAN EXAMPLES**

The PMCA was applied in two regions of Bolivia. In Cochabamba, the PMCA was introduced from Peru in 2003, validated, and adapted. PROINPA led the exercise with a local farmers' association, a food-processing firm, and a supermarket in Santa Cruz. Based on the common interest identified by the participants, two new products were developed for sale in supermarkets: colored chips made from native potatoes and high-quality, prepackaged, fresh native potatoes. PROINPA gained a new approach for linking small farmers to markets; it helped the farmers' association to get better organized, build links with market agents, and upgrade the quality of its members' native

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2 Tons refers to metric tons in this chapter.

potatoes. It also helped them to improve working relations and negotiation capacity with market-chain actors.

From 2003, the PMCA was applied twice in the Department of La Paz in market chains for *tunta* and *chuño*, traditional freeze-dried products. These applications involved farmers, traders, food-processing firms, exporters, cooking schools, and R&D organizations. In the first cycle, participants prepared a set of Bolivian quality standards for *chuño* and *tunta* in coordination with national authorities. In 2004, the PMCA was used to identify new uses for *chuño* and *tunta*, and ways to improve the products' image. This exercise involved some participants from the first cycle plus chefs and a food-processing firm manager. It resulted in a new product: clean, selected, and bagged *chuño*, marketed under the brand "Chuñosa."

In 2005, participants established the Bolivian *chuño* and *tunta* platform, formalized as the Bolivian Andean Platform, to sustain and consolidate their collective action. Among other activities, the platform has established links with market agents to develop better-quality *chuño*-based products with a higher price and to explore the export potential of *chuño* and *tunta*. The platform today [2009] represents 13 core members, including four farmers' associations with around 200 members, processing firms, development projects, an NGO, and a research organization, PROINPA. It has helped to build trust and social networks among its members and has improved links between small farmers and market agents on one hand, and R&D organizations and other service providers on the other.

#### ECUADORIAN EXAMPLES

INIAP's potato program initially attempted to create a national-level consortium of market-chain actors and development organizations to address macro-level problems. When this effort failed, attention shifted to local stakeholder platforms to develop better collaboration among local institutional actors and farmer organizations. With financial support from the SDC, it has provided small grants for collaborative projects that link small-scale potato farmers with specific markets.

Platforms and collaborative projects were set up in the provinces of Tungurahua and Chimborazo in 2003, and in Cotopaxi and Bolivar in 2006. With initial leadership from INIAP, these involved 24 farmer groups that were created through previous Farmer Field School experiences (they include around 200 members), universities, local governments, and NGOs representing 32 core members in total including the farmer groups' representatives. Platforms were organized around existing farmer groups. Their activities have included

marketing selected fresh potatoes to 29 restaurants, fast-food outlets, and processors in Ambato and Riobamba. Platform members grow the new Fripapa potato variety, which is in high demand for processing and fast-food outlets. Through the platforms, researchers have interacted with small farmers as well as local authorities, development projects, and NGOs. This has facilitated knowledge sharing, social learning, and capacity building, leading to improvements in small farmer productivity and the quality of potatoes supplied to market. As a result of this process, a national organization, the Consortium of Small Potato Producers (CONPAPA), was established to support joint marketing activities.

## **Discussion**

In this section, we summarize patterns that emerge from our examples of collective action in relation to the main components of the framework for analyzing collective action in market chain innovation (Figure 7.1).

### **Role of External Factors**

In each of the cases described, the collective action was triggered by a research organization associated with Papa Andina, external to the market chain. Once local groups had been established with external facilitators, they took on lives of their own and often evolved in unexpected ways. All the groups were supported by such external agents as NGOs, local or national governments, and R&D organizations. The Bolivian and Peruvian groups benefitted from policy support for market-chain development. In contrast, in Ecuador policies emphasized farmer organization and empowerment rather than market-chain development per se. In several cases, collective action for market-chain innovation built on earlier groups, such as Farmer Field Schools, NGOs, and farmer associations, confirming the importance of prior experience with collective action. In some cases, when collective action got under way, complementary groups were established at other levels (for example, CONPAPA, CAPAC-Peru, and the Bolivian Andean Platform).

### **Importance of Market-Chain Characteristics**

As shown in the cases, joint marketing can reduce transaction costs. However, commercial innovation and development of high-value niches for potato products have generated more significant benefits for small farmers as well as other market-chain actors. In Peru and Bolivia, use of the PMCA led to the development of new products based on native potatoes. In contrast, in Ecuador, where

attention focused on organizing farmer groups to respond to existing market opportunities for modern varieties, fewer commercial innovations and benefits, have resulted.

### **Importance of Participant Diversity**

In the Bolivian and Peruvian cases, small farmers, market agents, researchers, and service providers have participated in groups working with the PMCA. In contrast, in Ecuador market agents have not been involved in the platforms. An important factor for innovation has been the trigger effect of researchers who brought new information and ideas. For example, in Peru and Bolivia, researchers suggested that it might be possible to market a colorful native-potato product, and they assisted with laboratory testing of processing techniques. With these inputs, other participants took the lead in product development, testing, and refinement. The Ecuadorian approach focusing on farmer organization has strengthened farmer organizations but has led to less market-chain innovation.

Women were involved in all cases, more actively in marketing and processing than in production. In most of the cases, men assumed leadership at the community level, while women assumed leadership in R&D organizations in Bolivia and Peru. Small farmers are generally more dependent on the potato market chain than large retailers; this may be one reason why it is easier to engage small farmers in the PMCA than to engage market agents. Small Andean farmers have traditions of collective action at the community level, but not along market chains. Relations in market chains are traditionally characterized by lack of trust and cooperation. Hence, getting diverse market-chain actors (including small farmers) to work together in innovation processes is itself a significant institutional innovation.

### **Institutional Arrangements**

One of the key challenges has been to provide adequate facilitation for social-learning processes, which promote the development of collective cognition, social capital, and leadership capacity. In most cases, a research organization took responsibility for facilitation. There has been a tendency for facilitators to introduce rules to speed up the process, rather than facilitate the local development of rules. Where multistakeholder platforms have emerged from PMCA exercises, they have developed their own rules, often with little support from Papa Andina.

## **The Innovation Arena**

The three phases of the PMCA correspond to the three social processes that take place in the innovation arena. Therefore, where the PMCA has been implemented, in Peru and Bolivia, the groups involved have advanced through the phases of social learning and social-capital formation, and have engaged in joint activities focused on the development of specific commercial, technical, and institutional innovations. In all the cases, participants report that the group meetings and social interactions with other market-chain actors and service providers were useful to them, even before they began the process of developing specific innovations. Participants learned new things about the market chain or about technical and market potentials that they could put into practical use in their businesses. They also established personal relationships with other market-chain actors or service providers that have proved useful to them in their businesses. This is one reason why stakeholder platforms have been established in some cases: to allow the diverse stakeholders to continue to interact and work together over time.

## **Outcomes**

An important result of the collective-action processes promoted by the PMCA and stakeholder platforms has been the buildup of participants' capacity for teamwork and innovation. Leadership capacity has also been developed at the level of farm communities to enable communication and interaction with market-chain actors and service providers as well as institutional leadership for facilitating collective action and distributing roles among the market-chain participants.

The groups identified new market opportunities and developed new production processes, new ways of working together, and, finally, new commercial products to exploit these opportunities. This is illustrated by the case of T'ikapapa in Peru, where this commercial innovation stimulated other innovation in the areas of technology development to respond to the quality criteria required by the market and institutional innovation required in the CAPAC association, to provide the necessary services to these market-chain actors. The results of these outcomes can be summarized as higher prices for native potatoes, increased farmers' revenues, more stable markets for native-potato producers, improved image of native potatoes, and increased farmers' self-esteem.

An example of indirect outcomes is the creative imitation process by which other market-chain actors develop similar products based on the original

creative idea that stimulated further innovation and involved new participants in the process and eventually new members to the CAPAC association. The promotion of successful innovation has also attracted the attention of policymakers and donors to the process, increasing their support for future collective action for market-chain innovation.

## **Conclusion and Policy Implications**

### **Implications for General Understanding of Collective Action**

Papa Andina's work illustrates how collective action involving small farmers, market agents, researchers, and other agricultural service providers can generate pro-poor market-chain innovations. The collective-action literature emphasizes its role among individuals with common interests in managing common pool resources, reducing transaction costs, gaining scale economies, and improving the bargaining power of small farmers. The innovation literature, in contrast, highlights the importance of interactive, social learning among individuals with different perspectives and interests. Neither discusses the use of collective action in fostering innovation. Papa Andina provides some concrete examples of how these two fields can be bridged—how collective action involving diverse stakeholders can contribute to innovation processes that benefit small farmers. In the examples presented, participants strengthened business contacts and social networks, shared knowledge, and built up trust. As the capacity for teamwork developed, participants identified market opportunities and developed new products and marketing methods, creating innovation processes that improved the market participation of smallholders on more favorable terms.

Papa Andina's work shows that diversity of participants' roles and interests is not always bad for collective action. In fact, diversity is valuable for innovation. The collective-action literature commonly observes that diversity within a group impairs collective action. Papa Andina's experience confirms that diverse groups may be more difficult to establish and maintain over time, and that good facilitation is essential. But, in line with the innovation literature, diverse groups are potentially more productive in terms of social learning and innovative behavior. Papa Andina's experience shows that a well-facilitated group, with diverse backgrounds, values, and economic interests, can coalesce into a high-performance team that actively, creatively, and successfully pursues the common objective of market-chain innovation.

Papa Andina's work illustrates the synergies of different forms of collective action at different levels: stakeholder platforms and the PMCA have proven to

be highly complementary. At the market-chain level, groups have found that exploitation of new market opportunities often requires collective action at the local level, and vice versa.

In many cases, collective action has been short lived, linked to accomplishment of the initial goal. In others, it has evolved into more formal and stable multistakeholder associations. Much of the collective-action literature seeks to identify factors that contribute to sustainable institutions. While clearly important for natural-resources management, institutional sustainability is perhaps less relevant for innovation processes. Our experience highlights the dynamics of collective action—the different ways in which it has emerged and the different courses it has taken over time as social capital and leadership capacities have been built up and institutions have emerged.

Papa Andina's work highlights the initial importance of competent external facilitation and support. The collective-action literature notes that many local organizations are established as a result of external interventions. However, the roles of external agents and the capacities they need are seldom carefully assessed. In collective action for market-chain innovation, facilitators need to motivate business development, and at the same time foster development of social capital and leadership within the group. This often involves a delicate balance between achievement of short-term results (for example, new products) and the development of sustainable institutions that can foster innovation processes.

### **Policy Implications**

Three broad policy implications come out of Papa Andina's experiences with collective action. First, institutional innovations in R&D (such as use of the PMCA and stakeholder platforms) can lead to technical and institutional innovations that enhance small-farmer market participation. For example, as a result of the PMCA, new native-potato products were launched. This stimulated the formation and strengthening of farmer organizations, which facilitated marketing and improvements in production and postharvest practices. At the market-chain level, formal associations were established, such as the Bolivian Andean Platform in La Paz and CAPAC-Peru.

Second, market-chain innovation for indigenous agricultural products can aid in-situ conservation of biodiversity. In Bolivia and Peru, commercial innovation with native potatoes has been a key element in linking small farmers to markets. Until recently, urban consumers did not appreciate the cultural value and nutritional characteristics of native potatoes. However, recent concerns for food quality and safety have stimulated demand for locally grown,

organically produced foods, reflected in the number of gourmet restaurants serving dishes based on indigenous products. These trends have created new market opportunities for indigenous foods, including native potatoes. The resulting products also have export potential, because they are seen as exotic and nutritious. As Smale (2006) and others have shown, increasing farmer returns to crops with a high public value, such as native potatoes, will enhance the incentive for farmers to maintain agrobiodiversity. Applications of collective-action approaches such as the PMCA may also prove useful for the conservation of other indigenous agricultural products in other settings.

Last, for R&D organizations to contribute to market-chain innovation, they must develop their capacity to facilitate and participate constructively in collective action. Pro-poor innovation goes far beyond the traditional R&D. Implementing the PMCA requires R&D organizations to have the capacity to diagnose innovation systems and facilitate group processes involving people with diverse stakes in a commodity's production, marketing, and use. Women's opportunities for participation in collective-action processes like the PMCA and the potential benefits need to be addressed more systematically. To effectively facilitate such processes, R&D organizations need new skills and resources. Retooling themselves to play these new roles is likely to pose major challenges for many R&D organizations.

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## MULTISTAKEHOLDER PLATFORMS FOR LINKING SMALL FARMERS TO VALUE CHAINS: EVIDENCE FROM THE ANDES<sup>1</sup>

Graham Thiele, André Devaux, Iván Reinoso, Hernán Pico,  
Fabián Montesdeoca, Manuel Pumisacho, Jorge Andrade-Piedra,  
Claudio Velasco, Paola Flores, Raúl Esprella, Alice Thomann,  
Kurt Manrique, and Doug Horton

### Introduction

Developing countries have seen the reconfiguration of value chains presenting new opportunities for adding value and raising rural incomes (Gibbon 2001). Supermarkets and large-scale food manufacturers have transformed agrifood markets in much of the developing world (Reardon and Berdegú 2002). There is an extensive literature about the effects of this new economy on the potential exclusion of small farmers, who produce small volumes on dispersed fields and struggle to meet demands for quantity, quality, and timeliness of delivery. The difficulty is compounded by a lack of trust among farmers and other value-chain actors, which generates high transaction costs and short-circuits innovation. A recent review by Reardon et al. (2009) confirmed a mixed picture with some exclusion of small farmers in contexts where small and large farmers coexist, but also evidence of positive effects on income and assets of small farmers where inclusion occurs. Reardon et al. (2009) pointed out the critical nature of nonland assets such as inputs, credit, association, and extension, and the role of government to help small farmers “make the grade.” Many ongoing initiatives seek to improve value chains and favor poorer farmers (Harper 2010).

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This chapter explores the role of multistakeholder platforms in promoting inclusion of small farmers. It considers three different platforms with potato value chains in the Andes (Bolivia, Ecuador, and Peru). It presents a framework for characterizing and understanding platforms, with an action arena comprised of innovation and market governance. It then assesses evidence of the platforms' effectiveness and flags areas for future work.

## Literature Review and Theoretical Framework

The term *platform* is in vogue. Sometimes it refers to a methodology, such as Farmer Field Schools (FFS), or to any group that comes together for joint action. Building on Röling, Leeuwis, and Pyburn (2002) and Thiele et al. (2005), we define a multistakeholder platform *as a space of interaction among different stakeholders who share a common resource and interact to improve mutual understanding, create trust, define roles, and engage in joint action*. Henceforth we refer to this as a “platform.” It is related to the concept of learning alliances which promotes multistakeholder learning processes for stimulating innovation and business development, but differs in that it has a clearly bounded membership linked to a shared resource (Lundy, Gottret, and Ashby 2005).

Platforms involve stakeholders of diverse types, with different interests, ways of making a living, and assets. A producer cooperative is not a platform, because it includes only one type of actor. A platform has value for stakeholders, because they are, or may become, interdependent. Interdependence can create tension, conflict, maneuvering to seek advantage, and even group displacement. But it also opens opportunities for mutual understanding, building confidence, social learning, and joint action (Röling, Leeuwis, and Pyburn 2002). The platform makes possible actions that none of the members could have achieved on their own. Because of its complex membership and potential for conflict, a platform is likely to require facilitation and may have a lengthy initial phase of mutual learning and role definition, before it can get down to business (Thiele et al. 2005).

Stakeholders can have different roles in a platform. We distinguish platform *members* who are the core actors who make up the platform; *partners* who interact with the platform, contribute to defining its objectives, and share information and other resources; and *clients* and *providers* who may receive goods or services from the platform or provide them on a commercial basis. In practice, these categories may be somewhat blurred and some members may be more passive than partners.

Multistakeholder platforms were first proposed in the context of natural-resource management, where stakeholders share a common-pool resource, such as access to water in a river basin, and the platform contributes to the collective management of the resource (Röling, Leeuwis, and Pyburn 2002). The use of platforms in the context of value chains is less frequent. A recent overview of collective action for small-farmer market access considered small-farmer organizations, but did not mention platforms (Markelova et al. 2009). One exception is Vellema et al. (2009), who analyze an oilseed-subsectoral platform in Uganda.

In a value chain, a platform can perform three different but interlinked functions. First, it can create a space for learning and joint innovation, as innovation intermediary or broker. Second, it can perform a governance function within the value chain to improve coordination of business activities by actors and reduce transaction costs. Finally, a platform can perform advocacy functions to secure policy change or influence. We concentrate on the first two functions.

### **Learning and Innovation**

Increasing attention is being given to intermediaries or brokers to promote innovation (Howells 2006). Klerkx, Hall, and Leeuwis (2009) recognize that new types of systemic intermediary are needed to broker innovation in a complex innovation system. Klerkx and Leeuwis (2009) describe the key innovation brokerage functions as: (1) demand articulation, which articulates innovation needs and corresponding demands; (2) network formation, which facilitates linkages between relevant actors (scanning, scoping, filtering, and matchmaking of possible cooperation partners); and (3) innovation-process management.

Platforms have been also used as a type of innovation intermediary in the experiences described here in the Andes. In this sense, they complement, and (in two of the cases, Bolivia and Peru) build on, the Participatory Market Chain Approach (PMCA): a three-stage facilitated process that promotes innovation by strengthening trust and constructive interactions among chain actors (Bernet, Thiele, and Zschocke 2006). In a similar vein, Critchley, Verburg, and van Veldhuizen (2006) have emphasized the role of platforms as a space or theater for innovation involving different stakeholders.

### **Value-Chain Governance**

Value-chain governance may be provided by: (1) market mechanisms, (2) hierarchical nonmarket mechanisms, and (3) nonmarket-based voluntary coordination between actors of a collective action type (Markelova et

al. 2009). Dorward et al. (2009), writing from a new institutional economics perspective, note that coordination provided through different nonmarket mechanisms can help market actors reduce transaction costs and escape the low-level equilibrium trap associated with underdeveloped economies as a weak institutional environment and high transaction risks limit investment opportunities.

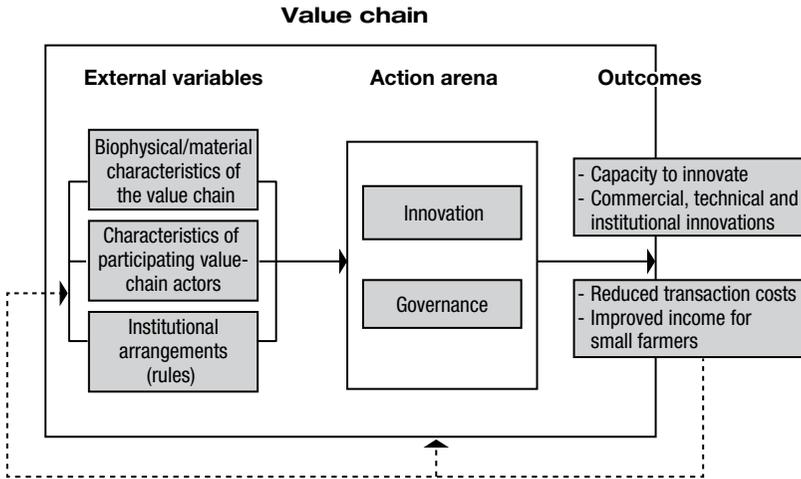
Developed countries have seen the emergence of supply-chain management, defined as the “integration of key business processes from end-user through original suppliers that provide products, services and information that add value for customers and other stakeholders” (Lambert 2008). Given the increasingly “disintegrated” nature of supply chains made up of different enterprises in automotive, textile, and electronic industries, Bitran, Gurusurthio, and Lin Sam (2006) postulate the need for a neutral third player or *maestro* to coordinate the network of suppliers.

The need for increased integration in developing countries and the disintegration of more hierarchically organized supply chains in developed countries has created a curious convergence with the need for new types of institutions to facilitate value-chain governance. As we shall see below, platforms have provided one such institutional mechanism for this market-governance function.

The Institutional Analysis and Development (IAD) framework was developed to explain the functioning of common-pool resource systems and has been applied in many empirical contexts (Ostrom 2005, 2010). The focus is on understanding the formal and informal rules that affect behavior in an *action arena*, where actors interact, make decisions, take actions, and experience the consequences of these actions. Behavior in the action arena is conditioned by: (1) biophysical conditions, (2) the attributes of community, and (3) the set of rules in use. Behavior in the action arena determines *outcomes*, and these outcomes and the valuation that actors make of them reshape the external variables and the action arena.

The present chapter further develops the IAD framework to understand the role of platforms in a value chain (Figure 8.1). It specifies as external variables the biophysical and material characteristics of the value chain, characteristics of the chain actors, and institutional arrangements which can be described as a set of rules. The rules are of quite diverse types, some have to do with who can be a member of the platform and what roles they may perform, and others to do with the types of benefit they receive through membership. Some of the rules are implicit, while others, as we shall see, are explicit and written. These external variables jointly determine and shape possibilities in the action arena made up of innovation and governance sub-arenas. These

**FIGURE 8.1** Framework for analyzing collective action in value-chain innovation and governance



**Source:** Adapted from Devaux et al. (2009).

sub-arenas interact as innovation can generate new governance opportunities, and improved governance interacts with innovation processes. Finally, actions in each sub-arena lead to a range of linked outcomes and benefits for actors. Next, we apply the IAD framework to analyze the three platforms and their contribution to stimulating innovation and improving governance.

## Platforms Compared

The three platforms we compare are: Andino Boliviana (ANDIBOL) in Bolivia; Cadenas Agrícolas Productivas de Calidad (CAPAC) in Peru; and the Chimborazo platform in Ecuador.<sup>2</sup> We begin by examining the three sets of external variables that condition the action arena of the platforms. We describe the platforms in the present tense, and the description relates to their status when this study was initiated. The Chimborazo platform was substantially restructured in 2006.

<sup>2</sup> These platforms were brought together by the Papa Andina Partnership Program of the International Potato Center (CIP). Papa Andina encouraged the development of the platform concepts and cross-learning between partners (Thiele 2007; Devaux et al. 2009).

### **Biophysical and Material Characteristics of the Market Chain**

Potato production in the Andes involves a mix of small, medium, and (in Peru and Ecuador) large farmers. Small farmers typically occupy land at higher altitudes, with poorer access, less input use, and often grow a relatively larger area under native varieties (landraces). Medium and larger farmers occupy higher-quality valley-bottom land, with better access and more input use, and typically have a much larger share of marketed production.

Most potatoes in value chains in Bolivia, Peru, and Ecuador still go through traditional market channels, with a large number of rural assemblers, supplying wholesale urban markets and a network of urban retail markets with graded potatoes of a considerable range of varieties sold loose to the consumer. In general, this market appears to be fairly efficient, with no clear evidence of excessive levels of intermediation (Scott 1985). The market is dominated by spot prices with high price volatility. Transaction characteristics with small volumes managed by each market intermediary make it difficult to plan for investments in improving product quality, and hinder innovation.

The three platforms described link farmers with high-value chains rather than with traditional market chains. These offer more scope for value-added, with potentially higher and more stable farmgate prices (in some cases with forward contracts), but may require considerable innovation for the entry of small farmers if they are to meet stricter quality and quantity criteria. In Peru and Bolivia, the focus is on native potatoes, one of the assets of poorer farmers, grown primarily for home consumption or local markets (Meinzen-Dick, Devaux, and Antezana 2009). Native potatoes were selected as having the greatest probability of generating benefits to poorer farmers as value-chain upgrading takes place. In Peru, the target market for native potatoes centers on high-income consumers in Lima, a large city with a growing middle class and a rapidly expanding agroindustrial sector. The challenge is to create a niche market for native potatoes as part of a more general interest in Andean cuisine. In Bolivia, while the market also centers on native potatoes and derivative products, the middle class is much smaller and there are no large agro-processors, so nontraditional retail outlets are the primary market. In Ecuador, native potatoes are much less widely grown and the market opportunity is a large agroindustrial chip producer, and fast-food outlets and restaurants which need potatoes for French fries. Medium and large farmers predominantly access this value chain, so the challenge is not to stimulate the creation of a new market, but to create a space for small farmers within an existing one.

### **Characteristics of Participants**

In each case, an agricultural research organization assumed the role of platform facilitator: the PROINPA (Promoción e Investigación de Productos Andinos) Foundation in Bolivia; Instituto Nacional Autónomo de Investigaciones Agropecuarias (INIAP) in Ecuador; and the International Potato Center (CIP), through the Innovación y Competitividad de la Papa (INCOPIA) project, in Peru. All these partners had experience with participatory approaches for on-farm research, but had not engaged multiple stakeholders to work with markets. The research organization learned how to assume a new role in facilitation of the process of platform creation and to “step back” and play a subsidiary role in research to address specific market constraints.

The CAPAC (Peru) and ANDIBOL (Bolivia) platforms were established by INCOPIA and PROINPA, respectively, resulting from applications of the PMCA with native potatoes, as more permanent forums to support the innovation process (Devaux et al. 2009). In the PMCA, the participation of private market-chain actors as members and partners to develop new business opportunities underpins the innovation process (Bernet, Thiele, and Zschocke 2006). ANDIBOL includes food-processing companies, such as Ricafrut, Ascex, and Bolivia Natural; farmer organizations, such as Asociación de Productores Ecológicos de la Provincial Aroma (APEPA); non-governmental organizations (NGOs), such as Kurmi Foundation; and others (Table 8.1). CAPAC interacts with some private-sector actors as members (formal membership), including Mi Chacra, a supplier of marketing information; the Gastrotur cooking school; potato processors, including Frito-Lay, a multinational chip producer; and the Wong supermarket group. Researchers and other agricultural service providers, including the NGOs Asociación Fomento de la Vida (FOVIDA) and Asociación para el Desarrollo Sostenible (ADERS), promote and support these market-driven platforms.

In Ecuador, the INIAP team, which facilitated the creation of the Chimborazo platform, was critical of the PMCA; they felt it paid insufficient attention to farmer empowerment and perceived a risk of capture of the benefits of innovation by the private sector. However, they recognized that broader impact for agricultural research means engaging a broad range of stakeholders with a clearer market orientation. The Chimborazo platform brings together 28 farmer organizations and a group of service providers comprised of three NGOs, two universities, and INIAP itself. Frito-Lay and restaurants serving French fries in Riobamba and Ambato are involved, but as clients rather than

full partners. Here the meshing of farmers and service providers in the platform is the driver of the innovation process.

### **Institutional Arrangements (Rules)**

Engaging such diverse sets of stakeholders for collective action in value chains requires a broad set of rules to guide and shape their interaction. Some rules are explicitly formulated—all platforms have written statutes that define their mandate or mission, and describe leadership positions (Table 8.1). Other rules are implicit or informal.

In CAPAC and ANDIBOL, rules about platform membership embodied in formal statutes give private market-chain actors a privileged position, as their decisions about new market opportunities underpin innovation options. Researchers and other service providers play a supporting role in sustaining innovation.

In the Chimborazo platform, INIAP seeks to build on the existing mandates and interests of a group of research and development (R&D) actors or service providers in the potato sector, recognizing that each has a particular competence, but guided by a new set of institutional rules called the “New Institutionality,” whereby each can best capture their comparative advantage (Crespo et al. 2005). Farmers organize the production process and demand an array of services provided by R&D organizations; NGOs provide technical assistance; and research organizations develop new technology to facilitate small-farmer entry into markets. Value-chain actors such as restaurants and supermarkets are treated as clients. These rules are most clearly articulated around multistakeholder platforms conceived as local alliances between farmers and R&D organizations. INIAP helped set up four platforms (among them the Chimborazo platform) differentiated by market catchment area. The rules for identifying and engaging actors are specified through a methodology that stipulates a series of steps in setting up the platform around a market opportunity (Reinoso et al. 2007). The steps include stakeholder mapping to identify and engage relevant platform members, and designation of one of the service providers to host the platform and assume more specific facilitation responsibilities.

Each of the platforms has different rules regarding the outcomes which they can affect. CAPAC and ANDIBOL have mandates to promote and develop value chains for potato and other Andean tubers and Andean products (Table 8.1). As discussed above, in these platforms it is the participation of private market-chain actors that drives innovation. In order to ensure that benefits flow to small farmers, both platforms have complementary

TABLE 8.1 The platforms compared: coverage, mandate, objectives, coordination, and stakeholders

Characteristic	CAPAC Peru	Plataforma Andina Boliviana (ANDIBOL)	Plataforma Chimborazo
Coverage	National, Peru, concentration Huancavelica, Junín, Ayacucho, Apurímac departments	Department La Paz, Bolivia	Chimborazo province, Ecuador
Period	2003–ongoing	2007–ongoing	2003–2007 (from 2007 most functions assumed by CONPAPA)
Mandate or mission and small-farmer orientation	<ul style="list-style-type: none"> <li>Second-level organization for social, economic, and technological development providing specialized services for the development of value chains of potato and other highland tubers</li> <li>Support improving income and employment of the actors who take part in value chains for tubers, and small farmers in particular</li> </ul>	<ul style="list-style-type: none"> <li>Promote and facilitate the development of businesses with Andean products. Motto: “Business with corporate social responsibility”</li> </ul>	<ul style="list-style-type: none"> <li>Achieve positioning in the small farmers’ potato agroprocessing market in the province of Chimborazo, supporting production, improving marketing mechanisms, and strengthening their entrepreneurship structures</li> </ul>
Facilitation/coordination	<ul style="list-style-type: none"> <li>Backstopping INCOFA (CIP)</li> <li>General manager</li> <li>Technical manager</li> <li>Board</li> <li>General assembly</li> </ul>	<ul style="list-style-type: none"> <li>Facilitation: PROINPA</li> <li>Board: coordination, business development, technological innovation, and commercial development</li> </ul>	<ul style="list-style-type: none"> <li>Backstopping and general facilitation: INIAP</li> <li>Full-time platform coordinator with NGO</li> <li>Board selected from farmers</li> </ul>
Stakeholders	<p>Members:</p> <ul style="list-style-type: none"> <li>Five producer organizations (635 families)</li> <li>NGOs: FOVIDA, SEPAR, DESCO, ADERS-Peru, PROANPE</li> <li>Small agro-industries: Mi Chacra, A&amp;L, Colcahuasi</li> <li>Others: Union of Stevedores of Lima wholesaler market, cooking school Gastrotur, Mi Chacra (market information service provider), four wholesalers (handle “Mi Papa” brand)</li> </ul> <p>Partners:</p> <ul style="list-style-type: none"> <li>Government bodies (MINAG, EMMSA), regional governments, Junin and Ayacucho</li> <li>Private companies: Wong Corporation, Frito-Lay, Villa Andina, Gloria Group, etc.</li> <li>Research centers (CIP, INIA)</li> </ul>	<p>Members:</p> <ul style="list-style-type: none"> <li>Producer associations: APEPA, APROECA, ASOPRACH, UNAPA, and FLOR DE HABA</li> <li>Private companies: DEZE Ltda. (loading and unloading), RICAFRUT (processing, marketing, and export), ASCEX (processing and export), and BOLIVIA NATURAL (processing and export of Andean grains)</li> <li>Support organizations: KURMI (NGO), Program of Business Development, PRO-FIN Foundation (finance), and PROINPA Foundation (research)</li> </ul>	<p>Members:</p> <ul style="list-style-type: none"> <li>Associations and producer organizations (28 organizations and 324 families from Licto, Pungala, Llicud, Cebadas, San Andrés in Chimborazo province in 2006)</li> <li>NGOs: CESA, CECI, MARCO Foundation</li> <li>PODER project and marketing company (SDC)</li> <li>Research organizations: ESPOCH and UNACH (universities) and INIAP</li> </ul> <p>Clients:</p> <ul style="list-style-type: none"> <li>Frito-Lay for chips</li> <li>Restaurants in Riobamba and Ambato for French fries</li> </ul>

Source: Authors.

Note: A&L = A&L Peru SAC; ADERS = Asociación para el Desarrollo Sostenible; APEPA = Asociación de Productores Ecológicos Primero Aroma; APROECA = Asociación de Productores Ecológicos y Conservadores Andinos; ASOPRACH = la Asociación de Productores Agropecuarios de Chirapaca; ASCEX = Procesamiento y Comercialización de Productos Andinos; CEG = Center for International Studies and Cooperation; CESA = Central Ecuatoriana de Servicios Agropecuarios; CIAT = International Center for Tropical Agriculture; CONPAPA = Consorcio de Pequeños Productores de Papa; DESCO = Centro de Estudios y Promoción del Desarrollo; DEZE Ltda = Agentes consolidadores y desconsolidadores de carga para productos de exportación; EMMSA = Empresa Municipal de Mercados S.A.; ESPOCH = Polytechnic High School of Chimborazo; FLOR DE HABA = Asociación de Productores Agropecuarios Chiva Cocani; FOVIDA = Fomento De La Vida; INCOFA = Innovación y Competitividad de la Papa; INIA = Agrícola y Competitividad de la Papa; INIAP = Instituto Nacional Autónomo de Investigaciones Agropecuarias; KURMI NGO = Apoyo al Desarrollo Sostenible Interandino; MARCO = Minga para la Acción Rural y la Cooperación; MINAG = Ministerio de Agricultura, Peru; Proyecto PODER = PODER Project; PROANPE = Procesadora Andina del Peru; PROFIN = Foundation for productive and financial development; PROINPA = Fundación para la Promoción e Investigación de Productos Andinos; RICAFRUT = Industrializadora, Transformadora y Comercializadora de productos alimenticios; SEPAR = Servicios Educativos, Promoción y Apoyo Rural; UNACH = Universidad Nacional del Chimborazo; UNAPA = Unión de Asociaciones de Productores del Altiplano.

rules, embodied in the formal objectives of the platforms, concerned with the inclusion of small producers and corporate social responsibility (CSR) (Thomann et al. 2011).

The Chimborazo platform focuses explicitly on strengthening small-scale potato producers and positioning them in the market for processed potato. Here it is the meshing of small farmers and service providers that drives the innovation process. Many farmers attend platform meetings and are active participants. The Chimborazo platform treats private-sector actors as clients rather than as members or partners, and they do not attend ordinary platform meetings. Initially, the primary client was seen as Frito-Lay, but in practice it was difficult to meet the more demanding quality (levels of reducing sugars), quantity, and continuity requirements imposed by this large agroindustrial client. As a result, the most important group of clients are restaurants serving French fries in the cities of Ambato and Riobamba.

We turn now to discuss the action arenas of the platforms.

### **Action Arena**

CAPAC as a platform has only one annual general assembly; other stakeholder interaction is project- and activity-specific. In practice, involvement of some private-sector partners is more active than that of some formal members. CAPAC was created as a result of the application of PMCA with the intention to support and consolidate the innovations that had been generated earlier and to promote additional innovation. It has some action in the innovation arena, for example in technical normative commissions that can change product-quality parameters and in promoting the use of CSR among private-sector actors. However, it has become increasingly active in the governance arena, providing business services on a not-for-profit basis for linking farmers to the supply chain of processors like Frito-Lay (for example, contract management, quality control). CAPAC also plays a role in advocacy and promotional activities (for example, as National Potato Day co-organizer).

ANDIBOL has regular monthly meetings with a principal focus on stimulating new product development by its members, and supporting innovation to address market constraints. Although set up with facilitation from PROINPA, the interest in developing new businesses has meant that private-sector actors have taken a more proactive role and are seeking additional funding. At the time of writing in 2009, ANDIBOL members are reframing and redefining the set of internal rules and statutes governing the operation of the platform and members' behavior to promote trust and

improve decisionmaking. Specifically, they are working on the definition of rules related to the entry of new members and those associated with the use of the “Chef Andino” trademark and “ANDIBOL” certification hallmark, both created by the platform. The first will be used as a commercial image to introduce new products to urban markets, and the second as a certification label to show that products have been developed with CSR (and generating benefits flowing back to small producers).

The Chimborazo platform has monthly meetings which focus on planning production, meeting quotas for delivery to clients, and overcoming technical constraints to improve the quantity and quality of potatoes produced. These platform meetings build on and complement planning by the NGOs and the farmer organizations they work with to meet their shares of the quota. One of the first activities of the Chimborazo platform was to coordinate farmer training through the implementation of FFS. INIAP and other NGO partners had organized FFS previously (Pumisacho and Reinoso 2003), but this was the first time that they were articulated around a specific market opportunity. The FFS covered traditional topics in integrated pest and crop management linked to the introduction of a new processing variety, Fripapa,<sup>3</sup> and also included new sessions on marketing, leadership, production costs, and pesticide management. INIAP trained NGO staff and farmer promoters as FFS facilitators, and provided backstopping to FFS implementation. The farmer training linked to the platform was substantial, and played a key role in facilitating technological innovation linked to the new variety to enable small farmers to meet quality and quantity parameters set by the market (Cavatassi et al. 2009).

The Chimborazo platform also planned interactions with clients and partners to capture demands and build networks to link producers with suppliers. In 2004, for example, a business roundtable was held with potential clients, primarily restaurants, for the Fripapa variety (suitable for frying) and other improved varieties. This had stands with information about research and training activities of the platform, production plans to assure regular supply, and bags of Fripapa with the CONPAPA label. The Cooking School from the local university Escuela Superior Politécnica del Chimborazo (ESPOCH) prepared French fries and other processed potato products, and restaurants were asked to estimate purchasing needs by variety (Reinoso et al. 2007).

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3 Processed variety released by INIAP from clones provided by CIP.

### Innovation Outcomes

CAPAC played a critical role in the creation of trademarks for native potatoes, a type of commercial innovation. First, CAPAC's collective trademark "Mi Papa" recognizes quality across a diverse range of potato-based products. Second, the "Andean Potatoes Label" is a certification trademark for native-potato trade with CSR. CAPAC participated in the public-private workgroup to define quality parameters for selling under the label and was chosen by the group to be the legal owner of the brand (Thomann et al. 2011). CAPAC also provides expertise to private partners for the creation of new products. It helped establish "Ayllin Papa," a product owned by a provider of the Wong supermarket, with clean, graded, bagged, and labeled native potatoes, which targets the gourmet high-value market.

With regard to technological innovation, production of native potatoes in Peru is highly seasonal, and sprouting and dehydration lead to progressive loss of market quality after the peak period of harvest. CAPAC linked with researchers at CIP to extend the period of supply through modifications to storage methods and the use of sprout inhibitors in stored potatoes (Manrique and Egusquiza 2009).

ANDIBOL has also acted as broker for technological innovation. "Chuñosa" is a packaged and graded product made from *chuño*, an artisanally freeze-dried potato that can be stored for long periods of time and is a key ingredient in some local dishes. *Chuño* is normally produced using very basic technology, under unhygienic conditions, and sold ungraded with impurities. The Ricafrut processing company, which owns the Chuñosa label, wanted to improve the product. They requested help to improve the quality and grading of the *chuño* raw material. The platform brokered this demand to improve cleanliness, grading, and presentation with PROINPA and Kurmi Foundation, which subsequently carried out participatory research to develop a potato peeler and grader. The manager of Ricafrut visited the production area to see how the machines performed and verify if the *chuño* obtained met market quality standards.

The Chimborazo platform only played a limited role in commercial innovation. This was related to the material characteristics of the market chain. The platform did not develop any new products, but instead sought to exploit existing market opportunities for French fries with restaurants in Ambato and Riobamba. It played a central role in articulating the demand for a potato suitable for frying from the platform's clients, refining the technology for the supply of quality potatoes of the Fripapa processing variety

from small farmers through the FFS, and establishing local farmer capacity for multiplying high-quality seed. This was a complex technological innovation. Because processing characteristics are variety-specific, the exploitation of a new market for potatoes for French fries, which involved a specific technological innovation (the new variety), triggered a series of other innovations. For example, restaurants prefer larger tubers for French fries. But Frippapa, initially selected by breeders for chipping, produces predominantly medium-sized tubers. This demand for larger tubers was brokered through the platform and led to the implementation by INIAP of research on planting densities and fertilization to increase the percentage of larger tubers and acceptability by the restaurants.

All three platforms stimulated market-linked innovation functioning to differing degrees as innovation facilitators or brokers performing brokering functions described by Klerkx et al. (2009). The type of innovation which occurred was shaped by the material characteristics of the value chains and the characteristics of the participating actors. For CAPAC and ANDIBOL, where a new market opportunity was created, commercial innovation was especially important and specific innovations, such as trademarks, were developed to ensure that benefits from value-chain upgrading flow back to small farmers. For the Chimborazo platform, where an existing market opportunity was exploited and innovation was driven by linking small farmers and service providers, technological innovation around the Frippapa processing variety predominated. The innovation outcomes in all cases were complex and would have been hard to achieve by a single R&D actor on its own. They involved an interaction between commercial and technological innovation, involving both private value-chain actors and service providers in the platforms in Peru and Bolivia, and a complex technological innovation combining varietal change, improvements in quality, and adjustments in cultural practices coordinated between service providers and farmer organizations in Ecuador.

### **Market Governance Outcomes**

In Peru, CAPAC has been instrumental in providing transparent information on price and volumes. It has assumed an important role in market governance by linking farmers' native potato production to Frito-Lay and Ayllin Papa through intermediary NGOs. Indeed, in the areas where no local partner (NGO) is available, CAPAC carries out more specific and local market-governance tasks (contract management, quality control, and delivery at the plant) that cannot yet be handled by farmer organizations, and provides them with orientation and capacity building for planning, production, and

postharvest management. In these areas, planning meetings among CAPAC and farmer representatives are held at the beginning of every planting season to establish quotas by area and planting times to organize production supply. This direct role as marketing agent may conflict with that of a national stakeholder platform, providing transparent information on native-potato supply and a higher-level integration function with the intermediary NGOs.

In Bolivia, ANDIBOL played an important facilitating and coordinating role, linking farmer organizations with exporting companies, and contributing to the supply of quality *chuño* for the export market. Without ANDIBOL it would have been impossible for *chuño* to enter export markets (Enrique Rivas, pers. comm.).

The Chimborazo platform played the most extensive role in market governance. The platform developed and monitored production plans with farmer quotas by market catchment areas to smooth the supply of potatoes to clients. This supply-chain management function was time-consuming and involved most of the time of the coordinator of the Chimborazo platform working with the intermediary NGOs. In addition, the platform empowered farmer organizations and associations to assume a greater leadership role. This began with FFS, which helped build social capital by creating trained and organized groups and included specific training in leadership with a particular emphasis on women. This process of empowerment led to the creation of Consorcio de Pequeños Productores de Papa (CONPAPA, Consortium of Small Potato Producers), which from late 2006 took over the technical assistance, production planning, bulking up, and marketing functions that the Chimborazo platform had previously performed.

## Impacts

The scale, sequence, and timing of the impacts of the platforms—understood as livelihood improvements for small farmers—differed. Platforms in Peru and Bolivia primarily involve the creation of new market opportunities for native potatoes with innovation brokering along a value chain, and benefits flowing back from the value chain to the small farmers. The immediate benefits of innovation brokers are often intangible and the time frame for change to work its way through the innovation system may be quite long (Klerkx et al. 2009). But because private market-chain actors are driving the innovation process, this change may be more pervasive and sustainable. In contrast, in Ecuador the platform was oriented toward existing market opportunities structured around geographically delimited supply areas composed of small farmers, and has primarily addressed market-governance problems in assuring

volumes, meeting quality and timeliness constraints, as well as empowering farmers. This generates a more immediate and higher impact but, because engagement of the private sector is weaker, the eventual scale of the impact could be less than in the first case.

In 2009 the companies linked to ANDIBOL sold over 9,000 half-kilogram bags of Chuñosa and nearly 3,300 boxes of Chef Andino. Exports have begun to Spain, so far benefiting 70 families directly, who receive US\$1.10/kg. These products are still in a pilot stage of development and the final market size and potential for increased farmer income is not yet clear.

In Peru, there has been a rapid growth of native potato marketed through CAPAC and its members to Frito-Lay, the fresh market, and as seeds, doubling from 2008 to 2009 and reaching over 400 tons.<sup>4</sup> Farmers selling through these channels received around double the price in traditional markets, with a profit margin over 20 percent, and reported significantly higher yields.

The clearest and largest evidence of impact comes, as expected, from the platforms in Ecuador (Cavatassi et al., 2009). By 2007, some 1,483 tons of potato from 260 ha were marketed through the platforms by smallholder farmers (average landholding 2.6 ha). Platform farmers obtained an average yield 33 percent higher than nonparticipants. Their input costs were also higher, but despite this their profit (gross margins) was approximately four times greater thanks to the higher yield and a 30 percent higher selling price. Secondary indicators suggest that the linking to the platforms did not lead to negative consequences for farmers from the intensification of agricultural production (careful attention was given to risks and precautions regarding pesticide use and to integrated pest management in FFS training).

## **Outstanding Questions and Issues**

### **Limited Underlying Conceptual Base and Methodology**

Despite developing a general definition of platforms and exchanges of ideas among partners, there has been little explicit theory behind the creation of the platforms. One attempt to provide a more general explicit theory was published but not widely applied among Papa Andina and its partners (Thiele et al. 2005). Theory behind platforms has been mostly implicit and the platform facilitators involved followed their noses in pragmatically developing the

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<sup>4</sup> *Ton* means metric ton throughout.

platforms. Only one platform (Ecuador) had a specific procedure for implementation (Reinoso et al. 2007). This lack of conceptual base, combined with the complexity of the challenges faced in increasing competitiveness of inclusive value chains, may explain why the platforms have sometimes taken on potentially conflicting functions (for example, legal owner of collective or certification brands, and market-chain facilitator for a specific geographic area and/or specific private-sector partners).

### **Funding Mechanisms and Sustainability**

All three platforms have had subsidies provided through project funding. This was probably a reasonable investment which generated acceptable returns to the use of public funding, as shown by the impact study of the Plataforma program in Ecuador (Cavatassi et al. 2009). But in the longer run, and for scaling up, other funding and management mechanisms should be explored. One such mechanism could follow the lines of US levy boards, which are funded through levies on both potato producers and purchasers ([www.idahopotato.com/](http://www.idahopotato.com/)), or models mixing levies and income from services ([www.swisspatat.ch](http://www.swisspatat.ch)). These are backed by government legislation and function in a very different institutional environment. Securing funding for the function of innovation broker where the services provided are less tangible is a challenge even in the Netherlands (Klerkx, Hall, and Leeuwis 2009).

### **Conclusion**

This chapter uses the IAD framework to understand the dynamics of three platforms linked to value chains. While all three platforms share some features, the material characteristics of the market chains they support, the characteristics of participating actors, their different underlying development paradigms, and institutional arrangements, mean that two different types of platform can be distinguished. In the first, the platform brings traders, processors, supermarkets, researchers, chefs, and others together with farmers and their associations to foster the creation of new market opportunities and commercial, institutional, and technological innovation with greater possibility of added-value for small farmers. In the second, the platform is structured around a geographically delimited supply area, meshing small farmers and service providers, and primarily addressing market-governance problems in assuring volumes, meeting quality and timeliness constraints, as well as empowering farmers, with a focus on technological innovation. Both types show indications of success, although the timescales to generate impacts

are rather different, and more time is needed to judge which would be most appropriate under what circumstances.

The platform in Peru began as the first type, but subsequently shifted toward the second, perhaps because as commercial innovations were consolidated governance became a more pressing concern. This raises a more general concern that, because of the more tangible nature of the services delivered, governance functions in platforms may tend to displace those of innovation brokers. Once this risk is appreciated, careful attention to the institutional rules which guide the functioning of the platforms could help maintain the broker function.

The evidence from these cases suggests that platforms can bring together diverse stakeholders and contribute to new products, processes, norms, and behaviors oriented toward value chains, which could not have been achieved otherwise. In addition, platforms can achieve significant outcomes, increase farmer income, and help lift small farmers out of the low-level equilibrium trap (Cavatassi et al. 2009). More systematic evaluation is still needed to assess the impacts of platforms and their cost-effectiveness relative to other types of innovation broker and mechanisms for improving market governance. Up to now, platforms have lacked a coherent theoretical framework, making their assessment more difficult. We hope that this chapter will encourage more rigorous comparative analysis and wider use of multistakeholder platforms in value-chain innovation and governance.

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## **UNRAVELING THE ROLE OF INNOVATION PLATFORMS IN SUPPORTING COEVOLUTION OF INNOVATION: CONTRIBUTIONS AND TENSIONS IN A SMALLHOLDER DAIRY-DEVELOPMENT PROGRAM<sup>1</sup>**

Catherine W. Kilelu, Laurens Klerkx, and Cees Leeuwis

### **Introduction**

Smallholder agricultural development in developing countries faces challenges and constraints related to persistent food insecurity, food price volatility, food safety, and sustainability concerns, but also is experiencing increased opportunities arising from growing domestic and global agricultural market demand (McCullough, Pingali, and Stamoulis 2008; World Bank 2006, 2007). Such a dynamic context requires the sector to continually innovate if it is to contribute to sustainable socioeconomic development. In this regard, the agricultural innovation-systems (AIS) approach has gained currency as a framework for understanding bottlenecks and identifying opportunities for enhancing the innovation capacity of agricultural systems, particularly in Africa south of the Sahara (SSA) (Hounkonnou et al. 2012; Spielman, Ekboir, and Davis 2009; Sumberg 2005; World Bank 2006).

AIS thinking recognizes that innovation occurs through the collective interplay among many actors—including farmers, researchers, extension officers, traders, service providers, processors, development organizations—and is influenced by factors such as technology, infrastructure, markets, policies, rules and regulations, and cultural practices (actors' values and norms). Thus, innovations are not just about technology, but also include social and institutional change, and have a systemic and coevolutionary nature (Biggs 1990;

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Leeuwis and van den Ban 2004). Coevolution entails mutual interaction and adaptation over time among the technological, social, and institutional components of an innovation, and therefore innovation cannot be understood and managed by separating these different components (Edquist and Johnson 1997; Ekboir 2003; Hall and Clark 2010; Nelson and Nelson 2002). However, coevolution does not mean seamless and smooth evolution, but is accompanied by tensions and sometimes incongruent actions that affect the outcomes of complex innovation processes (Leeuwis and Aarts 2011; Smits 2002).

Following the AIS perspective, the importance of recognizing and stimulating coevolution has been noted as key to promoting smallholder agricultural development in Africa south of the Sahara, and interventions increasingly focus on supporting interaction among multiple actors at different levels in agricultural production systems and value chains to enable innovation and enhance livelihoods (Ayele et al. 2012; Dormon et al. 2007; Hounkonnou et al. 2012). Such multiactor arrangements have been captured using different concepts and terminology, such as coalitions (Biggs 1990), innovation configurations (Engel 1995), innovation networks (Leeuwis and van den Ban 2004); public–private partnerships (PPPs) (Hall et al. 2001; Spielman, Hartwich, and Grebmer 2010), and innovation platforms (Adekunle and Fatunbi 2012; Nederlof, Wongtschowski, and van der Lee 2011). While these concepts are similar in their emphasis on understanding innovation as an interactive and collective process, they are mostly used as analytical concepts rather than intervention approaches, with the exception of innovation platforms and PPPs, although the latter has mainly been described in the context of research collaboration (see, for example, Hall et al. 2001; Spielman, Hartwich, and Grebmer 2010). In this chapter, we use the concept of innovation platforms, which generally has wider application in the agricultural field. We define an innovation platform as a multiactor configuration deliberately set up to facilitate and undertake various activities around identified agricultural innovation challenges and opportunities, at different levels in agricultural systems (for example, village, country, sector, or value chain).

Recent studies from Africa south of the Sahara have shown that multistakeholder platforms are contributing to agricultural innovation, citing enhanced interdependence among actors and enhanced social capital as some contributory factors (Nederlof, Wongtschowski, and van der Lee 2011; Tenywa et al. 2011; van Rijn, Bulte, and Adekunle 2012). Although these studies often point to issues such as platform composition, governance, and facilitation, they do not provide a clear understanding of how and why

these platforms shape the innovation process and contribute to the outcomes. Thus, innovation platforms largely remain “black boxes.” To understand innovation processes and how to support them through platforms, there is a need for more robust analysis of the dynamics of coevolution and the role of change agents in the process (Hounkonnou et al. 2012; Waters-Bayer et al. 2009). This chapter aims to fill this gap by unraveling how platforms shape and contribute to innovation processes, through a case study of the East Africa Dairy Development (EADD) program in Kenya. The EADD program provides a platform for stimulating multistakeholder collaboration aimed at improving productivity and incomes of smallholder dairy-producer households.

The chapter is organized as follows. The next section draws a conceptual framework that links the concepts of coevolution and innovation platform to provide an analytical framework to unravel innovation platforms. This is followed by a presentation of the research design. Then we present the findings, followed by a discussion of the merits and limitations of innovation platforms in supporting coevolution of innovation. We end with conclusions, which highlight some theoretical and practical implications of the findings.

## **Conceptual Framework**

This section first discusses the concept of coevolution and innovation platforms as innovation intermediaries. We then combine these concepts to build an analytical framework to elucidate the dynamics of coevolution of the innovation process.

### **Operationalizing Innovation as Coevolution**

AIS scholars point to coevolution as a useful concept for understanding the complexity of the innovation process, which entails continuous interaction of technical, social, and institutional elements. However, to enable a simultaneous analysis of these elements, the coevolution concept needs to be operationalized. Leeuwis and van den Ban’s (2004) adaptation of Smits’ (2002) definition of innovation as alignment of hardware (technology in the form of new technical devices), software (new modes of thinking and corresponding practices and learning processes), and orgware (new institutions and socio-organizational arrangements) aptly captures this view on coevolution of innovation and provides a heuristic for analytical purposes. The hardware elements refer to a tangible product or a well-defined set of practices that define a technology. The software dimension captures the essence of AIS thinking,

which emphasizes innovation as the outcome of interactive learning among multiple actors involving both explicit and tacit knowledge from different sources, such as scientific, experiential, and indigenous knowledge (Leeuwis and van den Ban, 2004; Oreszczyn, Lane, and Carr 2010). The characterization of the orgware dimension follows North's (1990) definition of institutions as the "rules of the game" or as human-devised rules that structure interaction, in which a distinction can be made between formal (for example, laws, regulations, standards) and informal (norms, attitudes, values) institutions. Institutions can be considered to have a twofold role, in that they provide the environment or conditions for collaboration necessary for innovation, but are also part of the innovation process and so they also need to be changed (Hung and Whittington 2011; Klerkx, Aarts, and Leeuwis 2010). Conducive institutional conditions enhancing collaboration for institutional change, or conversely a lack of them, have been underlined as key elements that enable or constrain innovation (Houkonnou et al. 2012; Klerkx, Aarts, and Leeuwis 2010; Leeuwis and van den Ban, 2004; Roep, Van der Ploeg, and Wiskerke 2003).

Coevolution points to deliberate efforts to align the technological and socio-institutional arrangements not only in the sense of trying to fit into pre-existing conditions (Leeuwis and Aarts 2011; Smits and Kuhlmann, 2004), but also in actively trying to change the socio-institutional environment, which has been referred to as effective reformism (Klerkx, Aarts, and Leeuwis 2010; Roep, Van der Ploeg, and Wiskerke 2003). Thus, innovation processes are marked by dynamics of alignment and conflict, with often unpredictable outcomes.

### **Agricultural Innovation Platforms and Their Role as Intermediaries in Innovation Coevolution**

Multiactor platforms have been noted as important interventions for creating spaces to orient interaction to enable innovation, as they stimulate changes among platform actors that eventually have greater effects in the broader environments in which these actors operate (Dormon et al. 2007; Klerkx, Aarts, and Leeuwis 2010). The platform concept has already been applied in the agricultural-innovation context to explore different modalities for collective action among multiple stakeholders around natural-resource management, for example, farmer field schools (FFS), local research committees (CIALs), natural-resource management platforms (Braun, Thiele, and Fernández 2000; Röling and Jiggins 1998). More recently, various forms of agricultural innovation platforms have been promoted as arenas for action in operationalizing

AIS interventions (Adekunle and Fatunbi 2012; Devaux et al. 2009; Nederlof, Wongtschowski, and van der Lee 2011). Platforms can have different goals and can also be structured and conceptualized in diverse forms: the focus of platforms can be research oriented, development oriented, or both, and some platforms take on more centralized forms with central coordinating structures, whereas others consist of distributed networks of interaction (Nederlof, Wongtschowski, and van der Lee 2011; Steins and Edwards 1999).

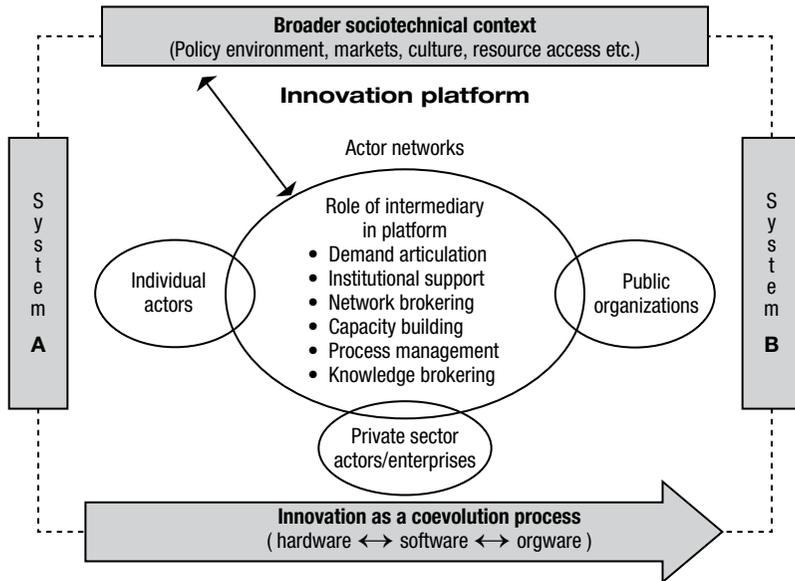
Innovation platforms generally do not emerge autonomously, but connections among platform members need to be forged and their interaction needs to be coordinated (Leeuwis and van den Ban 2004; Röling and Jiggins 1998). Building on the theoretical and empirical insights from the broader innovation-studies literature (Howells 2006; van Lente et al. 2003; Winch and Courtney 2007), AIS scholars have argued that there is thus an important role for so-called innovation intermediaries, who engage in coordinating and brokering relations at several interfaces in complex multiactor configurations in the AIS (Devaux et al. 2009; Klerkx and Leeuwis 2008a; Morriss et al. 2006). Kilelu et al. (2011) provide a collated range of functions that innovation intermediaries in agricultural innovation can fulfill; we apply these to understand the role of innovation platforms (for details see Kilelu et al. 2011). These functions include

- *Demand articulation*: Facilitating the process of identifying innovation challenges and opportunities as perceived by the various stakeholders through diagnostic exercises, visioning, and needs assessment. The needs could include access to information, technologies, finance, or institutional gaps.
- *Institutional support*: Facilitating and advocating institutional change (for example, policy change, new business models, and stimulating new actor relationships).
- *Network brokering*: Identifying and linking different actors.
- *Capacity building*: Strengthening and incubating new organizational forms.
- *Innovation process management*: Coordinating interactions and facilitating negotiation and learning among different actors.
- *Knowledge brokering*: Identifying knowledge/technology needs and mobilizing and disseminating the technology and knowledge from different sources.

Whereas literature which takes a more structural perspective on categorizing such innovation intermediaries in AIS suggests that a single innovation intermediary orchestrates innovation platforms (Batterink et al. 2010; Kilelu et al. 2011; Klerkx, Hall, and Leeuwis 2009), innovation process-oriented studies show that several intermediaries are active and that they make different connections between actors and components in innovation processes and act as change agents (Eastwood, Chapman, and Paine 2012; Klerkx, Aarts, and Leeuwis 2010; Stewart and Hyysalo 2008). This derives from the fact that innovation processes are of a highly distributed nature in terms of space and time. To resolve different problems and uncertainties (technological, social, market-related, institutional) in relation to realizing an innovative vision or problem, work is needed simultaneously at several interfaces in the innovation system (Klerkx, Aarts, and Leeuwis 2010). This suggests that the role of intermediaries in platforms can be conceptualized as ecologies or nested systems of intermediaries connecting different components of AIS and fulfilling complementary functions to guide coevolution.

Integrating these insights distilled from the literature on coevolution of innovation, innovation platforms, and innovation intermediaries, we construct an analytical framework (presented in Figure 9.1) to unravel the role of innovation intermediaries in supporting coevolution of innovation processes on the EADD multiactor platform. The model places the platform at the center and is the arena in which intermediation of innovation processes takes place, by undertaking the various intermediation functions described above. Outlining these functions provides a frame for understanding the nature of intermediation and how this contributes to innovation outcomes on the platform. The innovation processes are characterized as change, loosely from one system (A) to another (B). The change can happen through either radical (fundamental change to the system) or incremental (stepwise improvement of a system) innovation. The platform is situated in a broader sociotechnical context that influences how the change process evolves.

We now apply the analytical framework to answer the main question of this chapter as set out in the introduction: how do innovation platforms shape and contribute to the dynamics of coevolution?

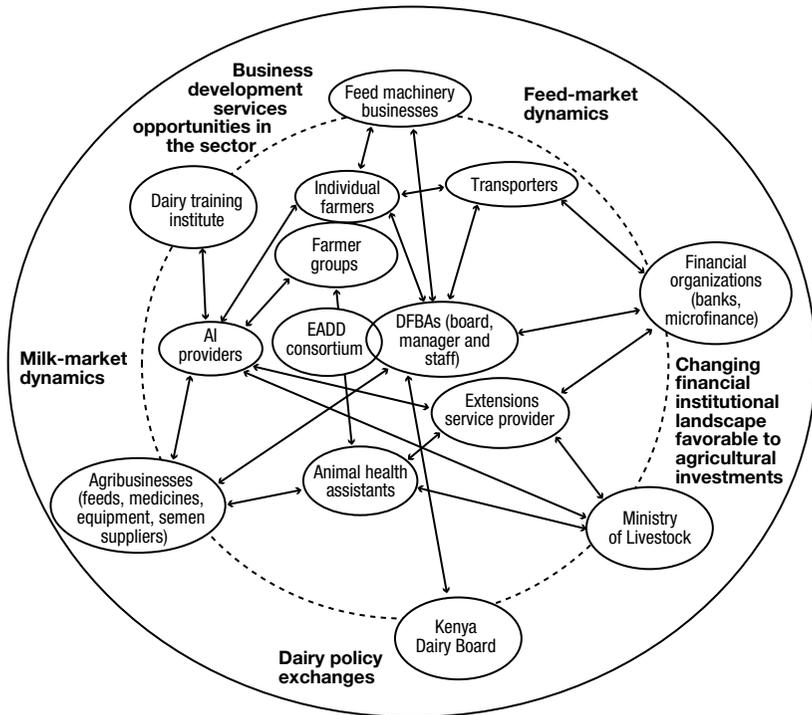
**FIGURE 9.1** Analytical framework: innovation platforms supporting coevolution of innovation

Source: Authors' elaboration based on Smits (2002), Leeuwis and van den Ban (2004), and Kilelu et al. (2011).

## Case Description and Research Methods

### Background of the EADD Program

The smallholder-dominated dairy sector in Kenya is considered to be relatively successful in the context of Africa south of the Sahara, but the sector still contends with many challenges that have limited its potential in terms of productivity, competitiveness, and improving livelihoods (Moll, Staal, and Ibrahim 2007; Muriuki et al. 2003; Technoserve 2008). To tackle these challenges, the EADD multiactor program was initiated in 2008. The EADD is being implemented in three countries in East Africa—Kenya, Uganda, and Rwanda—but this research focuses on Kenya only. The modality of the program as a multiactor platform (see Figure 9.2) in the dairy sector was noted as interesting for an in-depth study of innovation processes. EADD Kenya works at 19 sites in the Rift Valley and central Kenya regions where dairy production is concentrated. Such sites are defined in relation to one of the program's innovations—a dairy farmers' limited company (referred to as Dairy Farmer Business Association, DFBA) with an operational chilling plant

**FIGURE 9.2** A schematic presentation of EADD Kenya as an innovation platform

**Source:** Authors.

**Note:** DFBA = Dairy Farmer Business Association; EADD = East Africa Dairy Development; AI = artificial insemination.

that evolves into a local business hub. The DFBA has a catchment area that covers a radius of approximately 10 kilometers in which it aims to attract dairy farmers to deliver milk for bulking and collective marketing (EADD 2011b).

The EADD program is implemented by a consortium of five organizations: Heifer International, International Livestock Research Institute (ILRI), Technoserve (TNS), African Breeders Services Total Cattle Management Limited (ABS-TCM), and World Agroforestry Centre (ICRAF). The consortium brings in different expertise, including agricultural research, business development, and dairy production, in coordinating the program; this enables them to shape innovation in different ways.

The EADD staff, although coming from separate organizations, are all housed together in one office to enable them to work together collaboratively. As Figure 9.2 illustrates, the EADD as a multiactor platform consists of complex and layered linkages. The EADD consortium acts as a central coordinating

unit that facilitates linkages among different configuration of actors, including farmers, government agencies, and the private sector, which interact through the different DFBA (inner layer). Thus, each DFBA can be seen as a distributed platform for localized interactions among the various actors in an effort to meet the program goal. The EADD platforms operate in the broader context (outer layer) of a liberalized dairy market and increasingly dynamic agribusiness environment (in terms of a growing number of input suppliers, for example, feeds, supplements, and dairy processors and traders) in an evolving policy environment (in terms of a new dairy development policy, agricultural extension policy promoting pluralistic demand-driven service provision, policies to improve flow of credit to farmers, and so forth) (see Muriuki et al. 2003 for an overview).

### **Case Study Methods**

In line with other studies on agricultural-innovation processes (Eastwood, Chapman, and Paine 2012; Klerkx, Aarts, and Leeuwis 2010), a single case-study research design was selected as appropriate for providing in-depth insights into the dynamism of innovation processes (following Flyvbjerg 2006; Hoholm and Araujo 2011; Yin 2003). The EADD program in Kenya was selected for this study following initial exploratory research (see Kilelu et al. 2011 for details) that identified several ongoing initiatives supporting smallholder agricultural innovation in Kenya. From the exploration, the case provided indications of an innovation platform achieving tangible outcomes that made it interesting for a more in-depth study to elucidate the role of innovation platforms in supporting innovation processes. Further, as an ongoing project, it provided the opportunity to both reconstruct the innovation dynamics (Van de Ven, Polley, and Venkataraman 2008) and follow the process in real-time (Hoholm and Araujo 2011).

Because of the breadth of the program areas of focus, the research was conducted at two sites purposively selected with guidance from EADD staff—Tanykina (Kipkaren) Dairy Company Limited and Metkei Multipurpose Dairy Company Limited. Although we only studied two sites, the risk of bias in such a sampling strategy was minimized by selecting sites that were sufficiently advanced in the process of hub establishment but had followed different innovation trajectories and thus provided adequate depth of diverse experiences to elucidate the innovation process. The sites are located in separate districts in the Rift Valley region with different agroecosystems but similar mixed farming systems. Because the two sites have different histories with dairy farming, it was possible to glean a variety of insights on the dynamics of the innovation process. Tanykina was considered a pre-established site as

it had recently been established as a cooperative that had already been operating a chilling tank for cooling and bulking milk. Metkei was considered a new site where four small dairy societies worked separately and had no chilling tank. The aim of the case study was not to develop generalized, prescriptive accounts, but rather to look for patterns that could provide explanatory analysis (Flyvbjerg 2006; Yin 2003). Various data-collection methods were used to understand the processes, but also to ensure reliability and validity through triangulation. The data were collected from August 2010 to December 2011. Table 9.1 presents a summary of the data collected at each site.

Other data sources included direct observations and informal discussions from participation in various meetings and discussions during site and EADD office visits. We also conducted a semistructured group interview with six EADD team members. All focus-group discussions and interviews were taped and fully transcribed for systematic analysis. Various project reports (including annual project reports and mid-term evaluation) provided additional information. Following the analytical framework, we coded and characterized the data to identify different elements of the coevolution process in relation to the three intervention (innovation) areas and to unravel the role of the intermediaries on the platform.

## Findings

In this section, we describe the process of how EADD established and executed the program, distilling from this description the components of the coevolution of the innovation processes on the platform, and we highlight some of the issues and tensions that emerged as the process unfolded. We also examine the role of intermediaries in the processes, using the six intermediation functions described in the conceptual framework above. Quotes derived from the interviews are used to illustrate key points.

### **The Entry Point—Setting the Agenda, Mobilizing the Platform, and the Role of EADD**

The EADD program was established with the goal of improving the incomes of smallholder dairy households by implementing interventions that enhance both dairy production and market access. To guide these interventions, EADD first conducted diagnostic studies to understand the bottlenecks in smallholder dairy farming. These studies focused on three main areas: (1) improving breeding and animal health; (2) improving feed management and enhancing access to quality and affordable feeds; and (3) strengthening

**TABLE 9.1** Overview of data collection

Methods	Study site		Information gathered
	Tanykina	Metkei	
Focus-group discussion with farmers working in DMGs (approximately 15 farmers in each focus group)	8	9	History of dairy in the area; dairy production and marketing issues, linkage to DFBA access to services, marketing issues, perception of role of EADD and other actors
Focus-group discussion with non-DMG farmers (approximately 15 farmers in each focus group)	1	1	History of dairy in the area; production and marketing issues, linkage to DFBA access to services, marketing issues, perception of role of EADD and other actors, reasons for not working in groups
Semistructured interviews with Ministry of Livestock district officers	1 (5 participants)	1 (4 participants)	Views on the new DFBA business model; their collaboration with EADD, production and marketing issues
Semistructured interviews with service providers	4 (2 extension providers, AI, animal-health assistant)	2 (AISP/extension provider and animal-health assistant)	Views on the new DFBA model; links with EADD, views on production issues, their collaboration with EADD as business-service providers
Interviews with DFBA management team	3	4	DFBA history and governance; views on production and marketing issues, assessment of the challenges facing DFBA
Participation in meetings and discussions with DFBA Board of Directors	2	2	DFBA history and governance; views on production and marketing issues, assessment of the challenges facing DFBA, and collaboration with EADD
Unstructured interviews with other actors	1 (bank manager)	1 (manager of packing firm)	Involvement with EADD, views on production and market issues, the role of EADD

**Source:** Authors.

**Note:** AI = artificial insemination; AISP = artificial-insemination service provider; DFBA = Dairy Farmer Business Association; DMGs = dairy management groups; EADD = East Africa Dairy Development project.

market access for smallholders (EADD 2009a, 2009b, 2009c, 2009d). The studies pointed to areas of intervention; subsequently, how these were addressed evolved through testing and implementing various sociotechnical and institutional innovations. Furthermore, the EADD team also conducted feasibility studies to guide site selection.

As an entry point to the communities, the EADD consortium started by advancing a vision for the establishment of farmer-owned DFBA as an alternative to dairy cooperatives, which are the dominant institutional model of dairy-farming enterprises in Kenya (Technoserve 2008). Dairy cooperatives had faced several challenges over the years, with many of them disbanding for reasons such as mismanagement coupled with the collapse of the government-owned Kenya Co-operative Creameries (KCC), the main marketing channel before liberalization of the market in 1992. This had resulted in huge losses for farmers who hence became wary of cooperatives. This context informed EADD's drive for an alternative dairy business model, as illustrated by the following quote:

EADD was clear that we were only dealing with a limited liability company. Limited companies were considered less prone to challenges of accountability, governance, sound business management (EADD team interview, September 2010).

With this vision, the EADD started mobilizing dairy-farming communities. A key mobilizing strategy used by the EADD team was the involvement of the local administration and relevant government ministries at different administrative levels (for example, division and district) and local politicians. It was thought that getting these actors on board would ease entry into communities and ensure their long-term cooperation beyond the lifespan of the program. Involving the local administration was also useful in supporting the process of selecting the interim leaders for the DFBA. As one EADD team member noted on this point:

In sites where we worked with government from the word go and we had their buy in, and they contributed in selecting representatives from the community that served on the steering committee—When there was this interaction, it [mobilization] worked well (EADD team interview, September 2010).

EADD organized various public meetings to present the ideas of the program. After these first meetings, communities were invited to nominate an interim board of directors. The board members were to represent different administrative divisions where they were expected to mobilize farmers to register and purchase shares in the new company. These meetings spurred the initial platforms for interaction among multiple actors leading to the setting up of the DFBA. To demonstrate their commitment to the vision, farmers were

expected to raise an initial portion of the equity (10 percent) for the start-up that would go toward purchasing the cooling tanks and cover initial operational costs. To match farmers' 10 percent contribution, the EADD provided an interest-free loan of 30 percent from program funding, with the remaining 60 percent to be financed through commercial loans. Thus, an important intermediation role of EADD at the early stages was to mobilize farmers; support the interim leadership of the DFBA to draw up business plans; facilitate the setting up of governance structures; and bring on board other relevant actors as collaborators, broker their interactions, and support the interim leadership to raise capital.

In Tanykina, the farmer-mobilization process progressed fast because there was a pre-existing cooperative with a cooling tank (albeit running unprofitably), installed with support from Heifer International. EADD was to assist in remodeling the Tanykina cooperative into a limited company and support its further development into a business hub. In contrast, the Metkei Multipurpose DFBA was a conglomerate of four cooperative societies that were still operational but struggling: Tulwobei, Metkei, Kapkitony, and Kipsaos. This made mobilizing farmers a challenge. Although the cooperatives agreed to form the company, they retained their own members and respective organizational structure, making it difficult to mobilize farmers for the new Metkei Multipurpose Company, which was to encompass all four societies. There were underlying suspicions and competition among the respective cooperatives, as one EADD staff member noted:

There is a superficial barrier where you are working through the cooperative as a proxy. This is why in Metkei we are stuck with membership of 2,440 though there is potential to mobilize 5,000 farmers (EADD staff, interview, September 2010).

In Metkei, it took longer to raise the equity; this delayed the setting up of the chilling plant, which began full operations in February 2010, a year after EADD started its engagement with the community. Discussions with farmers indicated that there was confusion about the new entity, and this affected service delivery at later stages, as discussed below. One farmer noted the following on this confusion:

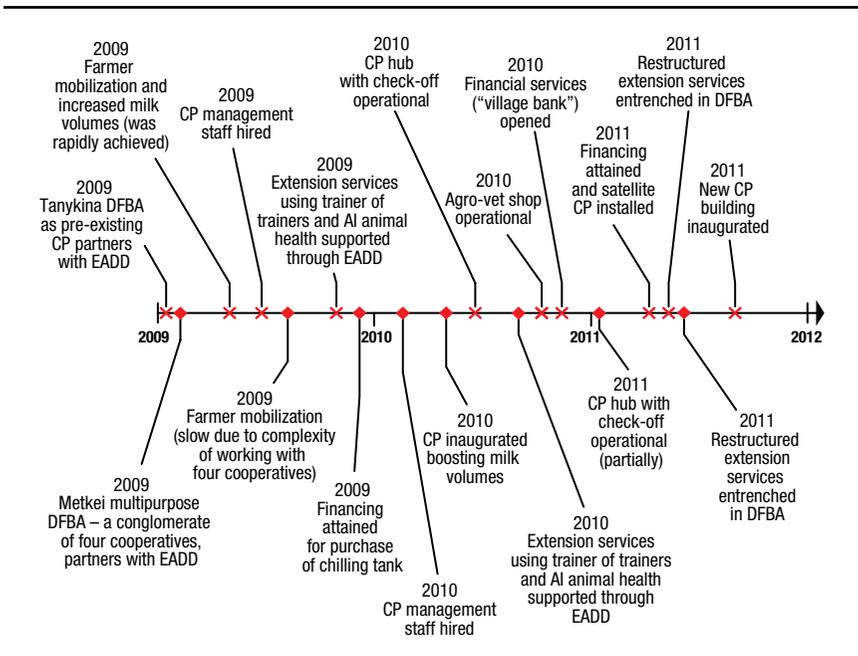
All of us have some Metkei shares, but are registered with the cooperatives. There are four cooperatives and, according to the constitution, the members have to go through the cooperatives (Farmer focus-group discussion, Metkei, November 2011).

The establishment of the DFBA therefore provided the entry point and a local-level platform for interventions and multiactor interactions as discussed below.

### The Dynamics of Coevolution of Innovation on the EADD Platform

In this section, we unravel this coevolution of innovation and the role of intermediaries on the platform in relation to the three main areas of intervention—milk marketing, breeding, and feeding. The findings also include some of the tensions that emerged in the process and affected the innovation processes in unexpected ways, revealing the complexity of such processes. Figure 9.3 presents a broad overview of events in the innovation process at the two sites, illustrating the interweaving of technical, social, and institutional dimensions of innovation that involved mobilizing different actors and resources at various points in time.

**FIGURE 9.3** Timeline of important events in the innovation process in the two study sites



**Source:** Authors.

**Note:** CP = chilling plant; DFBA = Dairy Farmer Business Association; EADD = East Africa Dairy Development project; × = processes in Tanykina DFBA; ◆ = processes in Metkei DFBA.

### ENHANCING INNOVATION FOR IMPROVED MILK MARKETING

As noted above, the starting point for EADD was the establishment of dairy limited companies as an alternative dairy business model to address constraints faced by smallholders in production and marketing (EADD 2009b; Technoserve 2008).

This model was in itself an institutional innovation which started by first setting up the chilling plant for bulking and cooling milk, and putting in place interim governance structures for the DFBA. This genesis provided the platform that triggered a series of other sociotechnical and institutional innovations that in combination enhanced marketing (see Table 9.2 for a summary).

With support from EADD consortium partners, the DFBA was linked to different actors to support different dimensions that were vital to improve marketing. In Metkei, EADD brought in a food processing and packaging firm as a partner that offered to finance the purchasing of a cooling tank, some laboratory equipment, and the dairy management software for the DFBA. As the firm manager noted:

[their] interest in supporting the cooling tank in Metkei was because it was important being part of the dairy value chain to ensure an increase in the quantity and quality of milk processed (Interview, February 2011).

As noted above, there was already a pre-existing chilling plant in Tanykina, so the starting point was the establishment of the DFBA, but also the improvement of the facilities where the chilling plant was located. Later on, Tanykina was linked to a commercial bank that financed a loan to purchase additional cooling tanks for satellite collection centers, thereby reducing the distance to be covered and time it took for milk to be delivered, and ensuring the quality of the milk.

Farmers commented that the installation of the cooling tanks and the establishment of the DFBA with new governance structures boosted their confidence about accessing markets for their milk. This was reflected in the increased number of farmers selling their milk through the two DFBA. In 2009, about 2,757 farmers sold an average of 15,000 liters per day in Tanykina; this rose to an average of 21,700 liters from 4,432 farmers. In Metkei, 1,188 farmers supplied on average 4,990 liters per day in 2009; this increased to about 17,000 liters a day from an average of 3,970 farmers. The EADD brokered negotiations for supply contracts between the DFBA and milk-processing companies as a way

**TABLE 9.2** Summary of coevolution of innovation relating to milk marketing and the roles of intermediaries in supporting the process

Dimension of innovation	Activities	Functions of intermediary actors
Orgware	<ul style="list-style-type: none"> <li>• Establishment of Tanykina Dairy Ltd and Metkei Multipurpose Dairy Company Ltd as new dairy-business enterprises</li> <li>• Signing supply contracts with milk-processing companies</li> <li>• Development of the chilling plants into business hubs that offer integrated services (for example, AI, animal health, extension, banking, milk transport, health insurance) and inputs (feeds, supplements, veterinary drugs, farming equipment) using a payment/credit system referred to as check-off</li> </ul>	<ul style="list-style-type: none"> <li>• F2 and F6—Guidance in the selection of DFBA board members and providing them with technical support—TNS and Heifer</li> <li>• F2—Development of strategic business plans in collaboration with the board members—and overall monitoring of performance—TNS</li> <li>• F5, F4, and F6—Providing board with technical support in negotiating contracts—TNS, Heifer</li> <li>• F2 and F6—Technical support to the board and management team, and monitoring in the stage-gate process of business-hub development—TNS and Heifer</li> </ul>
Hardware	<ul style="list-style-type: none"> <li>• Installation of chilling plants (CPs)—equipped with laboratories for milk-quality monitoring</li> <li>• Integrating the CPs with various ICT management and information systems (including electronic weighing scales, dairy information management software) to support overall business hub operations</li> </ul>	<ul style="list-style-type: none"> <li>• F4 and F5—Technical support in procurement of various equipment and set up of CPs, including identifying suppliers and vendors through a tendering process (for example, cooling tanks, construction of the plant, software)—Heifer and TNS</li> <li>• F5—Providing technical support to the board and management team in various areas (for example, human resource and financial management, financial-service delivery)—All EADD consortia</li> <li>• F4 and F6—Mobilizing of funding by linking DFBA with various financiers (banks and microfinance institutions)—TNS and Heifer</li> </ul>
Software	<ul style="list-style-type: none"> <li>• Facilitating new governance of the dairy enterprise by strengthening the functions and oversight structures of the board</li> <li>• Recruitment of skilled management team overseeing day-to-day business management</li> <li>• Integrating improved procedures to ensure quality management of the CP (including milk-quality testing)</li> </ul>	<ul style="list-style-type: none"> <li>• F1—Conducting diagnostic and feasibility studies—TNS and ILRI/ICRAF</li> <li>• F5—Providing guidance on governance and management of hub in set up and operationalizing of hub—TNS</li> <li>• F5—Mentoring and coaching board and management team</li> <li>• F2 and F6—Overseeing transparent process of recruiting skilled staff to manage the DFBA—TNS and Heifer</li> <li>• F4, F5, and F6—Providing technical support in managing the CP—TNS, Heifer.</li> </ul>

**Source:** Authors.

**Note:** DFBA = Dairy Farmer Business Association; F1 = Demand articulation; F2 = Institutional support; F3 = Knowledge brokering; F4 = Network brokering; F5 = Capacity building; F6 = Innovation process management; ICRAF = World Agroforestry Centre; ICT = information and communications technology; ILRI = International Livestock Research Institute; TNS = Technoserve.

of stabilizing the markets. Milk prices also increased, as farmers in Tanykina received Kenya shillings (KES) 30 (US\$0.35) per liter in 2011 compared to KES24 (\$0.28) in 2009, and in Metkei the price rose from KES23 (\$0.27) to KES31 (\$0.36) per liter (EADD 2011a). Data from project reports indicated an increase in milk production at farmer level during the period 2009–2011: in Tanykina, farmers involved with EADD increased production from 4 liters to about 8.1 liters per cow on average, whereas in Metkei the estimated production increased from 4 liters to 6 liters (EADD 2011a; EADD Kenya 2011). Although this is a notable increase, these average volumes are considered below the minimal levels estimated as necessary for households to move beyond the poverty line (TANGO International 2010; Technoserve 2008).

The increased milk volumes marketed by the DFBA and higher milk prices resulted in their profitability as enterprises and thus enabled them to expand services to farmers (EADD Kenya 2011; TANGO International 2010). The interviews revealed that EADD guided the DFBA in establishing business hubs within the chilling plants to offer a bundle of goods and services (for example, credit and financial services, artificial insemination, feeds, drugs, extension, and transportation) to farmers that supplied milk. The business hub integrated a “check-off” system where the farmers could access the goods and services through a credit system, and the cost was deducted from the monthly final payment to farmers. Tanykina was offering more services to its members than Metkei at the time of the study, but there was an overall increase in service delivery to farmers at both sites. The hub was managed by a professional team guided by the board of directors. From observations, we noted that, in both DFBA, older men continued to dominate the boards, reflecting the cultures of both communities. Hub development was accompanied by integration of other technological devices (weighing scales, dairy information-management software). To support delivery of some services such as extension, other new organizational structures such as formation of dairy-management groups (DMGs) were also put in place. From the focus-group discussion, farmers who had joined DMGs associated their increased production with the training and support introduced through these groups. At both sites, EADD facilitated financing arrangements with commercial banks to buy motorbikes for various service providers, including transporters, artificial-insemination service providers (AISPs), and animal-health assistants linked to the DFBA. Bringing together diverse actors with different stakes and interests required the platform intermediaries to broker continually and negotiate relationships.

Nonetheless, marketing remained precarious, as indicated by some of the issues and tensions that emerged from discussions and observations. The

bulking and cooling of milk as a way of collective marketing was expected to streamline supply to the DFBA. But there was no control over competition among the different buyers who formed part of the broader market environment in the sector. Many farmers at both sites indicated that they divided their milk and sold through different channels, including informal milk traders. The main reasons cited for selling to different buyers were price and transportation. We observed that some farmers from both sites were located far from the chilling plants, and some areas were unreachable even by motorbike, particularly during the rainy season. This made transportation not only expensive but also unpredictable. Many of these farmers stated that they opted to sell their milk to whoever could collect it at the farmgate. Both Tanykina and Metkei set up a few satellite collection centers to try to address this challenge.

Farmers also pointed to seasonal fluctuations in prices and indicated that in some cases the processors reduced the volumes that they bought during glut periods in the rainy season when there was increased milk production. Thus, the processing companies had control of the market and signing contracts did not deter this uncertainty in the market. Consistency in milk quality was also an issue that affected marketing. In Tanykina, it was noted that farmers continued to use plastic containers to deliver milk even though these were not hygienically ideal. The DFBA was trying to change this practice by making the more hygienic aluminum cans available through check-off, but not many farmers were using them. Further, in an effort to increase milk volumes in the DFBA, EADD was encouraging collection of evening milk. Metkei had started receiving evening milk toward the end of 2011. However, the discussions revealed that the evening milk was consumed mainly at home, and some was sold to neighbors mainly by women, to acquire ready cash for daily use. Whether this marketing emphasis has an effect on intrahousehold dynamics is an area for further research.

As illustrated above, the different consortium actors fulfilled complementary intermediary functions in the innovation process. In supporting the coevolution process, the intermediaries also shaped how the network structure of the platform changed over time. However, from interviews we found that consortium partners had divergent views regarding the goal of enhanced market access. Some partners considered that the primary focus should be on strengthening the DFBA as agro-enterprises and enhancing their profitability, which would then cascade down to improved productivity at farm level, whereas other partners thought that this emphasis on DFBA profitability deflected attention from the primary goal of improving productivity at farm level so that the farming households could benefit from marketing more milk. This

observation was also noted in the mid-term evaluation (TANGO International 2010). This may suggest that intermediaries also brought in competing interests into such processes that needed to be negotiated.

#### DYNAMICS OF IMPROVING BREEDING PRACTICES

The improvement of breeding practices through artificial insemination (AI) was one of the key interventions to enhance milk productivity. A combination of technical and institutional interventions to improve breeding practices was guided by a diagnostic study conducted at the early stages of the program (EADD 2009a). AI was not a new technology in Metkei and Tanykina, as noted in discussions with farmers, but its uptake had declined over the years due to various factors, including a policy shift to privatization of AI services, as some farmers noted:

There was government AI but they since stopped around the 1980s. The government used to do it for 1 Kenya shillings but now it has hiked to 1,000 Kenya shillings so it is now only for the rich (Metkei farmer, focus-group discussion, November 2011).

The first issue tackled was ensuring availability of, and access to, quality semen. To enable this, one of the EADD partners—ABS-TCM—facilitated procurement of semen tanks and semen for the DFBA. With semen available, the DFBA had then to ensure the service was delivered to farmers. At both sites, there was a shortage of well-trained AISP, therefore EADD supported the training of more AISP, four in Metkei and five in Tanykina. These AISP were then linked to the DFBA, where arrangements were later made for them to provide AI services through the check-off system. The AISP mainly used the semen that was available at the DFBA, but sometimes had to acquire other semen that was not stocked at the DFBA, but which farmers demanded. The check-off system ensured quality service delivery by the AISP who were now directly linked to DFBA. To further ensure service delivery, the platform also facilitated AISP to acquire equipment (AI tanks and motorbikes). Table 9.3 summarizes and characterizes the coevolution process, showing the interdependence of the interventions and actors, and how the platform intermediaries supported the process.

Several respondents, including farmers and ministry of livestock officers, pointed at the increased uptake of AI at both sites, indicating that the innovation platform contributed to innovation outcomes. Many DMG farmers indicated that the increased uptake was facilitated by the training on breeding that improved their knowledge about AI, complemented by the check-off

**TABLE 9.3** Summary of coevolution of innovation related to breeding and the roles of intermediaries in supporting the process

Dimension of innovation	Activities	Functions of intermediary actors
Orgware	<ul style="list-style-type: none"> <li>• Training of AISP to improve the AI-delivery system</li> <li>• Providing AI with necessary equipment (for example, motor bikes, semen tanks) through loans and integrating AI-service delivery with check-off system</li> <li>• Formation of DMGs as platforms for farmer training</li> </ul>	<ul style="list-style-type: none"> <li>• F4, F5, and F6—Forging partnership with various organizations for training AI service providers—Heifer and ABS-TCM</li> <li>• F2 and F5—Supporting entrepreneurial development of the AISP (as a business-development service) by facilitating access to finance and business skills training through partnering with relevant actors—ABS, Heifer, and TNS</li> <li>• F4, F5, and F6—Facilitating the mobilization of farmers into groups—Heifer</li> </ul>
Hardware	<ul style="list-style-type: none"> <li>• Acquisition of semen tanks by DFBA for semen storage and distribution to AISP</li> <li>• Acquisition of quality semen from various suppliers</li> <li>• Promoting “village bull” concept, that is, encouraging farmer groups (DMGs) to acquire semen tanks to store their preferred semen at village level</li> </ul>	<ul style="list-style-type: none"> <li>• F3 and F5—Providing information on semen tanks and facilitating their procurement—ABS-TCM and Heifer</li> <li>• F1, F3, and F5—Guiding procurement and distribution of selected semen at a subsidized price due to bulk buying—ABS-TCM</li> </ul>
Software	<ul style="list-style-type: none"> <li>• Improving service-delivery contracts between DFBA and AI-service providers</li> <li>• Promoting informed farmer decision-making and AI-service demand by farmers to improve breeding practices through training and information dissemination</li> </ul>	<ul style="list-style-type: none"> <li>• F5 and F6—Facilitating drafting and signing of contracts—Heifer</li> <li>• F1—Conducting baseline/diagnostic studies on breeding issues—ILRI</li> <li>• F5—Providing funding for extension services at the beginning, and later (from 2011) cost sharing with the DFBA—EADD</li> </ul>

**Source:** Authors.

**Note:** ABS-TCM = African Breeders Services Total Cattle Management Limited; AI = artificial insemination; AISP = artificial-insemination service provider; DFBA = Dairy Farmer Business Association; EADD = East Africa Dairy Development project; F1 = Demand articulation; F2 = Institutional support; F3 = Knowledge brokering; F4 = Network brokering; F5 = Capacity building; F6 = Innovation-process management; ILRI = International Livestock Research Institute; TNS = Technoserve.

system that allowed them readily to access AI services. Conversely, many farmers not in a group said that they did not use AI and linked this to limited access to knowledge on breeding, as groups were the platform for training and information dissemination. However, many farmers still perceived AI to be expensive, even with the check-off system and the subsidization of some semen through the program. The perceived high cost was linked to many instances of repeat inseminations because of missed conceptions, as illustrated by the following quote:

When you take the cow for insemination, there are times it will fail and people will decide that if the AI is failing yet it is very costly, it will be better to go back to the bull system  
(Tanykina farmer, focus-group discussion, August 2011).

On the one hand, many farmers linked repeats to delayed responses by service providers, particularly because there was still a shortage of personnel and the few available had to cover long distances over very poor terrain. AISPs, on the other hand, stated that part of the challenge was that farmers were not detecting heat on time and that this resulted in delays in insemination. Thus, some farmers reverted to using bulls as a cheaper option, although the use of bulls also persisted because of other traditional practices, including uncontrolled open grazing.

At both sites, AISPs, DFBA managers, and even EADD partners were aware and agreed that missed conception was an issue, but from interviews, we noted that there was no systematic feedback process that could guide collective learning in solving this problem. A few DMGs indicated that they had tried out the “village bull” idea that was being promoted as one way of giving farmers more control of AI services, but these groups ran into the challenge of lack of qualified service providers. The operation of a village bull depended on a group being able to hire their own service provider, but there was a shortage of locally available qualified AISPs. Some farmers expressed some reservations about the subsidized imported semen, pointing to issues of perceived poor quality (for example, weak calves from the semen) and also suitability of the semen (for example, adaptability). Further, the improvement of breeding practices depends also on farmers keeping proper records for all inseminations and on ear tagging; but discussions with farmers indicated that many of them did not consistently keep records on items such as AI servings, conception, calving, milking, and tracking of progeny, and there was no structured support through the platform to improve these.

This section indicates that the platform to a certain extent induced the uptake of improved AI practices by building adequate linkages with different actors at different times and also by integrating new organizational and institutional structures (such as the check-off system, or the village bull). However, the various gaps and tensions noted indicate that the interventions could not cater for all categories of farmers and also did not put in place all necessary conditions to address the bottlenecks to successful AI innovation.

### ENHANCING PRODUCTION THROUGH IMPROVED FEEDS AND FEEDING PRACTICES

In both Metkei and Tanykina, natural pastures for grazing comprised the largest portion of livestock feed. The predominant feeding system combined extensive open grazing, complemented by the use of planted fodder (mainly Napier grass and oats), and supplemented by purchased concentrate feeds. The reliance on pastures by a majority of the farmers resulted in a perennial problem of limited quality feeds, and this affected milk production. Many farmers indicated that growing fodder was a good alternative to expensive concentrate feeds. The platform supported various interventions that combined extension and training on new feed technologies (that is, forage and fodder production) and promotion of feed conservation methods so as to maximize milk production while minimizing feed cost. First, a trainer-of-trainers (TOT) approach that combined model (demonstration) farmers and community-based trainers was used to disseminate information and technologies to farmers in DMGs. ICRAF and ILRI provided dissemination support and conducted participatory research on some new fodder crops (for example, dual-purpose sweet potatoes) and on silage making. The district-level Ministry of Agriculture extension office also collaborated to support the trainers. However, the TOT approach faced challenges, as the trainers were not effectively reaching farmers as a result of an oversight relating to their supervision, because it was not clear whether they reported to the DFBA management or the EADD facilitators. This challenge resulted in extension services being halted for a period. Consequently, a new extension approach had to be designed, whereby community extension-service providers (CESPs) were to be hired directly through the DFBA; this meant that the DFBA had to contribute financially for this service from their revenues. Table 9.4 provides a summary of how the feed innovation dynamics coevolved.

At both sites, most farmers belonging to DMGs indicated increased knowledge about different types of feeds (for example, lucerne, *Calliandra*, sweet potato vines, *Desmodium*) and feed-conservation methods (for example, silage, hay) compared to those that were not in groups. Most of the DMG farmers indicated that they made better use of crop residue as feed, particularly maize stovers (leaves and stalks) which previously were not highly valued as feed, and some had also planted new fodder crops. However, we generally noted from the focus-group discussions with farmers that the adoption of the new feeding technologies and practices was still a challenge. The most common problem cited by farmers was the lack of access to seeds. Most of the seeds for the newly introduced feeds were not easily available at the local agro-vet shops, so

**TABLE 9.4** Summary of innovation activities for improved feeding and the roles of intermediaries in supporting the process

Dimension of innovation	Activities	Functions of intermediary actors
Orgware	<ul style="list-style-type: none"> <li>• Training and dissemination of information on improved feeds and feed conservation management through DMGs</li> <li>• Establishment of demonstration plots in farmer-trainer fields for use in training on growing various types of feeds and for seed multiplication</li> </ul>	<ul style="list-style-type: none"> <li>• F2—Facilitating extension-service provision, including design of training modules and training of extension-service providers in partnership with the Ministry of Livestock—Heifer and ICRAF</li> <li>• F3 and F5—Technical backstopping of demonstration farmers, including set-up, supplying seeds, and follow up—ICRAF/ILRI</li> </ul>
Hardware	<ul style="list-style-type: none"> <li>• Promoting the use of small-scale feed-processing technologies, that is, pulverizers and chuff cutters</li> <li>• Dissemination of various types of fodder crops (seeds, vines)</li> </ul>	<ul style="list-style-type: none"> <li>• F4—Facilitating procurement of feed-processing equipment through partnership with local small and medium enterprises—Heifer and TNS</li> <li>• F3—Conducting research to understand uptake and use of feed-processing technologies—ILRI</li> </ul>
Software	<ul style="list-style-type: none"> <li>• Conducting participatory research with farmers to test various newly introduced fodder crops (for example, dual-purpose sweet potatoes)</li> <li>• Promoting change in farmer feeding and feed-conservation practices</li> </ul>	<ul style="list-style-type: none"> <li>• F1—Conducting baseline/diagnostic studies on feeding issues—ILRI</li> <li>• F3—Identifying sites and setup of experiments in collaboration with other scientists and farmers—ICRAF/ILRI</li> <li>• Facilitating information dissemination and training through extension—Heifer and ICRAF/ILRI</li> <li>• F3—Conducting research to draw lessons on improving feeding practices and feed markets—ILRI</li> </ul>

**Source:** Authors.

**Note:** DMG = dairy-management group; F1 = Demand articulation; F2 = Institutional support; F3 = Knowledge brokering; F4 = Network brokering; F5 = Capacity building; F6 = Innovation-process management; ICRAF = World Agroforestry Centre; ILRI = International Livestock Research Institute; TNS = Technoserve.

farmers could not purchase them. Further, in some areas, farmers stated that the demonstration plots that were to serve as multiplying sites for seeds did not work as well as expected. In Metkei, farmers indicated that most demonstration plots had not yet been established and those that were set up did not receive adequate technical support from the program as planned. Various informants attributed some of the difficulties to how the extension approach was structured when the program began. However, although the extension approach was restructured and incorporated into the DFBA, the changes still did not address many of the challenges noted.

From discussions with various informants, we found that feedback and learning from some of these challenges were not systematically captured. We

found that, although learning on EADD's function was embedded into the program plan and led by one of the consortium partners (ILRI), this learning was not transferred to different levels on the platform. A mid-term evaluation report highlighted this challenge, pointing to the constraint of a focus on fulfilling program milestones as reflected in the monitoring and evaluation system which did not necessarily link to a learning agenda at the different levels of operation of the platform (EADD 2011b; TANGO International 2010). Additionally, at both sites, many farmers indicated that shrinking plot size constrained the possibility of switching from foodcrops to fodder crops on part of their land. The issue of access to land was particularly challenging for the youth and women, who had less control over land because of cultural factors. Furthermore, it emerged from both sites that poor rainfall also affected their plans to plant fodder crops, and a general lack of access to adequate water was a critical challenge to improving dairy production. This not only affected the productivity of the cow, but was also very time-consuming, particularly for women who were responsible for tasks such as taking cattle to the river.

These findings point to the important role of platforms in intermediating linkages among actors by trying out various organizational arrangements. However, the gaps noted point to the importance of systematic feedback and learning in the process to attain the expected outcomes. Furthermore, we note how the broader context impeded the extent to which the platform could shape the innovation process. Consequently, platforms may run into major constraints which need structural change, but this is not easily achieved.

## **Analysis and Discussion**

### **Innovation Platforms Synchronize Mutually Reinforcing Developments Through Distributed Intermediation**

The findings indicate how the innovation platform shaped the innovation process in addressing the various system weaknesses that had been impeding the enhancement of smallholder dairy farming, and contributed to outcomes in relation to access to services and inputs, and improved productivity. The strength of EADD as an innovation platform was in sequentially (but with recurring and sometimes simultaneous attention to the same issues if needed) implementing combinations of technical and social institutional innovations; this also contributed to some reconfiguration of relations among different actors. As the results show, the new dairy business model as an institutional innovation integrated technological elements that further catalyzed business-hub

development and accompanying institutional rearrangements in service delivery. Most of the innovations were institutional in nature, confirming earlier findings on institutional change as a *sine qua non* (essential component) for innovation (Clever 2002; Hounkonnou et al. 2012). However, the integration of technological elements (albeit incremental technological innovation) was also of key importance because technological innovation also triggers new practices. For example, the introduction of the dairy management software for records management introduced more transparency not only in the weighing of milk, but also in systematically tracking the various transactions relating to services used by each farmer, thus enhancing farmers' trust in the dairy company. Also, the establishment of dairy companies with improved governance and management structures, coupled with a credit guarantee provided through the EADD program, enabled companies to secure credit from commercial banks, which previously were wary of lending to farmers because of the perceived risk of agricultural enterprises. Thus, it is in the coevolution process that the different elements mutually reinforce one another, almost in a virtuous cycle (compare Hekkert and Negro 2009), which is also linked to changing and emergent network configurations (Ekboir 2003; Kash and Rycroft 2002; Klerkx, Aarts, and Leeuwis 2010). This is what contributes to overall system change—in our case moving from predominantly smallholder subsistence dairy farming (comparable to system A in Figure 9.1) to increasingly commercial dairy farming (system B in Figure 9.1).

As our findings demonstrate, the key role of platforms is in connecting the orgware component (institutional change) to the hardware and software components of innovation by establishing effective patterns of interactions for negotiating institutional change; this confirms earlier findings (Dormon et al. 2007). Here, it clearly emerges that the intermediation on the platform is critical in strengthening more system-level capacities relating to orchestrating and organizing networks, thus enabling the coevolution of innovation by facilitating linkages among different stakeholders who were previously not connected for various reasons (for example, cognitive distance, high transaction costs, and information asymmetry). But importantly, as others also have shown, it is the negotiated institutional changes as the outcomes of these linkages that can then provide opportunities for successful innovation for smallholders (see Dormon et al. 2007; Hall et al. 2001; Nederlof, Wongtschowski, and van der Lee 2011).

From these findings, we note that the important role of the EADD consortium actors as innovation intermediaries could be seen from the beginning of the innovation process, facilitating the articulation of the innovation vision, and mobilizing funding and other resources necessary for the program. This was

followed by orchestrating networks of different actors who were brought in at different points in time, mainly around specific issues. This included selecting which actors were important for fulfilling particular objectives of the program at various points in the innovation process, which contributed to reconfiguration among actors, including patterns of cooperation. This indicates that platforms are highly dynamic and distributed in composition, as opposed to static structures, as Nederlof, Wongtschowski, and van der Lee (2011) have also found.

The results indicate that platforms are effective in coordinating innovation because of the complementary skills and competencies that the various intermediary actors bring to them. The organizations in EADD were able to connect different actors representing different ambits of the innovation process. These findings confirm the complexity of innovation intermediation, which entails fulfilling a myriad of functions distributed over time and fulfilled by different actors. Rather than one central innovation intermediary acting as a platform facilitator, there is a set of innovation intermediaries, as other studies (Klerkx, Aarts, and Leeuwis 2010; Stewart and Hyysalo 2008) have observed.

### **Tensions and Caveats of Innovation Platforms in Stimulating Coevolution**

Despite innovation platforms acting as catalysts for innovation-systems interaction, the results also point to the limitations of platforms. As other scholars have also argued (Hall and Clark 2010; Hekkert and Negro 2009; Leeuwis and Aarts 2011), coevolutionary processes cannot be steered and controlled fully, so the platform is not a magic bullet for fully managing innovation processes. From our analysis, we can identify several tensions in relation to employing platforms as a tool to stimulate innovation.

A first tension relates to the structure of platforms in relation to purpose. As the results indicate, EADD appeared to be successful with regard to improving marketing at the DFBA level, but, despite some positive results, the platform appeared to be less successful with outcomes relating to farmer-level innovation and productivity linked to uptake of AI and improved feeding-management strategies. Despite the fact that EADD enabled the formation of different lateral networks to address a variety of emerging issues relevant to the overall innovation process, the platform appeared not to have sufficient capacity to enact the effective reformism needed to change all structures; this impeded change at different levels. This raises the question of whether all innovation platforms should have a similar composition in terms of diversity of participants and governance structure, or should also differ according to different types of outcomes (such as strengthening value-chain interaction,

raising farm-level productivity, and livelihood improvement) and the different levels of operation (such as platforms aiming at developing innovative solutions to problems, and platforms aiming at up-scaling such solutions), as the recent findings by Hermans et al. (2012) suggest.

A second tension is that, despite the usefulness of the distributed nature of innovation intermediation, it could also be seen as a source of tension and competition among the innovation intermediaries, which are essentially different organizations each with its own objectives. In this context, each organization focused on or pursued strategies that reflected its own imperatives and mandates, and in some cases this resulted in tensions that undermined the broader vision of the program. In relation to this finding, there is also a limitation in our analysis: by focusing only on the platform's formal innovation intermediaries (the EADD consortium), we did not necessarily capture the distributed agency of other actors involved in the network; but these could also be acting as innovation intermediaries in less formal ways and could even counteract overall platform objectives, as Klerkx and Aarts (2013) have observed elsewhere.

A third tension relates to the flexibility that platforms need to have vis-à-vis program planning. As the EADD case shows, platforms are continuously facilitating interactions with different actors, dictated by circumstances and unanticipated effects of actions. These findings confirm earlier findings that the management of innovation processes needs to be adaptive and guided by iterative learning (Klerkx, Aarts, and Leeuwis 2010; Kouévi, Mierlo, and Leeuwis 2011). Although the EADD platform was designed with a learning component, it was not always sufficiently adaptive and responsive, at least in the short term, to the new problems and tensions that emerged. This implies that platforms should not be seen as a development tool for executing a pre-conceived plan in a blueprint fashion, but rather they should be arenas for strengthening capacities to deal with the complex and dynamic nature of agricultural innovation (following Ekboir 2003; Hall and Clark 2010; Leeuwis and van den Ban 2004). This connects to the issue of the need to balance and reconcile results-based, milestone-focused monitoring (for example, logical frameworks) with process-based monitoring, where the intermediaries systematically capture feedback and enhance reflectivity to adequately support adaptive capacity in the innovation process (Regeer 2009; van Mierlo et al. 2010b).

This is an important finding in light of the increasing application of platforms in agricultural innovation and development programs. Such adaptive capacity can be a challenge in development program-driven innovation platforms. One of the reasons is the scale of programs and the platforms connected to them (for example, the Sub-Saharan Africa Challenge Programme working

in nine countries—van Rijn, Bulte, and Adekunle 2012) and demands in terms of clear planning for budgeting, implementation, and accountability purposes. Another reason is that some issues that emerge are beyond the scope of the platform given the broader contextual factors that impinge on the process. For example, infrastructural problems linked to inadequate access to water or poor feeder roads could not be adequately addressed by EADD. This hints at the need to be aware that adaptive management of innovation through platforms also requires funding schemes that are responsive to emerging challenges or finding ways to leverage the required resources.

## **Conclusion**

This chapter has demonstrated how innovation platforms are important mechanisms for stimulating and coordinating coevolution of innovation. A main implication of our study for theory is that the coevolving nature of innovation processes requires a conceptualization of platforms as dynamic and distributed networks instead of static and centralized networks. They have a nested structure comprising different intermediary actors who build bridges between different components in innovation systems, and it is the variety of intermediary actors that makes the platform effective. A key policy implication is that supporting innovation platforms as mechanisms for enhancing innovation requires platform funding, planning, and governance mechanisms that allow for continual adaptation to emerging issues. This also points to the need to integrate more reflexive forms of monitoring to optimally enable adaptive management of innovation through innovation platforms.

The study also highlights a number of areas for future research, connected to the tensions and caveats identified herein. A first area is about platform structure and governance in relation to the objective of the innovation platform (such as strengthening value-chain interaction, raising farm-level productivity, livelihood improvement). A key question is how to determine a priori the optimal diversity of participants on innovation platforms, and the optimal governance form for innovation platforms. This also relates to issues such as the costs of operating innovation platforms (efficiency), and sustaining action initiated by innovation platforms (effectiveness). It could be relevant to explore work from organization and management studies in order to inform studies on platform composition and governance (Klerkx and Aarts 2013; Provan and Kenis 2008).

A second area relates to the role of innovation intermediaries. Our study has shown that different innovation intermediaries are complementary, but

it also revealed diverging priorities among the different innovation intermediaries operating on the platform. For platform efficiency and effectiveness, a key issue is that overall facilitation should be in place to minimize such divergence and maximize complementarities between different innovation intermediaries. It is still an open question as to who is best placed to fulfill this role of overall platform facilitator. Klerkx, Hall, and Leeuwis (2009) have suggested that a specialized and independent organization has certain advantages for overall platform facilitation vis-à-vis innovation intermediaries on the platform, who also have a substantive role (for example, in undertaking research or providing technical services) and a stronger normative orientation or political or commercial interest, but further research is needed to verify this. Furthermore, whereas this study focused on the formal intermediaries on the platform, future studies should analyze the many informal intermediaries that may be active on the platform or in its broader environment. Finally, a third area for future research relates to how to shape monitoring to enable adaptive management of innovation through innovation platforms. Future studies should investigate whether and how different ways of monitoring can be combined to satisfy the needs of both innovation-platform participants and innovation-platform funders.

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## **DEALING WITH CRITICAL CHALLENGES IN AFRICAN INNOVATION PLATFORMS: LESSONS FOR FACILITATION<sup>1</sup>**

**Kees Swaans, Beth Cullen, André van Rooyen, Adewale Adekunle, Hlami Ngwenya, Zelalem Lema, and Suzanne Nederlof**

### **Introduction**

There is growing scientific recognition of innovation platforms (IPs) and the role of facilitation in catalyzing agricultural innovation (see Klerkx and Gildemacher 2011; Hounkonnou et al. 2012; Klerkx, Mierlo, and Leeuwis 2012), with increasing documentation of experiences from practitioners (see Hawkins et al. 2009; Nederlof, Wongtschowski, and Van der Lee 2011; Nederlof and Pyburn 2012; Mbabu and Hall 2012). IPs have become increasingly popular, and run the risk of becoming a void concept or misunderstood—for example, because they are taken as merely mechanisms to regulate value chains or to extend new technologies to large numbers of farmers (PAEPARD 2013; Darbas and Sumberg 2013); still, the discussion whether or not IPs are useful and effective is a relevant one. In this chapter, we argue that the success of an IP depends on the attitude and skills of the facilitator. Indeed, one of the most frequent questions from practitioners is: How do we best facilitate IPs?

IPs are composed of a range of actors, often with very different backgrounds, who discuss and address challenges and opportunities around a particular issue or area (Nederlof, Wongtschowski, and Van der Lee 2011). IPs may operate at local or national level; sometimes linking actors at different scales. Often, the actors have divergent and sometimes competing and conflicting interests and values, and they do not naturally want to cooperate or share information with each other. Experience has shown that skillful facilitation is needed to enable the platform members to reach a shared

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<sup>1</sup> The development of ideas presented in this chapter took place during a writeshop on innovation platforms, which was held on May 27–29, 2013 in Nairobi, Kenya, and was funded by the CGIAR Research Program on Integrated Systems for the Humid Tropics. The authors would like to thank Alan Duncan from ILRI for his comments on an earlier draft.

understanding of the issues at hand, agree on common goals, communicate, cooperate, coordinate activities to address their challenges, and take advantage of opportunities.

In this chapter, we reflect on some of the key challenges emerging from our experiences of facilitating IPs in Africa. The challenges are derived from discussions among researchers and practitioners during a “writeshop” on IPs in Nairobi, May 2013, in which most of the authors participated (see Gonsalves and Armonia 2010 for further information about writeshops). The identified issues related to IP facilitation are recognized challenges within development practice; despite this, however, they often do not receive the attention they deserve among IP practitioners.

## **The Process of Identifying Key Issues and Challenges**

The idea for this chapter was first born during a writeshop organized in May 2013 at the International Livestock Research Institute (ILRI) in Nairobi, Kenya. During the writeshop, 20 individuals worked together, with expert facilitation and artistic support, to produce “practice briefs.” The writeshop hosted two types of participants: (1) IP “practitioners” with significant experience of managing a diverse range of platforms; and (2) “researchers” studying innovation systems and IP processes, who could link practice with theory, and help refine and critique the products. Some of the participants bridged these two categories and could be described as “researcher–practitioners.” This group of experts, facilitators, and artists worked together intensively for three days. One of the key issues identified by the writeshop participants was “platform facilitation.” The participants observed the need for solid lessons on facilitation that could be utilized by brokers. To ensure that a wide range of experiences were included, additional authors were invited to participate. The current authors reflect a diversity of “IP initiatives” in Africa.

This chapter is based on qualitative research using a case-study approach. The cases were selected from agricultural-extension and research-for-development (R4D) projects. These projects were all implemented in southern, East, and West Africa in the past decade, and focused on agricultural production, value-chain development, and/or natural-resource management (see Box 10.1). Different IPs were taken as cases and systematically checked for consistency on the lessons derived. The authors used critical reflexivity to obtain the main lessons on facilitation (see Schön 1983).

### **BOX 10.1 Selection of agricultural extension and research-for-development projects across Africa with authors' involvement**

*Fodder Adoption Project (FAP)*: The project aimed to strengthen the capacity of poor livestock keepers to select and adopt fodder options and access market opportunities to enable them to improve their livelihoods; for this purpose the project engaged with a wide range of actors through IPs (Ethiopia, Syria, Vietnam) (2008–2010).

*Nile Basin Development Challenge (NBDC)*: Program to improve the resilience of rural livelihoods in the Ethiopian highlands through a landscape approach to rainwater management; district-level IPs were established to address natural-resource management issues at the local level (Ethiopia) (2010–2013).

*Volta Basin Development Challenge (VBDC)*: Program on integrated management of rainwater and small reservoirs for multiple uses; district-level IPs were established to improve rainwater management and increase production and market access at the local level (Burkina Faso, Ghana) (2010–2013).

*Small ruminant value chains as platforms for reducing poverty and increasing food security in dryland areas of India and Mozambique (imGoats)*: The project aimed to increase income and food security through a pro-poor value chain for goats using an IP approach (India and Mozambique) (2011–2013).

*Livestock Livelihood and Markets Project (LILI Markets)*: The project aimed to improve market participation by small goat and cattle growers in semiarid regions of southern Africa using IPs (Mozambique, Namibia, Zimbabwe) (2007–2010).

*Increasing food security and household income through small-stock market development in Zimbabwe (ZimGoats)*: Project to increase food security and income for small-scale goat keepers through increased production, market development, and through the testing and use of an IP approach (Zimbabwe) (2011–2013).

*Sustainable management of globally significant endemic ruminant livestock of West Africa (PROGEBE)*: Program on conservation of indigenous cattle in West Africa; local IPs were formed for value-chain development on specific commodities to increase interest among farmers (The Gambia, Guinea, Mali, Senegal) (2003–2013; IPs since 2011).

*Building livelihoods resilience to alleviate poverty in semiarid areas of West Africa (PLM)*: Program to build livelihood resilience of smallholder farmers through the establishment of community-level IPs for dairy and/or vegetable value chains (Mali, Niger, Togo) (2010–2013).

*Sub-Saharan Africa Challenge Programme (SSA CP)*: Response to the need to dramatically increase the development impact of agricultural research on livelihoods in Africa by developing, testing, and promoting an IP approach for conducting agricultural research for development (AR4D) in Africa (throughout East, West, southern Africa) (2005–2010).

*Convergence of Sciences—Strengthening Agricultural Innovation Systems (COS-SIS)*: Program to carry out interdisciplinary policy and institutional experiments with a view to elaborate, apply, and assess a development approach to sustainable rural-poverty alleviation and food security, based on innovation-systems thinking (Benin, Ghana, and Mali) (first phase 2001–2006; second phase 2008–2013).

*Broadening Agricultural Service and Extension Delivery (BASED)*: Bilateral program between Deutsche Gesellschaft für Internationale Zusammenarbeit (then Deutsche Gesellschaft für Technische Zusammenarbeit) and the Limpopo Department of Agriculture aimed at transforming the extension service-delivery system (South Africa) (1998–2006).

**Source:** Authors.

To strengthen the quality of the analysis and synthesis, triangulation of several methods is applied. The first method is a literature review on facilitation of IPs. Emerging findings were cross-checked and verified through literature. The second method entailed informal conversations and group discussions with practitioners, researchers, and researcher–practitioners in the field of facilitating IPs. These took place during the writeshop consultation process to identify key issues and challenges. As the writeshop participants began evaluating their various experiences of IP facilitation, certain patterns began to emerge—often across different programs working in different regions. A third method used was that of self-reflection by the authors as “researcher–practitioners” of IP facilitation themselves. Key issues and challenges identified during the writeshop were further reflected upon, prioritized, and synthesized by the authors based on their personal experiences with IP facilitation across Africa (see Schön 1983 for an elaborative discussion on the “reflective practitioner”). When possible, this information was further substantiated by referring to secondary literature.

The approach we have taken to gathering and analyzing the information included in this chapter has both strengths and weaknesses. Most of the authors and writeshop participants are “researcher–practitioners” with first-hand experience of IP facilitation. The experiences of such people, particularly those more involved in practice, often remain undocumented or are only

partially captured in reports and unpublished documents. The writeshop approach and critical reflexivity were used because they are specifically designed to capture and document the experiential, tacit knowledge of the practitioner (Schön 1983). The writeshop approach is particularly valuable considering the pressure that researcher–practitioners increasingly face to generate “key lessons” and recommendations for “best practice” (Patton 2001).

The methodology used allowed for analysis of a broad range of cases in Africa, including many well-known examples. We did not, however, analyze cases from other parts of the world. Yet, many interesting experiences exist in other parts of the world, such as those described for Papua New Guinea by Mbabu and Hall (2012), and experiences of the International Center for Tropical Agriculture (CIAT) with learning alliances in Latin America (see Lundy, Gottret, and Ashby 2005). In addition, most of the platforms referred to in this chapter have been established within AR4D projects and may not be representative of approaches being taken by organizations working in other sectors. We may also have missed examples of more locally emergent platforms.

## **Key Issues in Facilitating Innovation Platforms**

To frame the discussion on key challenges in facilitating IPs, we briefly reflect on what IPs are, the implications for facilitation, and who is best suited to facilitate these platforms, drawing from practice and current theory.

### **Innovation Platforms – Forums for Learning and Action**

In this chapter, we adopt Homann-Kee Tui et al. (2013)’s—practical—definition of IPs:

A forum for learning and action involving a group of actors with different backgrounds and interests: farmers, agricultural input suppliers, traders, food processors, researchers, government officials, etc. These actors come together to develop a common vision and find ways to achieve their goals. They may design and implement activities as a group or coordinate activities by individual actors (p. 1)

IPs are based on innovation-systems thinking: a holistic and comprehensive framework for understanding innovation (new products, new processes, and new forms of organization) as emerging from a broad network of dynamically linked actors within a particular institutional and policy context (Hall et al. 2006).

Within agriculture, IPs can be useful to explore strategies that can boost productivity, sustainably manage natural resources, improve value chains, or influence policies; these strategies often include biophysical, socioeconomic, and political elements, and concern various formal and informal institutions<sup>2</sup> (Homann-Kee Tui et al. 2013). By bringing together actors from various sectors and from different administrative levels, and by acknowledging and making use of their diverse capacity (knowledge, skills, capabilities, interests, resources), IPs may be able to identify and address existing barriers or challenges to innovation and/or take advantage of potential opportunities.

### **From Facilitation to Innovation Brokering**

The task of a facilitator in the context of IPs goes beyond merely facilitating meetings and managing dynamics between a bounded group of actors. Rather, “innovation brokering” is required, which involves stimulating interactions with a wide range of actors, often operating at different levels, with diverse interests (see Klerkx, Hall, and Leeuwis 2009; Kilelu, Klerkx, and Sitima 2011). *Innovation brokers* are defined as the persons or organizations that catalyze innovation by bringing actors together and facilitating their interaction (Klerkx, Hall, and Leeuwis 2009). To achieve this, brokers perform a variety of functions, ranging from facilitating interactions between actors, through linking and strategic networking, technical backstopping, mediation, advocacy, capacity building, and management, to documenting learning (see Box 10.2).

As we can see, the role of an innovation broker is diverse and challenging, and demands a particular set of skills. Effective innovation brokers are flexible and natural networkers, have a knack for developing cooperation and partnerships, a strong and wide personal network, a capacity to manage relations effectively over time, a good sense of power dynamics, the ability to manage conflict, a listening ear, group-facilitation skills, and the ability to consider broader system dynamics. They may also need to encourage actors within a given system to change entrenched practices and question the ways in which the system functions. This raises questions about who is best placed to fulfill this role.

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2 By *institutions* we mean the informal and formal rules and regulations that govern human action (Douglas 1986).

## BOX 10.2 Brokering functions

*Facilitation:* The facilitator convenes and manages regular meetings to identify key constraints and strategies, and ensures that all members can express their views. He or she safeguards the overall process and nurtures relationships among the members, coordinates interactions, negotiates where required, and facilitates collective learning based on increased insight.

*Linking and strategic networking:* The facilitator builds relationships with other relevant actors and invites them to collaborate with the platform; this may include mobilizing support and resources for activities undertaken by the platform.

*Technical backstopping:* The facilitator may provide technical advice or link the platform to others who can provide that information; he or she may also solicit further studies or consultations to identify or confirm problems and information needs.

*Mediation actors* may perceive others as competitors, who want to monopolize the process and prevent others from receiving crucial information. The facilitator prevents such power struggles and addresses them if they arise. He or she tries to help the platform members realize they all have an interest in finding solutions and creating opportunities.

*Advocacy innovation* requires an enabling environment. The facilitator may help the platform to advocate for policy changes, generate new business models, or stimulate new relationships among the actors, and get the buy-in and support of those who matter to the platform.

*Capacity building:* Most platform members are not equipped with the technical, organizational, and management skills to play their role in the platform effectively. The facilitator may link the platform to training institutes and organize exchange and exposure visits; he or she may also help actors to organize themselves better.

*Management* refers to the financial management, reporting, and communication with the donor. Sometimes the facilitator combines the function of broker with that of manager.

*Documenting learning:* The facilitator ensures that the meetings and the process are well documented and reported to relevant actors and other parties; it is used to stimulate reflection and learning based on actions initiated, as well as the overall innovation process.

**Source:** Authors, based on Heemskerck, Klerkx, and Sitima (2011).

## Who Are the Brokers?

There are different ways of categorizing innovation brokers (for example, see Klerkx, Hall, and Leeuwis 2009), but generally brokers can either be

organizations or individuals who can be members of the platform or independent from the platform (Tennyson 2005; see Table 10.1).

As Klerkx, Hall, and Leeuwis (2009) point out, the role of innovation broker in Western countries is often fulfilled by intermediary organizations that are independent from the platform and specialized in brokering (for example, innovation consultants). However, such specialist brokers are not common in developing-country contexts. As a result, the role of innovation broker is often fulfilled by those who instigate platform processes (for example, research or development organizations). Representatives from these organizations may not only be responsible for establishing platforms, they may also be platform members. In some cases, “insiders” from a given system may be selected to play the role of broker (for example, extension agents or government representatives).

## Voices from the Field: Challenges Faced

Although much has been written from a theoretical perspective on innovation systems and there are many guidelines for facilitating platforms, the challenges facing innovation brokers only become evident through practice. We highlight seven key issues here.

### Dynamic and Evolving Platforms—A Need for Highly Skilled Innovation Brokers

Ideally, an agricultural IP addresses social, technical, and institutional issues affecting the farm level as well as the wider context. Therefore, the ability of the facilitator to enhance interaction across different levels, with a view to enabling the enhanced functioning of the whole system, is of critical importance. This includes changes in attitudes, skills, and practice of individual actors, as well as the relations between them, all of which need to be carefully facilitated.

**TABLE 10.1** Different types of brokers

	Individual	Organization
Internal	An individual operating from within one of the partner organizations with a designated role to build and /or develop the partnership	A team or department located within a partner organization specifically tasked with building and/or developing partnership relations on its behalf
External	An individual working externally to the partner organizations, appointed by either one (or more, or all) of the partners to build or develop some aspects of the partnership	An independent organization or mechanism created specifically to promote partnerships and/or to undertake a brokering function on behalf of different partnerships

Source: Tennyson (2005).

For example, in a small-ruminant livestock project utilizing IPs in south-western Zimbabwe (LILI Markets/ZimGoats), local actors initially identified production and marketing issues as key challenges. After verification, the platform members agreed that market access was the most limiting factor; the IP members then sought to involve actors associated with marketing, including buyers, transporters, and auctioneers, as well as representatives from the local government responsible for regulating livestock marketing in the district. Once local markets were established and the sales modalities developed, the IP shifted to include processors, namely abattoirs, and focused on improving production, by linking farmers to commercial feed suppliers. This illustrates how the agenda of the IP, and in turn the composition of relevant actors, evolved and changed over time. Flexibility in facilitation of the innovation process and in the management of platform dynamics was vital to ensure that the IP focused on appropriate issues for achieving impact.

This example does not stand alone, and is typical for many IPs (see Duncan et al. 2011 for an example of how planted forage was used as an entry point for catalyzing innovation on broader livestock value-chain issues in Ethiopia). Based on an analysis of various case studies, Nederlof and Pyburn (2012) argue that a flexible approach to platform structure and membership is useful in case new topics arise, priorities change, or unexpected problems emerge. Sometimes the real issues only emerge after the process has begun. It may also take some time to determine the best level for the platform to operate in support of institutional change. Navigating these dynamics requires tact and diplomacy, and the innovation broker's role in orchestrating this is critical. While innovation brokers can be provided with how-to guidelines for facilitating IPs, it is much more complicated to equip them with the skills to manage change. As process-oriented approaches are by nature not a blueprint with fixed goals and time frames, it is important that facilitators have a clear understanding of the need for flexibility and have the skills to work in an iterative way with relevant actors to achieve desired outcomes (see Ngwenya and Hagmann 2009).

### **Power and Platforms – Risk of Reinforcing the Status Quo**

Although issues surrounding power dynamics are widely recognized within the “participation” literature (see Chambers 1997; Cooke and Kothari 2001), they have received scant attention<sup>3</sup> in research on IPs (Zannou et al. 2012; Cullen et al. 2014). It is tempting to think that bringing different actors

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3 Dealing with power dynamics in multistakeholder settings receives further attention in a recently published paper of Brouwer et al. (2013).

together may address key constraints for value chains, managing natural resources, and policy development, but bringing actors together may not address the underlying reasons for weak actor linkages. If these issues are not taken into account, IPs may be used to reinforce existing dynamics, or be misused by powerful actors to achieve their own goals.

Experiences with district-level platforms as part of a natural-resource management project in the Ethiopian highlands suggest that careful attention should be given to power asymmetries. During a series of exercises to identify natural-resource management entry points in one of the districts, termite infestation was identified as a priority issue by farmers, due to their impact on grazing lands, crops, and infrastructure. However, local government representatives insisted that soil erosion should be prioritized—in order to meet national government targets for soil and water conservation. Government actors were overrepresented within the platform, and facilitators realized that if the government agenda dominated the process it was likely to reinforce the status quo, in which farmers have limited voice in decisionmaking processes, and lead to lack of engagement and “buy-in” on the part of community members. Platform facilitators played a critical role in mediating between these different interests. Together with researchers, they identified an intervention that could serve as a compromise between farmers and government decisionmakers: a termite-resistant fodder species called Chomo grass. This would help to conserve soils, rehabilitate grazing areas destroyed by termites, and provide livestock feed.

However, achieving a compromise should not always be a priority for platforms. It is important to point out that the focus IPs place on identifying and solving common problems through a process of consensus building often ignores the fact that conflict can be an important catalyst for change. Pushing actors to achieve consensus may also lead to “solutions” that are not ideal for all of the actors involved, particularly those who have less of a voice. With this in mind, although platform-facilitation guidelines often state that the innovation broker should be relatively neutral and objective, there may be situations—particularly when there are power inequalities—when brokers may need to advocate on behalf of certain groups. There is growing evidence that suggests that such multiactor processes may not be advantageous for marginalized groups, who may be overruled or manipulated by more powerful actors (Edmunds and Wollenberg 2002). Those who take this view argue that measures should be taken to empower weaker groups before they engage in collective dialog within a platform space.

Although care should be taken to ensure that those with more power do not dominate the platform space, there can be advantages to working with powerful actors. The COS-SIS program facilitated the creation of a cocoa IP which aimed to secure higher prices for cocoa farmers. The cocoa sector is composed of powerful actors, many of whom were represented in the IP. One of the IP members was formerly an adviser to the minister of finance and economic planning, with responsibility for cocoa affairs. The IP members asked this influential member to represent their interests, and in doing so probably played a role in convincing the minister to raise the producer price of cocoa for all farmers (see also Nederlof and Pyburn 2012; Zannou et al. 2012).

### **Gender—Promoting Equitable Opportunities**

Gender is a critical factor in achieving development objectives, and evidence suggests that disparities between the sexes limit the effectiveness of development programs (World Bank 2001, 2011). Evaluating IPs from a gendered perspective can serve to highlight imbalances between men and women in terms of power and representation. However, when we look at the recent literature on IPs, gender only seems to feature in the margins. Moreover, if we look at all the R4D projects we are and have been involved in, only a few have given attention to roles played by men and women, the relationships between them, and how this influences innovation.

When reviewing the R4D projects, we found that women are frequently underrepresented in IP processes, despite the fact that in many project locations women are often the primary producers and processors of agricultural products. There are often limited numbers of women included in platform meetings, which in certain locations may reflect the wider cultural context. Platform facilitators and members may fail to take into consideration the constraints that women face in attending and being able to actively participate in platforms. Women's ability to participate may depend on the timing and location of meetings, the multiple demands on women's time, and social expectations. Even if women are present in the platform they may not be able to voice their views. In certain parts of Africa, women are constrained from expressing their opinions due to cultural attitudes toward women speaking in public. This can result in platforms prioritizing issues that either do not reflect women's concerns, or could have a negative impact on them. For example, NBDC's IPs working on fodder development did not consider the extra demands on female labor and time that the new interventions required. Having said this, merely focusing on assessing women's participation in such public spaces may

ignore the influence that women have over decisionmaking processes “behind the scenes.”

Nonetheless, it should be recognized that the recent focus on the use of multiactor processes to link the poor, especially women, to economic and social benefits, does not always lead to desired effects. This is particularly evident in value-chain processes where increasing women’s participation in market-oriented production can either increase or decrease their access to and control over income, depending upon the character of their involvement and the specific characteristics of the chain (Coles and Mitchell 2011; KIT, Agri-ProFocus, and IIRR 2012). For example, commercialization of small ruminants—which in many places are traditionally the responsibility of women—may lead to a loss of control over household resources for women unless provisions are put in place to protect female interests. This may be difficult to address because it entails interfering with power dynamics at a household level, which may have unpredictable and unintended consequences.

The use of a gender lens to critically look at the design, operating modalities, focus of the platform, key constraints, strategies, and resulting outcomes may avoid some of the adverse effects mentioned above. However, gender relations are usually deeply entrenched, so transforming them may not be always be something that a platform is able to address, particularly if they are operating in a short time frame. In addition, concepts of gender equality are often imposed from a Western point of view, and may need to be reconfigured to take into account what men and women want in specific contexts.

### **Internal Versus External Facilitation—Pros and Cons**

When reviewing the IPs described in Box 10.1, it was observed that almost all were facilitated by international and national research organizations; some were facilitated by NGOs, and occasionally extension officers were involved in brokering innovation. According to the scheme of Tennyson (2005), most of these individuals and organizations would be classified as “internal” brokers, as they often have a direct stake in the process.<sup>4</sup> This raises questions about their ability to facilitate platform processes as they may have a vested interest in platform activities. This issue is of fundamental importance to IP processes, as those who establish and facilitate the platform often set the broad objectives, and this may significantly influence the selection of platform members, identification of key

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<sup>4</sup> In the case of COS-SIS (see Box 10.1), the program paid the facilitators, who often came from universities or research organizations, to act as innovation brokers. But they did not have a stake in the objective of the IP.

issues, and subsequent entry points (see Nederlof, Wongtschowski, and Van der Lee 2011). For example, organizations that instigate platforms may have their own institutional agendas, such as an emphasis on commercialization and value-chain development, which may not always reflect the interests of the main beneficiaries.

Although innovation processes are based on participatory principles which include ensuring equal representation, flexibility, and adaptive management, those who manage and facilitate the process may not always get the organizational support to undertake such an approach, and individual facilitators may have a narrow understanding of the function and purpose of the IPs. For example, many IPs are currently driven by national research organizations in response to the low uptake of technologies developed by them, such as the Research Into Use (RIU) program funded by the UK Department for International Development (DFID) (see Mur and Nederlof 2012) and the Dissemination of New Agricultural Technologies in Africa (DONATA) program coordinated by the Forum for Agricultural Research in Africa (FARA).<sup>5</sup> Some merely use platforms as a dissemination mechanism for existing technologies, instead of exploring the underlying reasons for low adoption.

In the case where international research centers and NGOs facilitate the process, there is a risk that members of the platform associate the platform with the funding organization. This may lead to members choosing issues that reflect the mandate of the funding organization, rather than expressing more genuine concerns. An alternative is to seek facilitators who are more closely aligned with the existing agricultural system, for example, agricultural extension workers. However, such actors often have a limited mandate, which restricts their ability to act effectively as innovation brokers (see Leeuwis 2004). Moreover, in utilizing such actors, government agendas may come to dominate the discussion, as we have seen in the case of natural-resource management in the Ethiopian highlands. For these reasons it is important that both brokers and platform members clearly state their position and areas of interest.

A solution may be to involve specialized brokers, who have innovation brokering as their main task and are external to the membership of the platform. But this would require further experimentation to identify who could play this role, as well as willingness on the part of donor organizations to fund such arrangements. It is also important to bear in mind that, although external brokers may

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5 RIU is a DFID-funded program aimed at catalyzing agricultural innovation; DONATA is a six-year program run by FARA to accelerate the dissemination of agricultural technologies across the region.

have advantages in terms of perceived neutrality and objectivity, there may also be certain advantages to engaging internal brokers. Internal actors are often better positioned as they can use existing relationships, networks, and local knowledge, this is particularly important in contexts where there are poorly functioning institutional frameworks which external actors may find difficult to navigate (see Klerkx, Hall, and Leeuwis 2009).

While the identification of actors as “internal” and “external” can be a useful way of identifying the pros and cons of different brokering arrangements, these categories may not be as fixed as they initially appear. So-called internal brokers may initiate a platform process, but then gradually take more of an external role as the platform develops, and vice versa. There is also potential for designing brokering arrangements that involve cooperation and collaboration between both internal and external actors. Ultimately, the type of brokering will depend on the specific context, the purpose of the platform, the availability of actors, and the skills required.

### **Issues of Sustainability: Toward Self-Organization**

IPs exist only as long as they are useful: their composition is likely to change over time as different issues emerge, they may be reconfigured to address a new set of problems, and ultimately they may evolve into a more permanent entity, such as a producers’ association, cooperative, or even business. Platforms may serve to build the innovative capacity of actors within the system, but the platforms themselves may cease to function.

Although most IPs are facilitated by research organizations or NGOs, which themselves have a stake in the process, these organizations are often perceived as relative outsiders by the other actors in the platform; they often reside outside the project area and operate on behalf of a specific project and donor. In order to sustain the innovation process, it would be important to make other actors in the platform capable of taking over some of the critical innovation brokering tasks after project funding comes to an end. However, handing over facilitation may be a complicated process. For example, relative outsiders may be more accepted as facilitators by other actors—especially where there are power inequalities or conflicting agendas between platform members—leading to potential resistance to internal actors taking over this role. In some cases it may be easier for external actors to convene the process and to keep the overall objective of the platform in mind; insiders may need capacity building to take on this role. Facilitation by so-called insiders may encourage ownership of the process among local actors, making it easier for the implementing organization(s) to phase out, but there can be problems with lack of trust, particularly regarding finances.

Experiences from projects that have instigated platforms and then tried to “hand over the stick” illustrate some of the challenges that may be encountered. As part of a two-year project on goat production and marketing in dryland areas of Mozambique (imGoats), an international NGO was identified to take up the innovation-broker role. Although a project team from the NGO took the lead, they realized the need to identify local actors who could take over the role of innovation broker in order to sustain the process. The platform members elected a committee of four members, representing different actor groups. Throughout the process, the project team provided on-the-spot support and backstopping. Although the committee gradually took over responsibilities for facilitation and coordination, they faced two big challenges: linking with different actors outside the platform, and strategic networking with government agencies. One constraint was the low capacity among the committee members at the start of the project, but committee members’ competing commitments and the short time frame of the project played a role as well. However, there are also positive examples of platform sustainability, such as the case of the SSA CP—whereby 36 platforms were set up throughout Africa. Many have become established within the local or district government administrations. Support to farmers from local policymakers has strengthened the platforms. According to Mokwunye and Ellis-Jones (2010), the sustainability of the IPs has become apparent where farmer organizations, commercial people, and local governments have become drivers and champions.<sup>6</sup>

We find it difficult to draw conclusions regarding the most effective brokerage arrangements for the sustainability of platforms. Generally speaking, as the main focus of any IP is to stimulate and support actors to start working as a self-organized and self-managed innovation system, handing over the task to local innovation brokers should be a central part of the process.

### **Issues of Scale: How to Ensure the Quality of the Process**

Recently, FARA was approached by the Minister of Agriculture of Sierra Leone, who wanted to establish 230 IPs (Adekunle, pers. comm.). In addition to this, The Gambia, having been persuaded to try the approach, decided to commence by setting up 22 platforms.<sup>7</sup> However, working at this kind of scale

6 Champions are highly motivated actors that can play a role to mobilize peers of their groups, promote contact between the platform members and their constituencies, and often set an example (see Heemskerk, Klerkx, and Sitima 2011).

7 It is important to realize that IPs are not a blueprint solution; instead of starting with IPs, it is better to start with the identification of opportunities through a scoping exercise and then to take advantage of these opportunities, through establishment of actor linkages or an IP.

demands that a new generation of innovation brokers is trained and armed with the basic tools for effective platform facilitation.

FARA has started undertaking such capacity-building activities through a range of programs, including the SSA CP and the Platform for African–European Partnerships for Agricultural Research and Development (PAEPARD).<sup>8</sup> The PAEPARD project in particular places an emphasis on training “Agricultural Innovation Facilitators.” FARA is also working with partners to enrich the curriculum of universities to include soft skills that are essential for the successful facilitation of innovation processes. In addition, the Kenya Agricultural Research Institute (KARI) and the Australian Centre for International Agricultural Research (ACIAR) recently developed an initiative to train people from national research organizations across Africa in the facilitation of IPs (Makini et al. 2013).

Such endeavors are highly encouraging, but it is important that they are not one-off activities. Developing skills in innovation brokering requires an iterative learning process which cannot be dealt with through modular training, but requires learning by doing and reflection on the process (Ngwenya, Hagman, and Ramaru 2008; Ngwenya and Hagmann 2009, 2011). Moreover, institutional and policy support may be required over a sufficient time frame in order for such initiatives to have long-lasting impact. For example, those who are trained are likely to need support and possibly incentives from their organizations to address systemic and underlying constraints. Experience has shown that building facilitation capacity without investing in the institutional reform necessary to support process-oriented approaches is unlikely to succeed. In South Africa, for example, a Participatory Extension Approach (PEA) with facilitation for change embedded in it was implemented through the BASED program (see Ngwenya, Hagman, and Ramaru 2008). The program was successful in training quality facilitators among selected extension officers and managers. However, in order for these new emerging professionals to be successful, a radical transformation of government structures was required to provide an enabling institutional environment. At the beginning, some senior managers backed the approach and initiated the process of integrating PEA into the mainstream system. However, the process collapsed due to a change of management. As a result, many of the trained facilitators left the government system to form an independent NGO.

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8 PAEPARD seeks to strengthen African agricultural research and development actors’ capacity to participate in European-led development initiatives for Africa and to create more responsive development programs for Africa.

With these examples in mind, it is clear that developing facilitation capacity requires a much more systematic approach that pays attention to the broader supporting structure. Scaling out of IPs to other areas and locations needs to be accompanied by institutional and political support for different ways of working and for the newly emerging professionals who help guide these processes.

### **Monitoring and Evaluation: A Role for Facilitators?**

Monitoring and evaluation (M&E) is particularly important for IPs given the growing demand for evidence that innovation-system approaches lead to impact on the ground. However, facilitators of IPs often struggle to develop appropriate M&E formats. Traditional research and development approaches have a tendency to employ a linear M&E model based on an assumption that change can be planned, easily identified, and controlled (Prasad Pant 2010). However, such theoretical approaches and the associated tools are not necessarily suitable for an innovation-system approach due to its complex, non-linear, and participatory nature. Due to their nature, the impacts of IP processes are not always tangible and can be difficult to monitor. IPs therefore require an M&E framework and set of tools that take into consideration the complexities of innovation systems, and which can document and assess process as well as outcomes (see Njuki 2010).

The objective of M&E in the context of R4D projects is twofold: first, it may serve as a tool to generate research-based evidence for the effectiveness of IPs across different contexts; second, it is meant for joint learning among project teams and the actors by assessing their performance and to gain a better insight into the underlying issues to adapt the course of action. Although researchers may play an important role in the first objective, innovation brokers play a critical role in the second one through facilitating and documenting a systematic process of action, monitoring, reflection, and adaptation. In our experience, however, innovation brokers often do not consider M&E as part of their role, which makes implementation difficult. Based on the SSA CP, a set of tools to document IP processes and outcomes was adapted for use by innovation brokers in several R4D programs in West Africa (see Pali and Swaans 2013; initially adapted for PROGEBE, some tools were used for the PLM project and VBDC). However, the tools were applied with mixed success. After further training, research-focused platforms—which often assigned specific persons to document lessons—applied the tools successfully; however, facilitators of development-focused platforms either did not always understand what was expected in terms of M&E, or struggled to use the tools and found them cumbersome.

In one of the other projects (imGoats), outcome mapping—an alternative approach to planning, monitoring, and evaluating development impact developed by Canada’s International Development Research Centre (IDRC) (Earl, Carden, and Smutylo 2001), was adopted for M&E.<sup>9</sup> Project partners and innovation brokers used this approach to track changes in behavior (that is, actions, relations, activities) among actors in the platform and the wider environment. Although their experience was generally positive, the documentation and analysis was perceived as highly resource intensive. Overall, whether outcome mapping or other approaches were used, innovation brokers and project partners found it easier to apply and use the tools than to design the overall framework. This suggests a need for process-light, simple, and accessible formats for M&E.

While more resource-intensive approaches may work in more research- and learning-focused platforms, in more development-focused projects, the use of relatively simple participatory tools may be more appropriate to monitor progress. This could be a task of the innovation broker, but it should be borne in mind that joint observation, documentation, and analysis may also stimulate ownership of the process and outcomes among platform members. There are examples, such as the SSA CP, where farmers and other players on the platform helped in the monitoring process after having been trained. However, from our experience it seems that assistance and support from M&E specialists may be required for the development of an overall M&E framework and the tools themselves, particularly if the M&E goals are focused on collecting evidence for external donors or researchers rather than for platform members themselves.

## Conclusion

IPs are increasingly being used in research and development initiatives. However, the dynamic nature of innovation processes, and the differences in interest, capacity, and power among the actors involved, makes the role of facilitation or innovation brokering particularly challenging. We believe that the key to success of an IP is very much linked to the attitude, skills, and capacities of the innovation broker. This chapter has highlighted seven key issues which, in our view, are critical to effective platform facilitation and have

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<sup>9</sup> Outcome mapping is one of the more popular M&E approaches for the purpose of learning, but there are also other approaches and tools, for example Causal Process Tracing (Crane and Richards 2009), which was tested in the COS-SIS program.

not received the attention they deserve. They range from the dynamic and evolving nature of IPs to issues of power and gender, the problematic role of innovation brokers, issues of sustainability and scaling, and monitoring and evaluation for learning.

For maximum benefit of IPs, facilitators with a flexible attitude and process skills are needed. Both internal and external actors can act as facilitators and there is potential for brokerage arrangements which draw on both actor groups. For example, we have seen from many cases that with external support, farmers or other local actors can grow slowly into facilitation roles. It is also important to realize that not all brokering functions need to be fulfilled by one person or organization; so-called champions, that is, highly motivated actors in the platform, can play a role to mobilize peers of their groups, and promote contact between the platform members and their constituencies (see Heemskerk, Klerkx, and Sitima 2011; Klerkx and Aarts 2013). It is clear that capacity building for facilitators is of critical importance, and steps being taken by agencies including FARA and KARI are heading in the right direction for enhancing brokering skills at a larger scale.

Although IPs offer a potential way of achieving institutional change and a means for facilitating interaction and learning among different actors, this may be complicated in contexts where there are entrenched inequalities and political sensitivities and where informal (local) institutions play an important role (Cullen et al. 2014). A group-based approach provides an opportunity for different actors to interact, build trust, and engage in joint learning, and can potentially provide an opportunity to transform underlying values and patterns of interaction that may hinder innovation. However, this may work better in homogeneous settings where people are free to express themselves, than in heterogeneous settings such as IPs (Swaans et al. 2008). Under such circumstances, combining multiactor platforms with subgroups which can focus on the needs of specific actors should be considered.

The context and the aim of the platform may also determine who is best placed to take on the role of innovation broker. As IPs have evolving agendas, fluid brokerage arrangements may be required that also evolve over time to draw on the skills and resources of both “insider” and “outsider” brokers. This requires sufficient flexibility on behalf of the facilitating organization and an understanding that actor roles may need to shift depending on the trajectory of the platform. More research is needed to explore the effectiveness of different types of innovation brokers across different contexts, how their roles change over time, and the implications for the innovation process, as well as how different brokering arrangements can be institutionalized so that

innovation processes can be sustained after projects, or organizations instigating the process, phase out.

Despite the positive developments that are already taking place, significant changes to institutional arrangements and incentive mechanisms are required if IPs are to be successfully scaled up. This implies an emphasis on developing facilitation and management competencies among a range of actors that are systems based and process oriented, as well as the political will to support such new ways of working. Achieving socioeconomic impact among small-scale farmers will be critical to justify such time- and resource-intensive processes. IPs will also require critical monitoring and assessment to ensure that they adequately target and address the problems of the poor.

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## **PART 4**

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# **Evaluating Inclusive Value-Chain Development**



## EVALUATING INCLUSIVE VALUE-CHAIN DEVELOPMENT<sup>1</sup>

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Maximo Torero

### Summary

This chapter introduces the various qualitative and quantitative methods used to conduct value-chain program impact evaluations that will be discussed in the following four chapters. We provide a brief overview of each method, as well as its benefits and limitations, and the scenarios in which it should and should not be used. While each of these methods has its uses, significant research remains to be done to ensure that impact evaluations of value-chain interventions truly capture program effects and take into account the challenges faced when trying to scale up successful programs in different locations and across different populations.

Competitive and efficient markets are key to successful economic growth, and well-functioning value chains are in turn key to successful markets. However, constraints such as limited market power, high transaction costs, poor incentives, variable risk, and a lack of access to credit can hinder the development of high-value agricultural markets, as well as markets for staple crops. This introduction discusses how interventions designed to establish more inclusive value chains for smallholders, and thus more successful markets, should be evaluated so that their impacts, costs, and benefits can be better understood.

Traditional methodologies to assess the performance and impact of value chains have focused on techniques such as participatory data collection, case studies, or different mechanisms to collect data for point price estimates or identification of inefficiencies across the value chain. While these methods serve the needs of commercial actors, they do not identify an intervention's welfare benefits, nor do they provide measures of the performance of the

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<sup>1</sup> The authors thank PIM for supporting innovative work on impact evaluation for inclusive value-chain development and on the use of quantitative tools to measure gender differences within value chains, as part of their cross-cutting gender program.

whole value chain. We provide concrete examples of different methods that can be used to fill these two gaps.

In essence, impact evaluation will accumulate credible knowledge of what works and what does not work. The overarching goal behind impact evaluation is to maximize the impact of development projects in reducing global poverty by generating information which will help: (1) to improve the design of projects based on experience; (2) to improve accountability, by clearly identifying the causal links from intervention to impact; (3) to identify successful projects to be scaled up, and (4) to allocate resources across programs by better understanding what works well, and how and which interventions are more cost-effective than others.

Finally, it is not feasible to conduct impact evaluations for all interventions. We need to build a strong evidence base for all sectors in a variety of contexts to provide guidance for policymakers and practitioners. Some examples of the types of value-chain intervention for which impact evaluation would be useful are (1) innovative schemes to upgrade value chains; (2) pilot programs that are due to be substantially scaled up; (3) interventions for which there is scant solid evidence of impact in the given context; and (4) when there is a clear need to prioritize projects based on cost-effectiveness.

## **What We Know about Impact Evaluation for Value-Chain Interventions**

Impact evaluations measure the change in a development outcome that is attributable to a defined intervention; they are based on models of cause and effect, and require a credible and rigorously defined counterfactual to control for factors other than the intervention that might account for the observed change. Impact evaluations are structured around one question: What is the impact (or causal effect) of a program on an outcome of interest? The same general principles apply to impact evaluations of value chains and innovation platforms. Evaluation assesses whether the program has affected the key indicators of interest, such as poverty and nutrition, among a sample of project beneficiaries and across other dimensions of interest, such as gender.

There are different designs and methods of impact evaluation. Qualitative methods are normally used to understand the knowledge, attitudes, priorities, preferences, and perceptions of target beneficiaries and other stakeholders. These methods include, among other things, the organization of focus groups, informal interviews, semistructured interviews, and structured interviews (for further details see Lawrence 1999; Garbarino et al. 2009; Chung 2000a,b). In

addition, these methods are also useful to understand the mechanisms behind impacts and the channels through which observed effects emerge. The idea is that important information about perceptions, attitudes toward the program, incentives to participate, and the program's unexpected indirect effects on household or community dynamics may be missed by the use of purely quantitative methods. Qualitative methods are particularly useful for acquiring a more in-depth understanding of the factors influencing a program's operations or impact. Several examples are presented in parts 2 and 3 of this book. For example, the 5Capitals method (Donovan and Stoian 2012) spells out why impact evaluation is different in the context of value-chain development (VCD) and provides an example of how it can respond to the needs of non-governmental organizations (NGOs) and value-chain actors for learning what works and what does not work for achieving inclusive VCD. There is, however, a trade-off between depth and breadth, and smaller sample sizes in qualitative studies mean that findings are rarely statistically representative of a broad population. Quantitative and qualitative evaluation methods compensate for each other's weaknesses, and each approach provides more value when used in a mixed-method design, providing information and conclusions that are more coherent, reliable, and useful than those from single-method studies.

On the quantitative side, there are experimental and quasi-experimental methods (for a detailed review of all methods see Khandker et al. 2010; Gertler et al. 2011). A fully experimental approach takes a subsample of the population of interest and randomly assigns them as participants in the program (the so-called treatment group); a second subsample is randomly assigned to the so-called control group, which does not participate in the program. The control group provides a proper counterfactual by showing the conditions for the treatment group had they not participated in the program, thus allowing for a comparison that identifies the impact of the program. With a sufficiently large sample, this type of design relies on the correct implementation of the randomization and on the full exclusion of the control group from the program (when a control group is not properly excluded, this is called contamination).

A quasi-experimental approach may be used when it is not possible to conduct randomized evaluations. In such approaches, instead of creating treatment and control groups by random assignment *ex ante* (that is, prior to the beginning of the program), these groups are created *ex post* (that is, once the program has begun or even after it has ended). This is done by using observed sociocultural, economic, ecological, and geographical characteristics to ensure that the comparison groups are sufficiently similar, at least in observable

characteristics. In this way, it can be argued that any observed impact is due to the program as opposed to other confounding factors. Ex-post design is typically used when ex-ante randomization is not possible—for example, if the program has already begun or if ethical or targeting considerations rule out such randomization. A nonexperimental method may be used to generate a control group; this would involve the comparison of program beneficiaries and nonbeneficiaries who had similar observable characteristics before the project was implemented.

Finally, in a nonexperimental evaluation, a program is nonrandomly established across units (individuals, households, villages, and so on) to identify an appropriate counterfactual. The various nonexperimental methods can be classified into two groups. The first group assumes that the unobservable characteristics of the program's beneficiaries and control group participants have nothing to do with the individuals' decisions to participate in the program. This is also known as conditional exogeneity of program placement—a strong assumption. Such methods include single-difference methods and double-difference methods. The second group is comprised of matching (including propensity-score matching, PSM) methods, discontinuity design methods, and instrumental variables; these methods do not make the exogeneity assumption, but rather address the possibility that, even after controlling for observable characteristics, unobservable characteristics may still make participation nonrandom. As a result, these methods evaluate the impact of interventions by comparing the outcomes among participants to the outcomes among comparable nonparticipants, but without randomization of participation. If both groups are exposed to similar other external events, then they allow the analyst to disentangle the effect of the intervention from the effect of all other *confounding factors*. A second class of difficulties arises when the project is purposively targeted at particular classes of beneficiaries, leading to an external selection bias. Assume for instance that an intervention in the value chain is targeted at the neediest households. In this case, comparing the poverty rate between beneficiaries and nonbeneficiaries after the project may wrongly conclude that the overall impact is zero or negative. In such cases, a more valid control group would be households that were similar to the beneficiaries at the start of the intervention. One strategy may be to compare the changes—instead of the level—of a given indicator (what we refer to as double-difference methods) between the group of beneficiaries and the control group. Assuming that the change in the indicator in the control group is a good representation of what the change in the indicator would have been among the beneficiaries, this “difference in differences” estimate may provide a valid way

to neutralize the external selection bias among observables and unobservable characteristics that are fixed over time, and hence provide an unbiased assessment of the program's effect.

In other cases, however, the confounding factor will affect the beneficiaries and the control group differently—for instance, if one would like to assess the effect of microcredit targeted at the poorest households in an area. Assume that the program occurs at a time of relatively high economic growth or weather conditions from which all households in the targeted area (rich and poor) benefit. It is likely that the economic growth will also contribute to the improvement of the income among the poor program beneficiaries, while the effect will be limited on the richer households. In such a case, a “difference in differences” measure between the richer (control) and the poorer (beneficiaries) groups will tend to overstate the effect of the program on income generation for the poor. A valid control group is one that provides a valid representation of what the average poverty level among program participants would have been without the program. Several methods may be used to generate such control groups. For instance, if the program selection criteria are known, information may be collected on nonbeneficiaries who also satisfied the selection criteria but were not included in the program for reasons independent of the outcome of interest.

A third type of bias may, however, occur when the selection process is not fully observable. Such is the case, for instance, when not all targeted households decide to benefit from the program, leading to self-selection bias. The problem of biases linked to unobservable characteristics may be resolved by “natural experiments.” Such methods rely on the availability of some variable(s) that help predict participation in the program but are not related to the outcome variable (for example, income). Such methods include instrumental variables approaches, regression discontinuity designs, pipeline comparisons, and others as previously mentioned.

The following four chapters detail several distinct approaches to conducting value chain-intervention impact evaluations. The authors of Chapter 11 (Saenger et al.) implemented a randomized controlled trial and field experiment in Vietnam to improve dairy farmers' quality measurements. Chapter 12 (Cavatassi et al.) examines the Plataformas program in Ecuador using quasi-experimental methods. Chapter 13 (Horton et al.) analyzes the experience of Participatory Market Chain Analysis (PMCA) using qualitative methods in several case studies. Finally, Chapter 14 (Madrigal and Torero) provides several quantitative tools and metrics from the labor economics and discrimination literature, and gives examples of how these could be applied

in a value-chain context. All of these methods seek to connect smallholders and other marginalized groups to high-value markets. The approaches provide complementary views of the value chain and of methods to improve both the rigor and the nuance of impact evaluations for value-chain interventions.

Chapter 11 (Saenger et al.) provides a perfect example of a randomized controlled impact evaluation. The authors conducted a randomized controlled trial and field experiment with dairy farmers and a milk-processing company in Vietnam. Their approach, designed *ex ante*, is a theoretically ideal approach to constructing a valid counterfactual and to ensuring that there is no selection bias, given that the farmers are randomly assigned to treatment (beneficiaries) and control groups. This randomization ensures that all farmers have the same chance of participating in the program and that the distribution of the two groups' characteristics (both observed and unobserved) are statistically indistinguishable. The authors tested whether the quality-control procedures used by the processing company were leading farmers to underinvest. The risk on the farmers' part came from the possibility that the company would manipulate the process and say that the milk delivered was of low quality and therefore deserved a lower price. By introducing vouchers for third-party quality measurement, the program improved the company's credibility with the farmers. With this increased trust, the farmers then had more incentive to invest in techniques to improve milk quality and increase revenue. This chapter is unique in that it focuses on the mechanisms and incentives for different value-chain actors to contract with one another. The authors' proposed contract-farming designs make both parties better off, rather than trying to cut out the intermediary or encourage smallholders to take over other capacities in the value chain.

Although the intervention reported in Chapter 11 (Saenger et al.) affected the whole milk-production value chain, there were some specific characteristics of the intervention that enabled the use of the randomization procedure. First, the intervention was directly targeted to milk producers, which made it simpler to randomize; second, it was one single intervention rather than a package of interventions, which is normally the case with innovation platforms, as in Chapter 12 (Cavatassi et al.), or with participatory approaches, as in Chapter 13 (Horton et al.). Therefore, it is important to stress this given there are in general few value-chain impact studies that use experimental and randomized controlled trial (RCT) methods because value-chain development usually involves many different partners (public and private-sector institutions) and often complex interventions, which might make RCT and experimental approaches particularly difficult and in many cases not feasible to implement.

The authors of Chapter 12 (Cavatassi et al.) performed an ex-post evaluation using econometric techniques common in impact evaluations. They assessed whether participation in Ecuador's Plataformas program, which establishes alliances between small-scale farmers and a range of agricultural support-service providers, had any effect on income. The chapter finds that the program had a positive impact on yields, prices, and gross margins. The authors conducted baseline household and community surveys in two Ecuadorean provinces and then identified treatment communities. Using data from the most recent census, they constructed a counterfactual control group with similar geographical, agroecological, and sociodemographic characteristics to the treatment communities. They then used PSM to identify which control communities were most similar to each treatment community. In addition to creating control communities, they also factored in households in treatment communities that did not participate in the program. The PSM procedure allowed the authors to select a control community that was very similar to each treatment community in all observable aspects except for the treatment status, thus providing a proper counterfactual for each treatment community.

One of the major concerns regarding the PSM approach is that there might be other observable and unobservable differences that could explain a community's selection into the treatment group. To minimize this problem, the research (Chapter 12) implemented an instrumental variable (IV) approach to control for observable and unobservable differences in the control and treatment groups. The IV technique identifies a factor that predicts participation in a program but that does not influence the program's outcomes of interest. This factor is then used to simulate which participants would have been in the treatment group and which would have been in the control group had the project been based on that factor. The difference in outcomes between these simulated treatment and control groups constitutes the project's impact.

For an IV estimation approach to be viable, as it is in Chapter 12, the instrumental variables used must be strong predictors of whether or not a participant will receive the treatment; however, we must also be sure that the variables themselves will not determine the program's outcome. It will likely be difficult to identify variables that meet both these criteria since the factors determining whether a potential beneficiary wants to participate in the program are likely to also be factors that will affect the outcome of interest. IV methods estimate a program's impact on people who participate in the program *because* of the program's instruments. It is thus important to know which precise groups will be affected by those instruments, and whether these

groups are of interest for the program. IV estimation does not easily allow for generalizing to other groups.

The IV technique is useful in determining local average treatment effects (LATE) rather than average treatment effects (ATE), which are usually the effects examined in impact evaluations. The IV estimator is a weighted average of the LATE of different subpopulations; the subpopulations that are more responsive to the program's instruments carry a higher weight in the final IV estimate. These issues could severely bias the results or the conclusions that can be drawn from them if the subpopulation is not correctly identified; thus great caution is required when interpreting the results of the IV technique.

Finally, one important thing that the authors of Chapter 12 (Cavatassi et al.) did that can help strengthen the interpretation of a program's results is an assessment of the program's impact pathways. The authors analyzed the ways in which farmers might benefit from the program and found that the program significantly increased yields and gross margins for the treatment communities.

Chapter 13 (Horton et al.) tries to assess the impact of a PMCA. The chapter provides a clear example in which neither experimental nor quasi-experimental approaches could be implemented. In PMCA, practitioners gather various market-chain actors together to brainstorm ideas for new agricultural products and better ways to market existing crops. PMCA was created both to link smallholders to markets through innovation, and to evaluate participatory interventions. Chapter 13 (Horton et al.) evaluates eight PMCA interventions, four of which they exclude from in-depth analysis because of significant departures from the PMCA protocol. Attempts were made to conduct an impact evaluation using quasi-experimental methods; however, delays in conducting the baseline surveys prevented the data from being useful for evaluation purposes. Instead, the authors implemented a case-study evaluation following the methodology of Yin (2009). Drawing on the definitions of Chen (2005), they stressed the importance of the action model, "a systematic plan for organizing resources, staff, and relationships in order to deliver the intervention faithfully." They also identified the program's change model, which is the "broader conceptual framework that links the intervention's activities and outputs to the expected outcomes and impacts and explains how and why the intervention is expected to lead to the desired changes." Their evaluation is based on the "fidelity of implementation," which "refers to the extent to which a program's implementation is consistent with its action model." They discovered that PMCA needs to be adapted

to local country and market contexts, while still remaining consistent. The economic benefits of the four PMCA interventions were small, but by identifying both the action and the change models, the authors were able to distinguish creative adaptations to the program from lapses in implementation.

The approach followed by Chapter 13 (Horton et al.) is extremely useful in understanding the potential effects of PMCA, but it doesn't allow us to isolate whether the observed changes can be truly attributed to the intervention. Clearly, it would have been better to combine this method with an experimental or quasi-experimental approach.

Finally, Chapter 14 (Madrigal and Torero) sheds light on an important issue that is not captured by any of the previous approaches: Most value-chain impact evaluations fail to look at effects disaggregated by gender. This is an important oversight, because in most value chains men and women play different roles, and failure to account for gender in a randomized controlled trial, quasi-experimental, or participatory intervention may significantly alter the results of these studies. To resolve this gap in the literature, the authors focus on several tools and metrics to incorporate gender in value-chain impact evaluations. The Oaxaca Blinder decomposition analysis allows for proper measurement of wage gaps between men and women by controlling for other observable variables; the Duncan Index and Access to Work Equality Index measure occupational segregation and differential access to employment. Finally, time-use analysis can provide insights into how to improve labor opportunities for both men and women. Provided that gender-disaggregated survey data are collected, these tools can all be applied to value-chain interventions and analyses at low cost.

## **Gaps that Need to be Addressed**

Although the four chapters in this section provide clear examples of ways in which value-chain improvements can be evaluated, there are still some important issues and gaps that need to be addressed in future research. First, even where RCTs are used, as in Chapter 11, there are still concerns on RCTs that need to be looked at, and specific implications as mentioned by Barret and Carter (2010). Second, most of the value-chain improvements being developed include interventions that affect different nodes of the value chain. This creates enormous complexity when trying to assess the impact of a program experimentally or quasi-experimentally. For example, if the unit of treatment is a whole value chain, there will need to be sufficient treatment and control value chains of the same commodity to have enough statistical power to assess

the true impacts of the intervention. This would require an appropriate sampling strategy representative of each node: input suppliers, producers, traders, wholesalers, and retailers. However, it will sometimes not be feasible to find the number of value chains needed in the same geographical area. Similarly, the potential for spillovers of the effects in one node of the value chain to others is important, and methods need to identify ways to control for this.

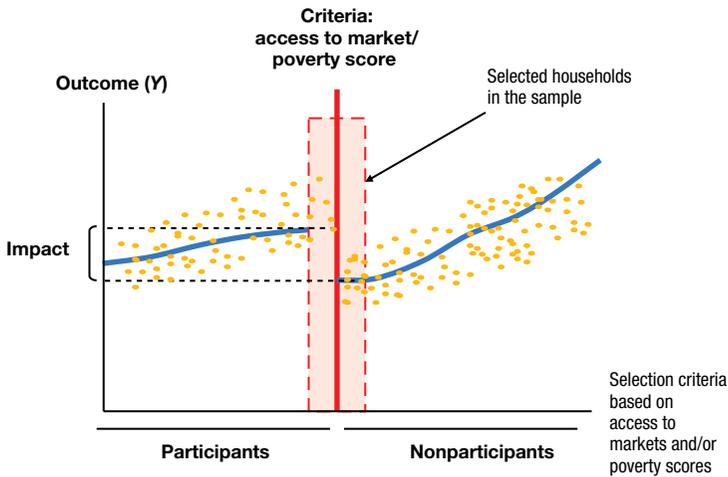
An alternate method which could contribute to partially addressing this problem is a nonexperimental approach known as regression discontinuity design (RDD) (for further details, see Jacob et al. 2012; Bloom 2012; Imbens and Lemieux 2008). If small variations in a specific variable produce a discontinuous change in a person's (or value chain's) eligibility for the treatment or participation in the program, this can be used to identify the program's impact using IV estimation, even if the variable is also a direct determinant of the program's outcome. For example, there may be levels of poverty or of access to roads or technology that determine a farmer's eligibility; these may in turn produce regression discontinuities. As presented in Figure P4.1, by using such discontinuities the impact of an intervention or program can be estimated by comparing outcomes for beneficiaries who just qualify for the project on this index/score<sup>2</sup> with outcomes for individuals who just fail to qualify for the program given their score (the so-called control group), as determined by these characteristics. The logic behind this is that since observations around the cut-off have treatment status, that is as good as randomly assigned.

One caveat to this approach is that if the discontinuity (or cut-off range) is too big, those who did not qualify for the program may be sufficiently different from those who did in terms of their observable characteristics. As a result, the impact of the program may be estimated incorrectly.

A variation on this type of evaluation method is called "fuzzy" regression discontinuity (see Jacob and Zhu 2012). In this case, some beneficiaries have scores that place them on the nonbeneficiary side of the discontinuity. This RDD method is termed fuzzy because the cut-off is not clear or strict. When the eligibility criteria for participation are public information, the variable used to establish the treatment group could be manipulated so that a person appears eligible; clearly, this can create difficulties when estimating the effect of the program. Such manipulation would introduce nonrandom selection

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2 Note that this score does not necessarily relate to the PSM procedure. The score for the RDD is a variable, either existing or constructed, that establishes a threshold above which individuals are allocated to the program and below which they are not part of the program. The propensity score is one such variable that can be used in this estimation if it is discontinued at some specific point.

**FIGURE P4.1** Regression discontinuity design

Source: Authors.

around the cut-off, which would need to be addressed by randomizing the subpopulation around the fuzzy cut-off; if this is not possible, nonrandom assignment can be permitted to adjust for selection into the fuzzy interval in the final estimation. However, as long as this manipulation is not precise, the RDD remains valid.

RDDs require a large sample (and a considerable amount around the cut-off) and the fuzzy interval must be moderate to be able to provide valid and precise impact estimates.

The second issue that calls for significant innovation and research is that in all the impact-evaluation approaches, even RCTs, there needs to be a mechanism to capture heterogeneity and external validity—that is, to understand how much the results identified can be extrapolated to other areas or even other value chains of similar commodities (heterogeneous populations). In a majority of impact evaluations, it is commonly assumed that the estimated treatment effects can be generalized to the whole population or to a new location in which no experiment was conducted. However, since individuals in a new location can have different observable and unobservable characteristics, the ATE can be significantly different from the one obtained from experiments conducted in other locations. Several authors have protested against policy recommendations that they believe are based on implicit extrapolation from a small number of experiments to a wide variety of dissimilar contexts

(Deaton 2010; Pritchett and Sandefur 2013). Empirically, a growing body of work shows that identical policies have different effects among individuals with the same observed characteristics living in different contexts (for example, Allcott 2012; Attanasio, Meghir, and Szekely 2003), because unobserved differences between populations remain. Hence, we need a method that accounts for heterogeneity across locations, or we need to design an evaluation that takes this issue into account from the beginning.

For methods that account for heterogeneity, there has been some progress. Athey and Imbens (2006) generalize the standard difference-in-differences estimator and derive an estimator that can be used to extrapolate results under perfect dependence between the treated and untreated outcomes. Gechter (2014) improves on this work by developing a method for predicting the ATE in a new location under a mild restriction on the joint distribution of potential outcomes. Specifically, he derives bounds on the predicted ATEs by imposing a lower bound on the rank correlation of the potential outcomes. We can then take the case of minimal treatment effect heterogeneity (perfect rank correlation) as a benchmark to further investigate how the predicted bounds on the ATE change by allowing different levels of heterogeneity.

Finally, an alternative way to ensure a certain level of external validity is through the ex-ante design of a scaling-up mechanism that will allow a program to be replicated on the basis of results from rigorous impact evaluations. An example of this potential approach is given by Torero (2014), who essentially develops a typology of rural areas that identifies needs, opportunities, and bottlenecks at the regional level based on modeling of agricultural performance and potential using the economic concept of the production possibilities frontier, drawing on highly detailed household-level survey data and geospatial tools. Such a typology allows program targeting based not only on needs, as is the case when using poverty maps, but also on economic potential against current performance (or efficiency relative to the economic potential) and the associated needed investment gaps to improve the respective performance so that it can reach its economic potential. As a result, projects designed to resolve those gaps can be replicated in similar types within the typology. In addition, combined with appropriate project designs and impact-evaluation tools, this typology can help systematize targeting of development projects in a range of technical domains across the value chains, including financial services. However, because this approach involves an ex-ante identification of similar locations where an intervention can be successfully tested, it will require significant work before implementation.

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## IMPACT OF THIRD-PARTY ENFORCEMENT OF CONTRACTS IN AGRICULTURAL MARKETS—A FIELD EXPERIMENT IN VIETNAM

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Christoph Saenger, Maximo Torero, and Matin Qaim

### Introduction

Over the past two decades, many smallholder farmers in developing countries have benefitted from closer integration into global value chains, but constraints in accessing high-value markets remain (Reardon et al. 2009). Contract farming, which has recently become more widespread, links farmers to output markets for high-value foods such as fruits, vegetables, meat, or milk (Birthal, Joshi, and Gulati 2005; Swinnen 2009; Reardon et al. 2009; Mergenthaler, Weinberger, and Qaim 2009; Bellemare 2012). When agreements between buying companies and selling farmers are complemented by schemes to provide inputs, credit, or training, contract farming can also help to improve access to technology and overcome factor market inefficiencies (Masakure and Henson 2005; Minten, Randrianarison, and Swinnen 2009; Rao, Brümmer, and Qaim 2012).

While in developed countries there are strong institutions to enforce contracts, in developing countries this is rarely the case (Key and Runsten 1999; Kirsten and Sartorius 2002). An environment of weak institutions can negatively affect both buyers and sellers of farm output. For example, buying companies that provide finance or inputs as part of a contract lose if farmers renege on the agreement by diverting inputs to other crops or side-selling their output on the spot market (Gow and Swinnen 1998; Bellemare 2010). On the other hand, farmers may lose if the buying company has a nontransparent system of quality grading and thus the ability to manipulate prices. In this chapter, we focus on small-scale contract farmers who are negatively affected by information asymmetry with moral hazard resulting from weak institutions. Since Akerlof's (1970) seminal work, the economics of information has received considerable attention. A relatively new and important application is the study of emerging markets for high-value agricultural products. In these

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markets, product quality is an important factor in determining farmers' pay. As costly technology is required to assess nonvisible quality attributes, a harmful asymmetry of information may occur. The buyer can accrue information rents from reporting lower than actual quality levels, thus downgrading the price paid to the seller. Rational sellers forming the belief that the buyer cheats will factor in the buyer's opportunistic behavior, lowering their expectations about the product price. In this situation, contracts are characterized by additional price risk from the farmers' perspective. This can result in underinvestment in inputs and productive assets, leading to lower output (Gow, Streeter, and Swinnen 2000; Vukina and Leegomonchai 2006; Cungu et al. 2008). Such underinvestment by farmers can also increase the per-unit transaction costs of procurement for the buying company. Hence, weak contract enforcement may prevent whole industries from attaining their full potential, which is especially important in economies where the agricultural sector plays an important role.

Here, we investigate whether improved institutions for contract enforcement can break the information asymmetry and lead to higher investment and output produced. Specifically, we test the impact of an independent agency that can verify product quality resulting from the existing farmer production intensity and output levels. We also explore whether this type of contract enforcement can improve farm-household welfare.

Previous research indicates that more transparency in the supply chain is one possible solution to overcome harmful information asymmetry (Balbach 1998; Sykuta and Cook 2001; Young and Hobbs 2002). In a laboratory experiment, Wu and Roe (2007) have shown that third-party contract enforcement can be one way to successfully mitigate underinvestment and enhance social efficiency. But as the laboratory systematically differs from natural environments, external validity of this type of studies may be limited (Levitt and List 2007). Over the past decade, randomized controlled trials (RCTs), in which subjects take decisions in their natural environment, have been used extensively. Only recently, RCTs have been carried out in the field of agriculture (Duflo, Kremer, and Robinson 2008, 2011; Ashraf, Giné, and Karlan 2009; Cole, Giné, and Vickery 2013a).

We contribute to the literature on RCTs in agriculture and information asymmetry in contracts through a randomized field experiment, using the example of the fast-growing Vietnamese dairy industry, in which crucial institutions to support contract enforcement are missing. The industry is characterized by a great number of small-scale dairy farmers who are contracted by a large milk-processing company. This is a typical situation for emerging

markets for high-value agricultural products in developing countries (Reardon et al. 2009; Rao, Brümmer, and Qaim 2012; Bellemare 2012). In this field experiment, the contract of a randomly chosen subsample of farmers, the treatment group, is altered such that it becomes enforced; previously unobservable quality attributes are now measured and verified by an independent and certified laboratory. Control-group farmers continue to produce under the initial contract. For the field experiment, we collaborated with a private dairy company that provided access to weekly farm-level output data. This information is complemented with data that we obtained through household surveys.

We find that our intervention leads to higher input use and increased dairy output. There is also a positive treatment effect with respect to household consumption expenditures for a specific subgroup of the sample. We are able to attribute observed differences in output to a behavioral change of farmers rather than changes in the reporting strategy of the buying company. Hence, in this specific case, the buying company did not behave opportunistically, but the supply-chain architecture did not allow the buyer to signal its fair type to farmers. Third-party enforcement of contracts in an environment of weak institutions can move the supply chain to a first-best scenario, in which both smallholders and buying companies benefit from increased farm productivity.

## **The Vietnamese Dairy Industry**

In Vietnam, much like in other countries of Asia, milk is becoming an increasingly popular food item, leading to high growth rates in the dairy sector. For example, only two decades ago the consumption levels of milk and dairy products were almost nil due to cultural practices and low incomes. But with increasing income, urbanization, and the spread of Western lifestyle, the demand for milk has increased tremendously (Saenger et al. 2013). Today's per capita consumption of milk in Vietnam has reached 15 kg per year, which is about 8 percent of the amount being consumed in the United States or Europe. Currently, the Vietnamese dairy sector is dominated by local processing companies, importing large quantities of powdered milk from overseas to satisfy domestic demand. However, more and more milk is produced domestically, especially by small-scale farmers. Fresh-milk production in Vietnam has tripled between 2003 and 2009, but it still meets only one-fifth of domestic consumption (USDA 2011).

The leader in the dynamic dairy industry—and the cooperation partner in this field experiment—is the formerly state-owned milk processor Vinamilk.

This company collects the major share of milk produced in Vietnam and is also a main importer of powdered milk. Currently, the company has contracted more than 5,000 small-scale dairy farmers, most of them located around Vietnam's largest city and commercial capital Ho Chi Minh City.

### **Supply-Chain Architecture and the Standard Contract**

In Vietnam, milk is produced mainly on specialized small-scale farms. Crossbreed dairy cattle are held in sheds all year round. The major input is fodder; rations usually consist of forage produced on farms, complemented with purchased fodder, primarily concentrate. Farmers usually sell the entire milk output to one dairy company. Alternative sales options are limited. Informal channels exist, but can absorb only small quantities due to low demand for highly perishable raw milk in rural areas. Hence, small-scale dairy farmers, who have undertaken relationship-specific investment, have little bargaining power vis-à-vis large monopsonistic dairy companies.

The raw milk is channeled through milk-collection centers (MCCs) located in the vicinity of the dairy farms. An average MCC is supplied by about 100 farmers and is operated by a private entrepreneur working on commission for the dairy processor, in our case Vinamilk. Each MCC carries out the following tasks: collection and handling of the milk twice daily, sampling of the milk, initial testing of quality (through staff deployed by the dairy processor), and daily transport of raw milk to company processing plants, which are located in urban centers. The MCCs also administer the weekly payments to farmers.

The production contract between Vinamilk and the dairy farmers is a country-wide standardized written agreement, determining how much milk of what quality is purchased at what price. The output price per unit of milk  $p$  received by farmers is a function of milk quality  $\theta$ :

$$p = f(\theta) \quad (1)$$

Quality is a composite measure of several parameters, most importantly milk fat and total solid content, as well as bacterial contamination, all of which depend on input use  $x$  (for example, type and amount of fodder, level of effort):

$$\theta = g(x) \quad (2)$$

Various factors, such as limited access to inputs, finance, and lack of skills, constrain farmers in developing and transition countries to produce high-quality milk (Dries and Swinnen 2004, 2010; Dries et al. 2009).

Vinamilk tries to address these limitations by supporting farmers through the provision of training to overcome technical gaps, while the MCCs provide farmers with prefinancing for inputs (concentrate). But incentive pricing remains the main instrument at Vinamilk's disposal to promote the delivery of raw milk with high milk fat and total solid content, which is desired as raw material in the high-value segment. At the same time, the company uses price signals to discourage the supply of raw milk with high contents of psychrotrophic bacteria or antibiotics, which are known to increase processing costs (Claypool 1984). Worse, adulteration of milk along the supply chain can even have adverse health effects for consumers, as the recent case of melamine-tainted milk in China has shown (Jia et al. 2012).

In the early stages of dairy value-chain development in Vietnam, it was prohibitively costly to assess the quality of milk supplied by individual farmers. Instead, the milk was pooled at MCC level. Only one sample per MCC was taken to be analyzed at the dairy plant, and one common price was paid to all farmers delivering to the same MCC. Hence, the company lacked the ability to trace back the milk to its origin and thus to attribute milk quality to individual farmers. As a result, the company was hardly able to incentivize quality milk production. Today, cheaper quality-testing devices allow dairy companies to assess quality individually for each farmer, which is a key requirement for incentive pay. This also reduces the risk of deliberate milk adulteration in the supply chain. Vinamilk employs tests to detect undesired substances; suspect batches of potentially tainted milk are not accepted, and farmers are banned from further supplying milk to the company. The high probability of being caught is a strong incentive for farmers to refrain from adulterating.

To assess milk composition (milk fat and total solid content), Vinamilk staff take milk samples individually from the daily delivery of each farmer to the MCC. One sample per week from each farmer is randomly selected for further analysis with sophisticated laboratory methods in the dairy plant. Producers have unique identification numbers and are paid individually according to their own output (quantity  $q$  and quality  $\theta$ ). The base price for top-quality milk is subject to harsh deductions if one or more of the quality parameters falls short of the requirements set by the company. One-tenth of a gram of milk fat below the threshold—a deviation far too small to be visually detected even by experienced farmers—can trigger financial penalties. As milk analyses are carried out in the company's own laboratory and cannot be observed by farmers, milk quality remains private information of the dairy company. Currently, smallholders cannot overcome the information asymmetry regarding milk quality by systematically cross-checking the results

provided by the company, because individual milk testing is prohibitively costly, and collective action fails.

It should be noted that Vinamilk's technical capacity to assess milk quality individually for each farmer has shifted the informational advantage. Before individual testing was possible, farmers had an informational advantage about the quality of their milk; now, the company has an advantage. These dynamics also have important implications for the distribution of gains in contract farming. This first step of supply-chain development in Vietnam—from the assessment of pooled milk to individual milk testing—may have led to a distribution of gains in favor of the company. This is in line with a model on rent distribution in global value chains developed by Swinnen and Vandeplass (2011). The subsequent step that restores the symmetry of information between farmers and the company, as intended by our intervention, could increase market efficiency, triggering a further round of adjustments in the distribution of gains—this time in favor of farmers.

## **A Simple Model of Underinvestment**

The information asymmetry in the Vietnamese dairy contracts, where farmers do not know the exact price that the buying company will pay, can be understood as a form of price risk. The effects of price risk on household behavior and welfare have received considerable attention in the theoretical literature. Baron (1970) and Sandmo (1971) analyzed the impact of price uncertainty on producer output and profit. This analysis was extended to consumers (for example, Deschamps 1973) and farm households that can be both producers and consumers (for example, Finkelshtain and Chalfant 1991; Barrett 1996). Recently, Bellemare, Barrett, and Just (2013) further developed the framework to cover price volatility of multiple commodities for producing and consuming farm households and also used this framework for empirical estimates.

In our analysis of dairy contracts in Vietnam, we only focus on milk for which farm households are pure producers.<sup>1</sup> Hence, we build on the model for producers described by Sandmo (1971) to formally derive how the described asymmetric information on relevant quality attributes leads to lower output and input use as compared to a situation with symmetric information. It is assumed that farmers maximize expected utility of profits from milk

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1 Dairy farmers in Vietnam do not produce milk for home consumption. Overall, milk consumption in rural areas of Vietnam is very low.

production. The utility function is a concave, continuous, and differentiable function of profits. The farmer's cost function is defined as:

$$T(q) = V(q) + F \tag{3}$$

where  $V(q)$  is the variable cost function, which depends on output quantity  $q$ , and  $F$  represents the fixed cost. Further, we assume that the cost function has the following properties:

$$V(0) = 0, V'(q) > 0, V''(q) > 0 \tag{4}$$

In a contract with symmetric information, the profit function can be defined as:

$$\pi(q) = pq - [V(q) + F] \tag{5}$$

where the product of output price  $p$  and quantity  $q$  is total revenue. Without price risk, farmers maximize profits where marginal cost equals marginal revenue according to:

$$V'(q) = p \tag{6}$$

We now take this as the baseline and analyze how optimal output and thus input use change when the buying company has private information about product quality  $\theta$ . Exploiting its informational advantage, the company may report to the farmer a quality level that is lower than the one actually assessed in its own laboratory. According to equation (1), such underreporting of quality would negatively affect the output price, while increasing company profit. For dairy companies in the Vietnamese market this would be a tempting practice, given that they face competition not only from domestic processors but also from imports.

Such information asymmetry leads to price uncertainty for farmers. Output price becomes a random variable with an underlying density function  $h(p)$  and an expected value  $E[p] = \mu$ . The expected utility of farmer profit becomes:

$$E\{U[pq - V(q) - F]\} \tag{7}$$

Hence, the first-order condition for a profit maximum is:

$$E\{U'(\pi) [p - V'(q)]\} = 0 \tag{8}$$

which can also be written as:

$$E[U'(\pi)p] = E[U'(\pi)V'(q)] \tag{9}$$

If we subtract  $E[U'(\pi)\mu]$  on both sides of equation (9), we get:

$$E[U'(\pi)(p - \mu)] = E[U'(\pi)(V'(q) - \mu)] \quad (10)$$

Sandmo (1971) showed that the left-hand side of equation (10) is negative if  $p \geq \mu$ . This can be assumed in our case, because the price uncertainty comes from asymmetric information. Farmers who believe that the company underreports output quality will have a price expectation  $\mu$  that is lower than  $p$ . In that case, the right-hand side of equation (10) must be negative as well, and it can be written as:

$$E[U'(\pi)] (V'(q) - \mu) < 0 \quad (11)$$

Since marginal utility is always positive, this implies:

$$V'(q) < \mu \quad (12)$$

Equation (12) shows that profit-maximizing output is less than the expected price, and, since  $\mu < p$ , optimal output quantity with information asymmetry is clearly lower than without. This also implies lower input use.

The introduction of independent quality assessment to enforce the contract would mitigate the negative effect on the expected price level, because formerly unobservable quality attributes would become verifiable for farmers. This would force the dairy company to report the actual level of quality, leading to a situation where  $\mu = p$ . Hence, we hypothesize that independent testing will induce farmers to increase their output.

How can dairy farmers practically respond to higher expected output prices? Generally, they can raise the output of milk fat and total solid—the value-defining parts of the raw milk—in three ways: (1) increase the quality (milk composition) while keeping the milk quantity constant, (2) keep the quality constant while increasing the quantity, or (3) simultaneously increase quality and quantity. At the farm level, the goal of increasing the absolute quantity of milk fat and total solid can be achieved in different ways. In the short run, the main instrument would be to increase the amount of purchased fodder (that is, concentrate) to make the ration more nutritious. Hence, we hypothesize an increase in concentrate use through independent quality assessment. All other inputs are quasi-fixed in the short run. The supply of forage produced on the farm can only be increased in the medium or long run, as additional land would have to be acquired. Likewise, the herd size can only be increased in the medium or long run, as this requires significant investments for buying cattle or raising own female calves. In the long run, selective breeding may also improve the herd's overall genetic potential for milk production.

## Experimental Design and Implementation

After having outlined the theoretical framework of third-party contract enforcement, we now describe the design and practical implementation of our intervention in which randomly selected dairy farmers were provided with the opportunity to verify milk-testing results provided by Vinamilk.

Every treatment farmer received three nontransferable vouchers, each valid for one independent analysis of milk quality (milk fat and total solid). Vouchers were meant to be executed whenever eligible farmers challenged the testing results reported by Vinamilk. Providing farmers with third-party quality verification involved complex transport and testing logistics. For each milk sample obtained at the MCC under the original contract (hereafter A-sample), an additional identical sample (hereafter B-sample) had to be taken for each treatment farmer. The B-sample was sent to an independent and certified laboratory in Ho Chi Minh City, where it was stored. If a farmer executed a voucher, the B-sample was analyzed by the third-party laboratory, and the testing results were reported by mail to the farmer. This allowed the farmer to compare if the results based on the A-sample reported by Vinamilk were identical to the results of the corresponding B-sample provided by the independent laboratory.

While Vinamilk knew the identity of the treatment farmers, the actual execution of vouchers could not be observed, that is, the company did not know when an individual farmer in the treatment group executed her voucher. Hence, there was a constant threat to the company that any of the farmers in the treatment group could in any given week verify their testing result and detect potential opportunistic behavior. The combination of a constant threat to be caught and the associated high reputational costs,<sup>2</sup> should effectively discourage Vinamilk from behaving opportunistically. This is a central assumption in our study and crucial for the intervention to work; we will substantiate this assumption further below.

Compared to validating the results of every sample analyzed by Vinamilk, the voucher mechanism enabled us to systematically overcome the information asymmetry on milk quality attributes at relatively low cost. All outlays arising from setting up a parallel testing infrastructure for the B-samples and milk analyses were borne by the project, ruling out that farmers would not request independent milk testing for reasons of monetary costs.

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2 Before the intervention started there was substantial coverage in Vietnamese newspapers, alleging that Vinamilk mistreated farmers by paying too low and unfair milk prices. While Vinamilk was publicly denying these allegations, the reports caused some reputational damage (*Viet Nam News* 2008).

The logistics of the voucher treatment are complex. Thus, it was especially important that both the treatment farmers delivering milk and the Vinamilk staff taking the B-samples thoroughly understood the procedure. During a compulsory half-day workshop, treatment farmers were informed about the independent milk testing and learned how to use the vouchers. Every treatment farmer received written instructions, supplementing the information presented during the workshop, and was provided with a phone number of trained field staff. To assure that farmers regarded the third-party testing as credible and independent, we had identified a certified laboratory that both farmers and Vinamilk explicitly agreed on. Further, to ensure the comparability of the A- and B-samples, we calibrated the third-party laboratory and Vinamilk's in-house laboratory using imported reference milk. By employing the same cooling technology we also assured that during transport and storage the A- and B-samples were kept in identical environments.

To avoid contamination in the sense that control-group farmers get access to the third-party milk testing and thus effectively become treated, the emergence of a secondary market for vouchers had to be prevented. We handed out personalized vouchers tagged with a unique identification number. Vouchers passed on to other farmers (also outside the treatment group) automatically became invalid. A scenario in which control farmers sell their milk through treatment farmers to benefit indirectly from the independent quality verification and higher expected milk prices is possible but seems unlikely. First, to maintain traceability within the milk supply chain, Vinamilk's procurement policy includes a mechanism to control the quantity delivered by individual farmers, strongly discouraging milk producers from accepting milk from other sources. Specifically, milk producers are required to register their herd size with Vinamilk. This information, which is regularly verified through field visits, enables the company to estimate the production potential of each farmer. Thus, Vinamilk would notice if a farmer were to accept milk from others and thus increase their delivery beyond expected levels. Second, if a treatment farmer accepts milk from a control farmer (or any other source), she would take the risk of mixing her own milk with milk of unknown quality, potentially leading to financial loss.

If participation in field experiments is voluntary, individuals who are assigned to the treatment group may refuse to participate. This may lead to low compliance rates which can be a challenge for impact analysis. Cole et al. (2013b) found that uptake rates for innovative crop insurances in India were as low as 5–10 percent despite high potential benefits. Hill and Viceisza (2012) overcame the problem of low uptake in a framed field experiment by

imposing mandatory insurance. Our intervention is special with respect to compliance, as a high voucher-execution rate is not a necessary condition for the voucher treatment to be effective. The specific design of the third-party contract enforcement does not depend on an individual farmer's decision to execute a voucher to build a direct threat to Vinamilk. Instead, it is sufficient if farmer A believes that farmer B or C may request an analysis. This belief—from farmer A's point of view—would be an indirect but sufficiently powerful threat to the dairy company being monitored, ruling out underreporting. Ultimately, this would imply that all farmers in the treatment group can be regarded as treated, regardless of their actual voucher execution. This is a further necessary assumption for our experimental design to be effective, which we will also substantiate further below.

It should be noted that when designing the voucher treatment, we were interested in isolating the effect of third-party contract enforcement in general, rather than evaluating a particular way of providing farmers with independent testing of quality attributes. Our voucher-based approach is too costly to be easily scaled up. In a nonexperimental setting, complete outsourcing of milk testing to an independent laboratory would be more efficient than establishing a parallel structure for B-sample analyses.

### **Study Area, Sample, and Randomization**

Almost 70 percent of the domestically produced milk in Vietnam stems from the region around Ho Chi Minh City. The study area is located in Long An and Tien Giang, two provinces south of Ho Chi Minh City where Vinamilk has contracted 402 dairy farmers. The milk supply is channeled through four MCCs.

At MCC level, differences with respect to average dairy output (quantity, quality) can be observed (Appendix Table 11.A1). Three out of the four collection centers (MCCs B, C, and D) are spatially clustered, so it is unlikely that agroecological factors cause the performance differential. As farmers can choose freely which MCC to supply their milk to, we suppose that selection based on unobservables may cause the farmer population of one MCC to systematically differ from farmers at other MCCs. For example, dairy producers choose an MCC not only on the basis of the distance to their farm but also based on soft factors such as trust toward the management of the MCC. Beside the three clustered MCCs, there is also one more isolated collection center (MCC A) where farmers do not have the option to choose between different Vinamilk MCCs. However, a competitor of Vinamilk sources raw milk in the area of MCC A. Hence, farmers could switch to the competing dairy

company, if they were dissatisfied with Vinamilk, the contract, or the collection center management. We reckon that farmers who deliver to Vinamilk despite having an alternative may be systematically different from Vinamilk farmers without such an outside option. Such possible differences are accounted for in our analysis through MCC dummies.

Given the limited number of MCCs and significant mean differences in observable characteristics, a randomization of treatment status over MCCs—even though easier to manage—might have confounded our results. Hence, we randomized over the entire population of 402 dairy farmers. In May 2009, all farmers attended a public lottery in which 102 farmers were randomly assigned to the treatment group. Another 100 farmers were randomly assigned to the control group, continuing to produce under the original contract without third-party enforcement. Farmers were informed that due to a budget constraint and for the sake of a clear evaluation of the experiment only a limited number of slots would be available in the treatment group. Owing to the complexity of the treatment design, the implementation had to be delayed several times. The intervention eventually started in May 2010 when the first batch of B-samples was obtained. It was continued for a period of 12 months.

## Data

We collected detailed information for all farmers participating in the experiment. Through two rounds of structured household surveys we generated a dataset comprising socioeconomic details on dairy production, income from agricultural and nonagricultural activities, household expenditures, and assets owned. Additionally, questions measuring social capital, trust, time, and risk preferences were included in the questionnaire. The first round of interviews, the baseline survey, took place in May 2009 before the experiment started. In May and June 2011, all farmers were revisited for the follow-up survey when the experiment was completed.

The household data were complemented with farm-level output data for each producer in the sample provided by the company. Vinamilk provided these data for the period from May 2008 to May 2011, covering 24 months before the intervention and the time period of the intervention. On the one hand, it can be assumed that these data are of higher quality than self-reported recall data on output obtained through household surveys, as this weekly reported information—disaggregated by milk quantity and three quality parameters—is the basis for farmers' payment. On the other hand, the dairy company may have an incentive to strategically release

information, providing manipulated data to mask underreporting of milk quality and price in case farmers were cheated before the intervention. This would clearly undermine the internal validity of the results. If the company had underreported output quality before the independent quality verification was implemented, we would not be able to easily attribute observed effects to changes in either farmer or company behavior. In an extreme case, higher output could be entirely the result of Vinamilk ceasing to underreport quality. We carefully address this issue in the discussion section.

## Identification Strategy and Econometric Estimation

The impact of third-party quality verification is assessed in three dimensions: (1) input use in milk production, (2) output generation in milk production, and (3) welfare of the farming household. While (1) is measured by the amount of purchased fodder (concentrate) used per cow and day reported by farmers, (2) is captured by three variables, namely total amount of milk fat and total solid produced during the 12 months when the experiment was ongoing, as well as revenues from dairy farming for the same time period. Data on these output variables are provided by the company. For (3) we use total annual household consumption expenditures on food (own-produced food items were valued at the market price), other consumer goods, and durables obtained through the household surveys.

We seek to identify two types of treatment effects: first, the average treatment effect on the treated (ATT), which is estimated according to:

$$ATT = E(y_1 - y_0 | v = 1) \quad (13)$$

where  $ATT$  is the difference between  $y_1$ , the average outcome of the treated, and  $y_0$ , the counterfactual outcome of the untreated, conditioned on the treatment status  $v = 1$ , which means being treated. In view of the random assignment of  $v$ , the control group constitutes an adequate counterfactual of the treatment group.

Second, we would like to assess the ATT conditional on specific baseline covariates  $x$ . To estimate this heterogeneous treatment effect, we condition ATT on  $x$  according to:

$$ATT(x) = E(y_1 - y_0 | x, v = 1) \quad (14)$$

Given that the voucher use was voluntary (we did not use an encouragement design), one might argue that the intention to treat (ITT) analysis would

be a more suitable approach. In our view, the ATT analysis seems appropriate because all farmers in the treatment group can be regarded as treated. As explained above, the effectiveness of the third-party quality verification scheme does not depend on an individual farmer's decision to execute the voucher.

In order to estimate ATT econometrically, we first specify an ordinary least squares (OLS) according to:

$$y = \alpha + \beta v + \varepsilon \quad (15)$$

where the dependent variable  $y$  is the outcome variable of interest measured at the end of the experiment, and  $v$  is the treatment dummy.

To estimate average treatment effect on the treated, ATT(10), and thus to explore treatment heterogeneity, we modify the model by including a vector of variables, indicating baseline characteristics at time  $t_0$ , and an interaction term between treatment and baseline characteristics:

$$y = \alpha + \beta v + \gamma x + \delta vx + \varepsilon \quad (16)$$

This interaction term allows for testing whether the relationship between baseline characteristics and outcome variables is different conditional on treatment status. One specification for ATT(10) includes the variable *trust toward Vinamilk*, which is a dummy variable taking the value 1 if farmers agreed with the statement "Vinamilk is a trustworthy business partner" in the baseline survey, and 0 otherwise.<sup>3</sup> We suppose that initial trust levels may affect the impact intensity of the voucher. For example, farmers already trustful in the baseline may be less affected by an intervention that aims at ruling out potential opportunistic behavior by Vinamilk. Another specification for ATT(10) includes dummies indicating the farmers' delivery to milk-collection centers (MCC B, MCC C, and MCC D; MCC A was chosen as benchmark). These dummies capture the effect of unobserved characteristics that make farmers select a specific MCC.

## Randomization

Before the impact analysis, we verified that treatment and control groups are similar statistically with respect to the large number of observables available from the baseline survey, including the outcome variables (Table 11.1). The

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3 In the baseline survey, interviewees had to rate this statement on a four-point Likert scale ("very much agree," "agree," "disagree," "very much disagree"; the option "I don't know" was also included). We collapsed the responses into a dummy taking the value 1 if farmers opted for "agree" or "fully agree," and 0 otherwise. It should be noted that the results are sensitive to the specification; when including dummies for each response level, the coefficients for these trust variables are insignificant.

**TABLE 11.1** Mean difference for baseline variables in treatment and control groups

Variable	Control – voucher	Standard error
Basic household (HH) characteristics		
Age of HH head (years)	1.233	1.558
Education of HH head (years of schooling)	0.556	0.442
Number of HH members	0.073	0.183
Total land size (m <sup>2</sup> )	893	783
Distance to paved road (km)	0.270*	0.122
If agree to postpone at interest rate $\leq$ 3.5 percent (1 = y)	-0.183**	0.069
Dairy enterprise		
Delivers milk to MCC A (1 = y)	0.033	0.063
Delivers milk to MCC B (1 = y)	-0.098	0.064
Delivers milk to MCC C (1 = y)	0.065	0.065
Delivers milk to MCC D (1 = y)	-0.000	0.065
Daily concentrate per cow (kg)	1.626	1.826
Absolute milk fat (kg)	-53.519	59.996
Absolute total solid (kg)	-173.342	194.658
Annual revenue from dairy (US\$)	-432.499	550.234
Household expenditure		
Annual HH expenditure (US\$)	36.410	111.463

Source: Authors' estimates.

Notes: HH = household; MCC = milk-collection center; probability = \* < .1, \*\* < .05.

only statistically significant differences (at 10 percent level) are for the variables capturing road infrastructure and time preferences,<sup>4</sup> indicating that treatment farmers are located slightly further away from paved roads and are more patient than their peers in the control group. It should be noted that given the random assignment of the treatment status, the observed differences are not systematic, that is, worse infrastructure and lower time preferences did not make a household more likely to be assigned to the treatment group.<sup>5</sup>

### Attrition

Between the baseline survey in May 2009 and the implementation of the treatment in May 2010, a number of milk farmers ceased production or switched from Vinamilk to a competing dairy processor. The number of households in the treatment and control groups decreased from 102 and 100

4 In the baseline survey, we elicited—through a battery of choices between hypothetical pay-offs—the discount rates at which farmers accepted to wait for one month to receive a significant lump-sum payment. The variable was converted into a dummy which takes the value 1 if farmers agreed to wait for one month if a monthly interest rate of up to 3.5 percent is paid. These farmers have a lower time preference and can be considered more patient.

5 As robustness checks, both variables were included in the regression models, but their inclusion led neither to significant coefficients for these variables nor to notable changes in the treatment effects.

to 94 and 90, respectively. Those producers dropping out of the sample have significantly (at 10 percent level) smaller baseline herd sizes, are less productive, and have lower revenues from milk. The attrition rate is balanced between treatment and control groups.

### **Compliance**

As discussed above, the intervention did not require high compliance rates, that is, it was not necessary for a large number of treated farmers to actually execute their vouchers, for the treatment to be effective. Nevertheless, from a treatment farmers' perspective a certain minimum level of compliance in the treatment group might be (psychologically) desirable to credibly build up the threat of effective monitoring vis-à-vis the dairy company.

We find that only seven farmers (out of 94) had actually requested independent verification of milk-testing results despite it being easy, cheap, and safe to execute. Those farmers who had executed vouchers had larger herd sizes with more productive dairy cattle on average. A possible explanation could be that these larger farmers had greater interest in verifying the milk-testing results, because even little underreporting of quality by the company would lead to substantial losses due to larger quantities involved. We systematically evaluated the voucher treatment in the follow-up survey to identify reasons for low execution rates. The survey results suggest that the majority of farmers who had not executed a voucher agreed that third-party quality assessment was useful and easy to request, and that the independent laboratory is trustworthy. Around 50 percent of all treated farmers stated they had not executed a voucher because they were satisfied with the milk-quality results provided by Vinamilk. A significant proportion (almost 40 percent) indicated that they would feel uneasy secretly checking up on Vinamilk. While we assured them that they would face no monetary cost for executing vouchers, these findings suggest that some might still consider it risky to double-check the testing results in terms of jeopardizing the relationship with the company.

It is likely that this subjectively felt risk could foster free-riding among treatment farmers, meaning here that individuals take advantage of the third-party enforcement while not actively contributing to the scheme through execution of a voucher. Such behavior does not necessarily undermine the scheme's overall effectiveness (as perceived by individual farmers) in providing protection against opportunistic behavior by the company. Also, in other contexts, it is not uncommon that individuals choose to free-ride, while still believing in the effectiveness of the system as a whole. For example, in the area of public health

it can be observed that some free-ride on the protection offered by a vaccination scheme. Individuals may want to avoid possible risks of getting vaccinated, expecting that a sufficient number of other people will get vaccinated to ensure the desired level of protection (Bauch, Bhattacharyya, and Ball 2010).

We are confident that the low execution rate of vouchers in our case does not undermine the effectiveness of the intervention and does not pose a major problem for impact analysis. Based on the above discussion, we argue that all individuals assigned to the treatment group (except for dropouts) can be regarded as treated. Nevertheless, we acknowledge that for future research an encouragement design would be a good way to overcome this potential limitation.

## Estimation Results

At first we investigate how the treatment affects self-reported fodder usage (concentrate fed per cow and day in kilograms). Results are presented in Table 11.2, columns (1) to (3). We find a significant positive treatment effect, which is robust across specifications. Farmers in the treatment group on average fed their cattle 0.83 kg more purchased concentrate than their peers in the control group, which implies an increase of 12 percent. The coefficients of the additional control variables, baseline trust toward Vinamilk, and the affiliation to a specific milk collection center are mostly insignificant. As we do not find significant effects for the interaction terms, the treatment effect seems to be homogeneous. That is, we find a significantly positive impact of third-party enforcement on input use that does not differ across treatment farmers.

Beside the amount of purchased concentrate, which makes up the largest share of total input costs, we also analyzed treatment effects for labor input, veterinary services, and artificial insemination. For these other inputs we did not find significant differences between treatment and control groups.

The regression results for dairy output are also presented in Table 11.2. Without controlling for other covariates, the ATT for absolute milk fat and solid produced is positive but insignificant. Also the level of baseline trust does not seem to have an impact. But once we control for milk-collection center affiliation, we find significant treatment effects for both output measures (columns 6 and 9). Apparently, third-party enforcement of the contract increases not only concentrate use but also output quantity, as hypothesized. Yet the treatment effects for output quantity are not homogeneous across milk-collection centers. Considering the interaction terms in columns (6) and (9) of Table 11.2, we find significant effects for farmers delivering to MCCs

TABLE 11.2 Estimation results for input use and output produced

	Input			Output					
	Daily concentrate per cow (kg)			Absolute milk fat (kg)			Absolute total solid (kg)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Voucher treatment (1 = y)	0.826** [0.365]	0.869** [0.414]	0.973* [0.512]	71.3 [80.4]	119.1 [111.1]	289.7** [136.9]	227.6 [249.5]	387.8 [344.1]	913.9** [433.4]
Trust toward Vinamilk (1 = y)		-0.020 [0.369]			157.6 [141.5]			505.5 [448.0]	
Vinamilk trust* Voucher		-0.033 [0.566]			-82.0 [165.8]			-279.7 [515.8]	
MCC B (1 = y)			-0.935 [0.504]*			212.8 [134.5]			683.3 [425.7]
MCC C (1 = y)			-0.847 [0.541]			29.5 [151.7]			105.6 [480.1]
MCC D (1 = y)			0.136 [0.541]			110.3 [144.9]			367.7 [458.6]
MCC B * Voucher			0.271 [0.701]			-154.8 [193.4]			-522.8 [611.9]
MCC C * Voucher			-1.059 [0.709]			-271.9 [198.5]			-829.2 [628.3]
MCC D * Voucher			0.088 [0.720]			-363.7* [197.0]			-1,139* [623.5]
Constant	6.905*** [0.284]	6.915*** [0.399]	7.375*** [0.393]	515.2*** [53.3]	443.2*** [54.98]	415.2*** [101.1]	1,630*** [170.3]	1,399*** [167.9]	1,304*** [320.1]
Observations <sup>a</sup>	164	162	164	172	170	172	172	170	172
R-squared	0.056	0.060	0.221	0.006	0.025	0.071	0.006	0.026	0.066

**Source:** Authors' own estimates.

**Notes:** MCC = milk-collection center; Robust standard errors, clustered at MCC level, in brackets; probability = \* < .1, \*\* < .05, \*\*\* < .01. The number of observations varies across models because of missing values for some of the variables. We also ran alternative estimates with equal number of observations across models, excluding farmers with missing values throughout. The results are similar, although with somewhat larger standard errors in some cases (see Table S1 in the supplementary material online at <http://dx.doi.org/10.1093/ajae/aaud21>).

A, B, and C, but not for those delivering to MCC D. The treatment effects for farmers delivering to MCC A are particularly large. The coefficients for the treatment dummy imply an increase of approximately 40 percent for milk fat and total solid. We already explained above that farmers who deliver to MCC A may be systematically different. For farmers in MCCs B and C, the treatment effects are smaller but remain positive and significant.

We also ran regressions using average fat and solid content per kilogram of milk as dependent variables,<sup>6</sup> without finding significant treatment effects (results not presented here). Looking at quality, the relative composition of milk remained constant, as a comparison of fat and total solid content per kilogram of milk before and after treatment shows. This might seem surprising given that the aim of the intervention was to break the asymmetry of information with respect to milk-quality attributes. A possible explanation for the observed increase in milk quantity instead of quality can be found in the physiology of dairy cattle. To produce large quantities of milk, the dairy cow requires a nutritious and balanced fodder ration, especially with respect to protein and energy. If the ration is unbalanced, for example if it contains too little protein relative to energy, milk yields will drop (Roth, Schwarz, and Stangl 2011). The concentrate purchased by farmers in Vietnam is rich in protein. It is therefore plausible that an increase in concentrate use, as observed among treated farmers, contributes to relaxing a protein constraint in the fodder ration, leading to higher milk quantity produced per cow. The same increase in protein-rich concentrate alone does not necessarily lead to higher fat and solid content per kilogram of milk.

Higher output leads to more revenues from dairy production, as shown in Table 11.3. The positive and significant coefficient of the treatment dummy in column (3), in which baseline characteristics are controlled for, points to a heterogeneous treatment effect, especially with respect to MCC affiliation. As milk quality was not affected by the treatment and thus the average price received remained unchanged, the increment in revenue can entirely be attributed to increased production quantity.

Finally, we look at the intervention's impact on total household consumption expenditures, a commonly used measure of living standard and welfare. We do not find a significant ATT (Table 11.3, columns 4 to 6). This is not surprising, because households tend to adjust their consumption expenditures only slowly, that is, an increase in revenue or profit may not immediately be

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<sup>6</sup> In dairy farming, the output is usually quantified using weight measures such as pounds or kilograms.

**TABLE 11.3** Estimation results for revenue and household welfare

Parameter	Revenue Annual from dairy (US\$)			Welfare Annual HH expenditure (US\$)		
	(1)	(2)	(3)	(4)	(5)	(6)
Voucher treatment (1 = y)	812.8 [830.7]	1,446 [1,179]	3,164* [1,659]	82.95 [375.0]	-733.6 [358.9]	153.5 [931.4]
Trust toward Vinamilk (1 = y)		1,940 [1,725]			-661.5 [390.0]	
Vinamilk trust * Voucher		-1,119 [1,855]			1,731** [363.4]	
MCC B (1 = y)			3,173* [1,629]			-63.94 [907.6]
MCC C (1 = y)			874.4 [1,837]			-344.6 [972.8]
MCC D (1 = y)			1,931 [1,755]			-778.6 [940.5]
MCC B * Voucher			-1,825 [2,342]			-1,185 [1,310]
MCC C * Voucher			-2,704 [2,404]			658.8 [1,300]
MCC D * Voucher			-3,859 [2,386]			-17.20 [1,294]
Constant	6,118*** [762.3]	5,232*** [693.1]	4,474*** [1,225]	4,106*** [181.2]	4,400*** [316.6]	4,401*** [687.9]
Observations <sup>a</sup>	172	170	172	184	182	184
R-squared	0.005	0.025	0.060	0.000	0.021	0.026

**Source:** Authors' own estimates.

**Notes:** HH = household; MCC = milk-collection center; Robust standard errors, clustered at MCC level, in brackets; probability = \* <.1, \*\* <.05, \*\*\* <.01; <sup>a</sup> The number of observations varies across models because of missing values for some of the variables. We also ran alternative estimates with equal number of observations across models, excluding farmers with missing values throughout. The results are similar, although with somewhat larger standard errors in some cases (see Table S2 in the supplementary material online at <http://dx.doi.org/10.1093/ajae/aau021>).

reflected in changed consumption behavior. To measure impacts on consumption expenditure, the duration of the experiment may have simply been too short.<sup>7</sup>

But we observe a significant welfare increase for those treatment farmers who were more trustful toward the company before the intervention. This

7 In a recent impact assessment for a new agricultural technology in India based on observational panel data, Kathage and Qaim (2012) also found that technology adoption did not raise household expenditure in the beginning, in spite of sizeable profits gains, but significantly contributed to increased consumption after some time. In general, household consumption levels tend to change less rapidly than income levels.

can be inferred from the positive coefficient of the trust–voucher interaction term in column (5) of Table 11.3. Interestingly, neither the trust variable itself nor the interaction term was significant in any of the previous models. The results here appear counterintuitive on first sight, as one would expect stronger impacts for farmers who do not trust the company much. Yet, it should be noted that our trust variable may capture trust toward the company in multiple dimensions, also beyond quality reporting. The statement “Vinamilk is a trustworthy business partner” that farmers were asked to rate may also involve expectations regarding the timing of payment, or beliefs about the company’s long-term commitment to the contractual relationship. Hence, farmers with lower levels of trust may perceive the relationship with Vinamilk as riskier, and thus act more cautiously, for instance by saving additional revenues instead of spending more on consumption. While we did not explicitly collect data on savings, higher profits without higher consumption expenditures imply higher savings.

## Discussion

Our findings confirm the hypothesis that third-party enforcement of contracts mitigates underinvestment, and hence are in line with Wu and Roe’s (2007) results from laboratory experiments with college students. Furthermore, our study shows that, under real-world conditions, higher input levels observed under the enforced contract actually translate into higher output, a result that we hypothesized based on the theory but that would be impossible to obtain in the laboratory. The findings also suggest that specific subgroups are affected to differing degrees by the intervention. Differences occur especially between farmers delivering to different collection centers. Given data limitations, we are not able to further analyze possible mechanisms that may explain these differences in the treatment effects. In part, they may be due to unobserved factors that determine farmers’ self-selection into specific MCCs.

## Contamination

As pointed out before, by issuing personalized vouchers for treatment to farmers we avoided the possibility of control farmers getting direct access to third-party quality assessment. However, the random assignment of the treatment may still have led to contamination more indirectly through trust spillovers. For example, it is possible that a control farmer updated her belief about Vinamilk’s type from “unfair” to “fair” after communicating with a neighboring treatment

farmer. We evaluated this possibility through specific questions in the follow-up survey.<sup>8</sup> Trust levels of both treatment and control farmers significantly increased (though more so for treatment farmers), pointing to the existence of positive spillovers. Hence, we conclude that the treatment effects that we measured possibly underestimate the real impact of third-party contract enforcement.

A cleaner design, less susceptible to spillovers, would have required us to strictly separate treatment and control farmers, to avoid communication between groups. However, choosing the MCC as unit of randomization, as one possible way of separating treatment and control farmers, would have been much more costly due to the large number of collection centers needed for proper randomization. With only a small number of MCCs, as in our case, randomization among MCCs could have led to biased treatment effects due to systematic differences, as discussed above.

### **Data Provision and Incentive Compatibility**

We attribute the entire treatment effects to a behavioral change of treatment farmers, not to a change in Vinamilk's reporting behavior. This is justified, but deserves further explanation. We distinguish between the output (quantity and quality) *reported* by Vinamilk and the *true* output obtained using laboratory methods. In the baseline scenario before the intervention, milk quality was private information of Vinamilk. If the company had exploited this informational advantage, reported output levels would have been lower than true output levels. If instead Vinamilk played fair, reported and true output levels would have been identical.

We have shown that independent verification of quality attributes made farmers produce more milk fat and total solid during the intervention compared to the baseline. This was a result of an increase in milk quantity  $q$ , while milk quality  $\theta$  remained unchanged. It is important to note that the quantity of milk delivered has been observable to both farmers and the company at any point in time, before and during the intervention, because milk is weighed at the MCC under the eyes of the farmers. This implies that there has never been information asymmetry with respect to quantity. It follows that reported and true output must be identical. Thus, the observed treatment effect with respect to  $q$  can unambiguously be attributed to a change in farmers' input use.

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<sup>8</sup> Trust levels were measured before and after the treatment. The variable is constructed in the same way as baseline trust.

While  $q$  increased,  $\theta$  was not affected by the intervention. During the intervention, when quality was verifiable through the independent laboratory, we know with certainty that reported  $\theta$  and true  $\theta$  must be identical. If Vinamilk had cheated before the intervention and stopped doing so when the third-party testing started, we would have been able to identify a discontinuity (jump) in the reported average quality. We do not observe such a discontinuity in the data.

But before we can infer that Vinamilk did not underreport in the period before the intervention, we need to rule out a possible alternative explanation for the missing discontinuity: Vinamilk could have stopped cheating the farmers in the run-up to the intervention, as soon as they learned about its design and the fact that it would include third-party verification of the company's testing results. In this case, Vinamilk would have ceased underreporting at a much earlier point in time (that is, not covered by our dataset) to avoid providing evidence of cheating. This possibility, however, can be ruled out, because Vinamilk had already started providing production data (quantity and quality) at a very early stage of our cooperation, before we actually discussed the nature of the specific intervention. Hence, we had already received data at a time when Vinamilk could not anticipate that we were planning to look into independent quality verification. This precludes the possibility that the company provided us with "tailored" data to mask strategic underreporting of quality. Also the mere fact that the company agreed to this intervention can be interpreted as a sign that Vinamilk did not cheat on quality reporting prior to the experiment.

### **Moving Toward a First-Best Scenario in the Supply Chain**

Putting these pieces of evidence together, we conclude that the company has not been deliberately underreporting milk quality and price, neither before nor during the intervention. Apparently, the company played fair but the supply-chain architecture prevented it from sending a credible signal of its fairness to the farmers, who in turn reacted with distrust. The finding that Vinamilk had not cheated the farmers has strong implications for the distribution of gains from third-party monitoring. As the company did not behave opportunistically in the first place, it also did not accrue any information rents. Thus, in a situation in which the principal plays "fair" but is unable to send a credible signal, third-party verification can restore a first-best scenario, increasing the welfare of both actors in the supply chain, sellers and buyer—while farmers benefit from unlocked productivity reserves, the company's per-unit transaction costs decrease if procuring from farmers who are more productive in a situation with symmetric information.

The distribution of gains is also driven by the stage of development of the supply chain. In the baseline scenario, without third-party contract enforcement, the company holds an informational advantage that can be exploited to capture additional gains. Moving toward a more efficient market with symmetric information shifts the distribution of gains in favor of farmers and hence—from their point of view—a desirable outcome.

Generally, for a rational buyer to refrain from cheating, expected benefits from underreporting quality should be lower than expected costs. Such costs could arise from two sources: first, in the form of forgone operational profits from farmers' suboptimal milk output (as we could show), and second, from the expected damage when cheating is detected. Reputational damage in particular could be severe for Vinamilk, given the company's size and the fact that it has established several high-profile brands in the national market. But this may not be so obvious for farmers. While company decisionmakers have more information to assess expected costs of cheating, contracted smallholder farmers may underestimate Vinamilk's risk and damage of being caught. For example, farmers may find it unlikely that Vinamilk would be convicted for fraudulent behavior. Anecdotal evidence suggests that Vinamilk is perceived as a powerful and politically well-connected player, due to its history as a state-owned company.

Based on this argumentation, we cautiously conclude that for Vinamilk it is the dominant strategy to play fair, but that farmers may nevertheless form the belief that the company behaves opportunistically. It remains to be discussed why in this situation the company itself has not established an independent system of quality verification to signal its fair type, even though this could be profitable. One explanation could be that the credibility of any processor-driven initiative to increase transparency may be low. Duflo et al. (2012) showed for industrial pollution in India that—if incentives are not aligned—firms employ auditors who write favorable reports, actually understating pollution caused by the company. The current equilibrium of distrust that we find could probably be broken by a credible intervention from outside, such as by public research institutions—like in our experiment—or more generally by the government. A study by Olken (2007) found top-down monitoring to be relatively effective, even in an environment notorious for corruption. But governments do not necessarily need to undertake controls by themselves. As Yang (2008) has shown for import-tax fraud, governments can “hire integrity” from private firms, which is comparable to the independent laboratory in our case. The fact that no such attempt has yet been undertaken by the Vietnamese government may not surprise us, given that the local dairy industry is still emerging. Also in other sectors of developing countries,

such as health and education, market and policy failures are widespread phenomena (World Bank 2003).

## **Conclusion**

Contracting has become a widely embraced approach to facilitate supply-chain relations between selling farmers and buying companies, especially in emerging markets for high-value agricultural products. Smallholders entering contractual relations with buyers of high-value products such as fruits, vegetables, meat, or milk often become highly specialized and derive a considerable income share from the output sold under contract. However, a harmful asymmetry of information occurs if product-quality attributes are observable to the buyer but not to the selling farmer. If buyers behave opportunistically and exploit this information asymmetry to increase their profit, output prices for producers are subject to risk, and expected prices are lower than in a situation with symmetric information. Farmers taking this into account will underinvest, that is, they may use suboptimal levels of input, which translates into lower output levels. This is a nondesirable outcome for both farmers and buyers.

In this study, we have shown that third-party contract enforcement can be one way to mitigate the adverse effects of information asymmetry. Conducting a field experiment with dairy farmers in Vietnam we found that the provision of third-party contract enforcement had a positive impact on input use (purchased fodder) and output levels (quantity of milk fat and total solid), ultimately translating into higher revenue and also higher household welfare for specific subgroups of the sample. While we carefully designed the intervention to retain the internal validity of the results, we are also facing some limitations. Given the design of our intervention, we cannot fully avoid positive contamination of the control group, and thus may actually underestimate the treatment effects. While the postexperiment survey suggests that the intervention (which relied on a threat of selective double-checking rather than a comprehensive surveillance scheme) provided effective protection against cheating on the side of the buying company, residual doubts remain in view of the surprisingly low uptake rate (execution of vouchers for independent milk-quality testing). An encouragement design, with double-checking of milk quality being compulsory for treatment farmers, would be one option to consider in follow-up research.

From the available data, we infer that the observed treatment effects can be fully attributed to a behavioral change of farmers, instead of a change in the

company's reporting strategy. It can also be concluded that, in this specific case, the company had not exploited the informational advantage when the contract was not yet enforced through third-party testing. Instead, the company was playing fair but could not credibly signal its type to the farmers due to the specific architecture of the supply chain. Hence, not only farmers can benefit from more transparency regarding quality assessment. If more output per farmer is generated, the per-unit transaction costs for the buying company are reduced.

Our results were obtained in an environment that is representative of the fast-growing Vietnamese dairy sector. The findings may also be transferable to other agricultural sectors, especially those where competition between buyers is low and information asymmetry exists. If quality attributes determine output price but testing requires costly equipment, independent monitoring helps to overcome problems associated with information asymmetry, whether this is for fat content in milk, sugar concentration in cane, or protein content in grains—in Vietnam and beyond. The impact of third-party enforcement on the distribution of gains from contract farming depends on the stage of market development.

## Appendix

**TABLE 11.A1** Summary statistics of selected variables by milk-collection center

Characteristic	MCC A (n = 113)	MCC B (n = 103)	MCC C (n = 86)	MCC D (n = 83)
HH characteristics				
No. of HH members	4.513 [1.536]	4.641 [1.514]	4.244 [1.255]	4.341 [1.399]
Age of HH head	45.46 [11.53]	44.66 [9.161]	47.61 [11.74]	47.38 [11.39]
Total HH income (VND)	74,192,179 [49,567,765]	82,514,741 [69,491,153]	67,618,558 [58,362,681]	73,970,047 [53,442,489]
Dairy income (VND)	45,968,059 [35,675,422]	53,551,420 [55,525,486]	44,313,419 [53,633,181]	52,171,927 [47,796,603]
Dairy production				
Herd size (heads)	7.611 [5.417]	8.194 [5.369]	7.744 [4.587]	6.398 [3.751]
Productivity per cow (kg)	4,051.6 [2,888.4]	4,925.9* [2,229.7]	4,477.3 [2,472.7]	n.a.
Average milk price (VND)	6,850.0 [275.6]	6,730.9** [294.7]	6,542.4*** [416.7]	6,671.4* [772.3]
Total solid (%)	12.63 [0.520]	12.50 [0.496]	12.35*** [0.427]	12.61 [0.641]
Milk fat (%)	3.980 [0.280]	3.907* [0.245]	3.862** [0.221]	4.074 [0.482]
Milk hygiene score	3.572 [0.368]	3.642 [0.205]	3.686** [0.162]	3.578 [0.465]

**Source:** Authors' own estimates.

**Notes:** HH = household; MCC = milk-collection center; VND = Vietnamese dong.

Mean values are shown with standard deviations in brackets; mean differences are tested for MCC B–MCC A, MCC C–MCC A, and MCC D–MCC C; probability = \* <.1, \*\* <.05, \*\*\* <.01.

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## **LINKING SMALLHOLDERS TO THE NEW AGRICULTURAL ECONOMY: THE CASE OF THE PLATAFORMAS DE CONCERTACIÓN IN ECUADOR**

Romina Cavatassi, Mario González-Flores, Paul Winters,  
Jorge Andrade-Piedra, Patricio Espinosa, and Graham Thiele

### **Smallholders and the New Agricultural Economy**

Agricultural producers in developing countries, including smallholders, are increasingly relying on market transactions to procure agricultural inputs and concomitantly linking to long and complex value chains for high-value fresh and processed products. In these high-value markets, greater emphasis is being placed on private grades and standards for food quality and safety, leading to new organizational and institutional arrangements within the food-marketing chain (Reardon and Berdegú 2002; Dolan and Humphrey 2004). The growth of a dynamic food-marketing sector and the changes it implies for agriculture and related systems could potentially increase farm income and improve food security, particularly among smallholders (Eaton and Shepherd 2001; Winters, Simmons, and Patrick 2005). However, access to input and output markets has proven difficult for many smallholders, who often remain at the margin of this new agricultural economy (Little and Watts 1994; Berdegú et al. 2003; Reardon et al. 2003; Johnson and Berdegú 2004). The process may in fact exacerbate poverty levels if smallholders are unable to take advantage of new market opportunities or benefit from increased labor demand. Additionally, agricultural market integration has been associated with negative environmental and health impacts, due to increased pesticide use and a deterioration of the crop genetic-resource base (Barrett, Barbier, and Reardon 2001; Dasgupta, Mamingi, and Meisner 2001; Pingali 2001; Singh 2002; Winters, Simmons, and Patrick 2005).

In seeking ways for smallholders to access high-value markets while minimizing negative consequences, there has been a growing recognition that standard production-oriented interventions designed to enhance productivity are insufficient unless they are accompanied by actions that target other parts of the production–distribution–retail chain. One intervention that has used

this broader approach in the Andes is the *Plataformas de concertación* (multistakeholder platforms, or *Plataformas*), which seeks to link smallholders to high-value agricultural markets (Devaux et al. 2009). The *Plataformas* are alliances between small-scale farmers and a range of agricultural support-service providers.<sup>1</sup> The main objectives of the *Plataformas* are to increase yields and profits of potato-producing smallholders in order to reduce poverty and improve food security (Pico 2006). The program provides participants with new technologies and high-quality seeds in addition to facilitating access to high-value potato markets. Through the *Plataformas*, smallholder potato producers are directly linked to restaurants, supermarkets, and processors that are willing to pay a premium for potatoes that meet their grades and standards. By establishing direct linkages between farmer organizations and purchasers, the *Plataformas* have reduced the number of intermediaries within the value chain, providing smallholders with the opportunity to benefit from the changes in agricultural marketing systems.

The objective of this chapter is to understand whether, and to what extent, participating in the *Plataformas* impacts farmers' well-being through enhancing the earnings from potato production in poor areas of Ecuador where potatoes are a key staple crop. The mechanisms by which program objectives have been achieved, and secondary environmental and health effects, are also analyzed. The results, although context specific, provide insights into the challenges of linking smallholders to high-value markets and of the possibility of meeting these challenges. The remainder of the chapter is organized as follows. Next, we present the logic of the *Plataformas* intervention. The methodological approach used is then described, followed by a description of the context and the data. Then we present the results, followed by a discussion of lessons learned and conclusions.

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1 The *Plataformas* program in Ecuador has been coordinated by the National Autonomous Institute for Agricultural Research (INIAP) through the Fortalecimiento de la Investigación y Producción de Semilla de Papa (FORTIPAPA; Strengthening of the Research and Production of Potato Seed) project working with local NGOs—Central Ecuatoriana de Servicios Agropecuarios (CESA); MARCO (Minga para la Acción Rural y la Cooperación); the Instituto de Ecología y Desarrollo de las Comunidades Andinas (IEDECA)—and other partners, including research centers and universities. It has been supported by the International Potato Center (CIP) through the Papa Andina Partnership Program, funded by the Swiss Agency for Development and Cooperation (SDC).

## **Linking Farmers to Markets: The Logic of the *Plataformas* Approach**

While there are multiple structures for organizing production, the new institutional economics literature posits that the one that emerges is that which minimizes overall costs including transaction costs (Williamson 1985). Such costs include standard production costs, but also the ex ante costs of drafting, negotiating, and safeguarding agreements, as well as ex post costs of maladaptation, setup, and running of governance systems and bonding costs of securing commitments (Dietrich 1994). For agricultural industries where crops are sold in high-value markets or for processing, timely delivery and quality standards are often crucial to the decision of how to organize production. Using the open market for obtaining these commodities may involve high transaction costs and therefore may have limited appeal (Winters, Simmons, and Patrick 2005). Agribusinesses may then seek alternative structures for organizing production, such as through vertical integration or contract farming, if they view creating such a relationship as the least-cost alternative option.

The manner in which smallholders fit into a specific agricultural value chain depends on the costs that determine its organization. The primary cost advantage of smallholders is in their ability to supply cheap labor for labor-intensive crops. In such cases, it may be worthwhile for an agribusiness to deal with numerous smallholders, since overall costs include a large share of labor costs. The agribusiness may choose to contract smallholders or groups of smallholders directly to minimize transaction costs. To ensure smallholder participation, some cost advantage or price premium must be paid to contracted smallholders. If the crop is not labor-intensive and it is possible to contract a smaller number of largeholders thereby minimizing transaction costs, this is a more likely outcome. If, alternatively, the agribusiness chooses to purchase the commodity in the open market, since it is the lowest-cost option and allows the agribusiness to meet its quality and timing needs, intermediaries are likely to play the role of obtaining the necessary product and providing it to the agribusiness. While these intermediaries may purchase the crop from smallholders, it will be at going market rates and provide no price premium or cost benefit to smallholders unless they are large enough suppliers that they can influence overall price.

The motivation for linking smallholders to agribusinesses is the presumed price premium for selling in these markets and thus overall income gains. When smallholders have no apparent comparative advantage in production, the challenge is to create that advantage or to reduce the transaction costs associated with purchasing from large numbers of farmers producing small

quantities. Linking smallholders to high-value purchasers is likely to require organizing smallholders to overcome transaction costs, as well as providing them with the necessary information to meet market requirements. While this adds costs for smallholders, since they must take the time to organize and obtain information, it lowers the costs to the industry.

This is exactly the logic of the intervention undertaken through the creation of the *Plataformas*; namely, reducing transaction and production costs so smallholders can be a low-cost option for high-value purchasers, and providing smallholders with the necessary tools to meet quality and quantity demanded. The primary mechanism by which the *Plataformas* reduce transaction costs is through providing support for smallholders from a range of agricultural support-service providers including the National Autonomous Institute for Agricultural Research (INIAP), nongovernmental organizations (NGOs), researchers, universities, and local governments, and through fostering organization among smallholders. This support network comprises the *Plataformas*. The support and organization enable smallholders to improve production generally and meet the needs of high-value markets, allowing them to sell directly to restaurants, processors, and supermarkets. The *Plataformas*, therefore, reduces costs for two types of transactions: (1) between farmers and final purchasers; and (2) between farmers and suppliers of services (inputs, seeds, and technical assistance).

More specifically, the *Plataformas* ensure seed provision and seed inventories are matched to detailed production plans established during regular meetings held among farmers, coordinating NGOs, and other stakeholders in order to achieve monthly quotas for delivery to clients. Further, the *Plataformas* provide training through Farmer Field Schools (FFS) to enhance productivity and promote integrated pest management (IPM) techniques with the aim of improving quality and quantity of production while promoting decreased use of pesticides (or at least limited increases). Farmers are also trained to oversee quality control during harvesting and commercialization, and to identify potential clients who can make a verbal commitment to buy their produce as long as the required standards are met.

Our main interest in evaluating the *Plataformas* project is to determine the feasibility of linking smallholders to the new agricultural economy in a context in which they have little obvious comparative advantage. The approach seeks to lower transaction costs and to improve overall cost-effectiveness through creating a support system to facilitate smallholder entry into this market. The three hypotheses we wish to test are: (1) participating in the *Plataformas* has increased farmers' welfare as measured by potato yields

and gross margins; (2) greater potato sales and higher prices are the primary mechanism through which the program has improved welfare; (3) although high-value markets require high product quality, participation has not led to health or environmental degradation as measured by levels of agrochemicals used, their toxicity, precautions taken in their applications, and changes in varietal use. The methods for testing these hypotheses are discussed in the next section.

## **Empirical Approach and the Search for a Counterfactual**

The key to identifying and measuring the impact of *Plataformas* participation is to have a proper counterfactual—that is, a comparison (control) group that is similar to the intervention (treatment) group in all ways except that it did not receive the intervention. The empirical problem faced in this analysis is thus the typical one of missing data to fill in the counterfactual; that is, it is not known what the outcomes for participants would have been had they not participated. In experimental studies, households are randomly assigned to treatment and control *ex ante* and, given a sufficiently large sample size, it is reasonable to assume that the treatment and control are alike in all ways except in receiving the intervention. When assessment studies are set up *ex post* (after project implementation) and not as part of project design, experiments are not possible and nonexperimental methods must be used to identify impact. This section describes the steps taken to ensure quality data to construct a proper counterfactual was collected, followed by a description of the empirical approach used in the analysis.

### **Data Collection**

The data used in this analysis come from household- and community-level surveys that were administered from June to August 2007 in the Ecuadorian provinces of Chimborazo and Tungurahua. Before administering the surveys, a series of steps were taken to facilitate an evaluation of the program. First, participating communities (treatment communities) were identified in each province and information on these communities was obtained. Second, using the 2001 Ecuador census data (INEC 2001), the treatment communities and a set of potential control communities with similar geographic, agroecological, and sociodemographic characteristics were identified. This provided a list of all possible treatment and control communities to be included in the survey. Third, using propensity-score matching (PSM) (described more fully below), control

communities that were most comparable to treatment communities were identified—that is, control communities with similar propensity scores to the treated communities were kept as the potential set of communities for the sample.

Fourth, the resulting list of potential control communities was discussed with key local organizations that had a central role in the *Plataformas* to determine if they were indeed comparable to the treatment communities. Some of the key characteristics considered were similarities in agricultural production, agroecological traits, and levels of community and farmer organization. Thus, the PSM selection was fine-tuned by local agronomists and leaders of organizations that had local knowledge. Through this process, the best control communities were identified. Further, treatment communities with distinct characteristics with no comparable control communities were excluded from the sample. The final community list contained 35 communities (18 treatment and 17 controls).

Within each treated community, there are community members who participate in the program and others who do not (nonparticipants). There are two concerns about including nonparticipants in the treatment communities as part of the counterfactual. First, they may have chosen not to participate and therefore may be fundamentally different from the participants. The fact that participant and nonparticipants self-select can lead to a potential bias in estimates of impact since the estimates may reflect fundamental differences between the two groups rather than the impact of the program. Second, since they live near beneficiaries they may obtain indirect benefits from the program (spillover effects). For both these reasons, using solely these households as a control group is potentially problematic. Yet, this is likely a useful group because their observable characteristics are probably similar to participants and so they were included in the sample. The final sample, therefore, includes three sets of households: (1) *beneficiaries* of the program, (2) nonbeneficiaries in the treatment communities (referred to as *nonparticipants*), and (3) nonbeneficiary households in the control communities (referred to as *noneligible*). Lists of households from each of these subgroups were provided by *Plataformas* coordinators and community leaders. Households were randomly selected to be included in the sample. The final sample includes a total of 1,007 households of which 683 reside in treatment communities (324 beneficiaries and 359 nonparticipants) and 325 in control communities (noneligible). Of those, full information on the potato-production cycle is available for 660 households.<sup>2</sup>

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2 In this region, potato production can be conducted year round. Treated and nonbeneficiary households appear to be equally likely to have completed the production cycle and there are no systematic differences found between households that have completed the production cycle versus those that had not yet completed it, suggesting this should not influence results.

This sampling strategy allows for different comparison groups, each offering interesting insights. The ideal comparison group partly depends on whether there are spillover effects on nonparticipants. If there are such effects, including nonparticipants in the counterfactual would lead to an underestimation of program impact (Angelucci and Attanasio 2006). If spillover effects are substantial it may be desirable to include nonparticipants as treated households (intent to treat group: ITT) to get the total effect (direct and spillover effect) of the program and use only noneligible households as a counterfactual. These different options are considered below.

### Empirical Approach

With the available data, four methods are used to identify impact: ordinary least squares (OLS), propensity-score matching (PSM), propensity score weighted least squares (WLS), and instrumental variable (IV) regression. The reason for these multiple methods is to ensure a reasonable level of confidence in our impact estimates. The methods and underlying assumptions are presented below. The approach also includes exploring alternative counterfactual groupings to determine the role of spillover effects. Ultimately, we argue that results are consistent when using approaches based on selection on observables (PSM and WLS), as well as when using an approach that deals with unobservables (IV). Further, we argue that spillover effects are minimal and that the main source of potential bias is related to program selection of beneficiaries.

The first approach is a standard OLS regression framework where the program impact on outcome variable  $Y_i$  can be determined by:

$$Y_i = \beta X_i + \alpha d_i + \varepsilon_i \quad (1)$$

where  $d_i = 1$  if households participate, 0 otherwise;

$X_i$  is a set of exogenous variables including socioeconomic characteristics of the households, agroecological conditions, geographic and location effects, and so forth;

$\alpha$  measures the treatment effect for household  $i$ ;

$\beta$  defines the relationship between  $X_i$  variables and  $Y_i$ ; and

$\varepsilon_i$  is the error term.

This formulation assumes that the outcomes are linear in parameters and that the error term is uncorrelated with the exogenous variables  $X_i$  and with treatment. Conditional on these  $X$  variables, if the control group is like the treatment group in all characteristics except for having received the program,  $\alpha$ , the measure of treatment's effects provides an unbiased estimate of the program effect. However,  $d_i$  may be correlated with the error term  $\varepsilon_i$  leading to

a biased estimate of the treatment effect  $\alpha$  since it may capture not just the impact of the program but differences between treated and control households (Ravallion 2005). If the source of the problem is program-placement bias—differences due to characteristics of the household the program deemed desirable—the differences are more likely to be observable. If self-selection bias is the issue—certain types of households chose to enter into the program—the differences are more likely to be unobservable.

Assuming the source of bias is observable, a way to obviate the problems outlined above is offered by our second method, the PSM approach. The main contribution of PSM<sup>3</sup> is to construct a control group that has similar observable characteristics ( $X_i$ ) to the treated group, through a predicted probability of group membership calculated through a logit or probit regression, and then compare the outcomes. Given the unconfoundedness assumption (Rosenbaum and Rubin 1983) or selection on observables assumption (Heckman and Robb 1985), if we call  $YT_i$  the value of the outcome for the treated household and  $YC_i$  the value of the outcome for the control, these are independent of the treatment ( $d_i$ ) but conditional on a set of observable characteristics  $X_i$ .

$$(Y_{T_i}, Y_{C_i} \perp d_i) \mid X_i \quad (2)$$

Since matching on  $X_i$  is the same as matching on the probability of being treated  $P(X_i)$  (Rosebaum and Rubin 1983), all dimensions of  $X_i$  can be summarized into a predicted probability of being treated:

$$P(X_i) = Pr(d_i = 1 \mid X_i) = b(x'_i b) \quad (3)$$

where  $b$  is the standard normal distribution function.

Households in the untreated group that have a very similar probability of participating would be used as controls for their treated counterparts. So the effect of the treatment on the treated  $\alpha$  can be defined as:

$$\alpha = E(Y_{T_i} - Y_{C_i} \mid P(X), d = 1) \quad (4)$$

Conditioning on the propensity score results in the balancing of covariates across treatment and control groups, thus focusing the analysis on the area of common support by dropping those observations without a clear match. Further, PSM evades the arbitrary linear-in-parameters form of an OLS approach (Ravallion 2005). Heckman et al. (1996), Heckman, Ichimura, and Todd (1998), and Dehejia and Wahba (1999, 2002) show that PSM does

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3 See, for example, Heckman, Ichimura, and Todd (1998); Imbens (2004); Ryan and Meng (2004); Ravallion (2005).

well in replicating experimental results provided researchers have access to a rich set of covariates or control variables and use the same survey instruments. These two requirements are fulfilled in this case since the collected data, as described in the next section, are rich in information, and were obtained using the same survey for treatment and control households. In the PSM approach, a common method of determining the statistical significance of results is to use bootstrapped standard errors since it provides reliable standard errors for all of the matching estimators and also accounts for the fact that the balancing score is estimated (Diaz and Handa 2006). Bootstrapped standard errors are therefore used to test the significance of the PSM estimates of impact.

An alternative to PSM, particularly when control and treatment, although not randomly assigned, are reasonably comparable, is a WLS method using weights calculated by the inverse of the propensity score (Sacerdote 2004; Todd, Winters, and Hertz 2010). Weighting by the inverse of the estimated propensity score has been demonstrated to achieve covariate balance and, in contrast to matching and stratification/blocking, uses all observations in the sample (Sacerdote 2004). Following Hirano and Imbens (2001), weights are calculated as follows:

$$\omega_{(T, C)} = \frac{d_i}{p(X_i)} + \frac{(1 - d_i)}{1 - p(X_i)} \quad (5)$$

where  $p(X_i)$  are the estimated propensity scores calculated as in equation (3), above.

Using equation (5), the weights created can be used to adjust the distribution of the two populations of interest (participants and nonparticipants) to help account for the area of common support. The weights imply a greater emphasis on those treated households with lower scores and control households with higher scores. Further a regression framework as expressed in equation (1) can be used where  $X_i$  is included as a set of covariates and where standard tests of significance can be used (Robins and Rotnitzky 1995; Hirano and Imbens 2001). This approach retains full information from all households, while using weights ensures no correlation between treatment and covariates leading to a consistent estimate of the average treatment effect (Imbens 2004).

Each of these three approaches relies on an assumption of exogeneity, namely that program participation is exogenous to outcomes given a rich set of observable covariates  $X_i$ . When this assumption holds, treatment effects can be estimated without bias using observed estimands. Although we are

reasonably confident that this assumption holds, to explore the possibility of estimates being biased by unobservable differences between treatment and control groups, an IV approach is also used. An IV approach allows relaxing the exogeneity assumption, but requires identifying an instrument,  $Z_i$ , which is correlated with program participation but uncorrelated with the error term (that is, would not capture the bias associated with unobservable differences between treatment and control). In an IV approach, two stages are estimated as follows:

$$\begin{aligned} \text{Stage 1: } d_i &= \delta Z_i + \varphi X_i + v_i \\ \text{Stage 2: } Y_i &= \beta X_i + \alpha d\_hat_i + \varepsilon_i \end{aligned} \quad (6)$$

where

$\delta$  defines the relationship between instrument  $Z_i$  and *Plataformas* participation;

$\varphi$  defines the relationship between instrument  $X_i$  and *Plataformas* participation;

$d\_hat_i$  is predicted participation in the *Plataformas* as estimated from the first stage;

$v_i$  is the error term in the first stage;

and remaining variables are as previously defined.

The first stage is estimated as a linear probability model. Angrist (2000) suggests this approach when the first stage is a limited dependent variable model and argues that it is consistent and safer since predicting using a probit in the first stage is only consistent if the model is exactly correct. The main advantage of using an IV approach, when a valid instrument can be found, is that it deals with potential bias from observable and unobservable differences in control and treatment. In addition, the method can be used to test the exogeneity assumption used in PSM and OLS (Ravallion 2005).

To summarize, for the indicators analyzed ( $Y_i$ ) that test the hypotheses noted in the previous section, these four empirical approaches are employed. This allows for a clear assessment of the impact of the program. The next section presents the data used to conduct these analyses.

## Data

Two survey instruments (household and community) administered in the field were developed using qualitative information gathered by means of value-chain analysis, stakeholder consultations, and focus-group discussions.

Several revisions of the survey instruments were done based on field testing and conversations with key informants from the two study regions. The household survey included demographic information, economic and financial conditions of the households, social capital information, and agricultural production data, including detailed information on potato production. The community survey included information on the overall community population characteristics, access to infrastructure, and community organization.

### Household Characteristics

Table 12.1 presents descriptive statistics of household characteristics along with *t*-test of difference for equality of means for the various counterfactual groups. Beneficiaries are contrasted with nonparticipants and noneligible households, as well as with the whole group of nonbeneficiaries (that is, nonparticipants plus noneligibles). The *t*-test of difference for equality of means provides evidence of significant differences among the groups, offering an initial assessment of which group may represent a better counterfactual. The table presents statistics for 660 households used in the analysis for which full information on an entire production cycle is available.<sup>4</sup> In the interest of space, the details of the descriptive statistics are not discussed and we focus only on a few key characteristics, and overall on the evidence regarding whether the survey design and data collection created a reasonable counterfactual. The exception is the social-capital variables which played a key role in the formation of the *Plataformas* and are therefore discussed in more detail.

Examining the first three sections of Table 12.1, the results suggest that households in the sample have many of the characteristics of smallholders in the Andes. They have limited amounts of land (2.58 hectares of land with less than half dedicated to potato cultivation), which tend to be spread across a few (about three), often steep plots. Household heads tend to be indigenous (62 percent) and have limited levels of education (around five years) with an average family size of nearly five members. Asset ownership is generally limited and diverse, so a PCA has been conducted to construct variables for assets ownership, grouped as durable assets, agricultural assets, and livestock. Although households tend to own their own homes and have access to a water system (95 percent), many have limited access to a sewage system (7 percent) and modern methods of cooking (54 percent cook with electricity or gas). Among the land, sociodemographic, and welfare variables, most do not show

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<sup>4</sup> See footnote 2.

TABLE 12.1 Descriptive statistics

Variable	Whole sample	Beneficiaries	Nonparticipants	P( T  >  t )	Non-elig.	P( T  >  t )	All nonbeneficiaries	P( T  >  t )
<b>Land</b>								
Altitude (m.a.s.l.)	3,458	3,448	3,461	.701	3,466	.617	3,463	.613
Land owned (ha)	2.58	2.55	2.04	.106	3.14	.115	2.59	.891
Owned plots (no.)	2.97	3.25	2.55	.001***	3.11	.502	2.83	.016**
Black soil (%)	79	77	80	.407	81	.240	81	.242
Flat land (%)	39	38	40	.446	40	.516	40	.420
Irrigated land (%)	57	54	57	.499	61	.135	59	.214
<b>Sociodemographic</b>								
Family size	4.71	4.79	4.77	.905	4.57	.241	4.67	.448
Average education HH head	4.96	5.24	4.91	.342	4.74	.169	4.82	.176
Indigenous HH head (%)	62	58	59	.766	68	.020**	64	.133
Female HH head (%)	12	12	12	.766	13	.827	12	.939
Age of HH head	42.3	42.2	40.33	.143	44.38	.105	42.35	.901
Dependency share (%)	29	29	31	.332	27	.399	29	.929
<b>Welfare</b>								
Durable assets	0.013	0.040	-0.025	.474	0.025	.874	0.00	.623
Agricultural assets	-0.005	0.129	-0.095	.033**	-0.048	.125	-0.07	.014**
Livestock	0.067	0.063	-0.036	.297	0.174	.300	0.07	.950
Own house (%)	86	84	88	.234	87	.374	87	.223
Concrete/brick house (%)	87	83	90	.041**	90	.043**	90	.015**
Access to water system (%)	95	92	94	.413	97	.016**	96	.060*
Access to sewage system (%)	7	6	7	.743	7	.600	7	.627

Variable	Whole sample	Beneficiaries	Nonparticipants	P( T  >  t )	Non-elig.	P( T  >  t )	All nonbeneficiaries	P( T  >  t )
Cook with electricity/gas (%)	54	57	54	.518	52	.285	53	.323
Distance to closest city (km)	29.38	27.13	25.46	.171	35.53	.000***	30.49	.025**
<b>Social capital</b>								
Participate in nonagricultural association in community (%)	83	82	83	.815	84	.639	84	.684
Participate in agricultural association in community (%)	23	43	14	.000***	14	.000***	14	.000***
<b>Nonagricultural associations in community</b>								
Membership (max. no. years)	9.54	9.97	8.60	.129	10.06	.921	9.33	.405
Meetings (no./year)	32.46	32.32	33.18	.808	31.88	.892	32.53	.944
<b>Agricultural associations in community</b>								
Membership (max no. years)	6.57	3.96	10.03	.000***	11.06	.000***	10.56	.000***
Meetings (no./year)	16.56	16.82	12.77	.189	19.45	.433	16.16	.794
<b>Before <i>Plataformas</i> (five years prior to surveys)</b>								
Agricultural associations in community (%)	8	7	8	.938	8	.918	8	.920
Membership (max. no. years)	17.29	15.20	17.00	.585	18.88	.311	17.94	.404
Meetings (no./year)	14.74	21.30	12.69	.144	12.69	.167	12.69	.084*
<b>Outside associations</b>								
Nonagricultural associations (%)	17	17	18	.887	16	.782	17	.969
Agricultural associations (%)	7	4	5	.512	7	.231	6	.773
<b>Observations</b>	<b>660</b>	<b>217</b>	<b>222</b>		<b>221</b>		<b>443</b>	

Source: Authors' calculation using survey data.

Note: HH = household; probability: \* ≤ .1, \*\* < .05, \*\*\* < .01.

statistically significant differences between the beneficiary group and any of the nonbeneficiary groupings. The few variables that are significantly different have similar magnitudes and could potentially be controlled for in the analysis. In general, the first part of Table 12.1 shows that the most similar possible control group would be the group of nonparticipants, since they have the fewest differences from the beneficiaries. However, even the noneligible group seems to be reasonably comparable to the beneficiaries. The entire group of nonbeneficiaries thus is a reasonable counterfactual and it offers a greater number of farmers highly comparable to the beneficiaries.

Moving to the social capital section of Table 12.1, a broad set of variables is presented since social capital was a key element in the *Plataformas* program. These show that participation in nonagricultural community associations is quite high (83 percent) and over three times the membership in agricultural community associations. While membership in nonagricultural associations is not different across the groupings, the membership in an agricultural association does show statistically significant differences: while 43 percent of beneficiaries belong to an agricultural association, the percentage adds up to 14 percent for both nonparticipants and noneligibles. At first glance, these results would indicate that there is something fundamentally different about the group of beneficiaries who participate in an agricultural association at higher rates than the possible control groups. However, while the *Plataformas* allowed all individuals and households to participate in the program, the program gave preference to those in associations. Thus, before joining the *Plataformas*, farmers may have been members of existing associations, may have joined existing ones, or may have formed new groups. This may explain the differences in the percentages of those who belong to an agricultural association across the three groups compared in Table 12.1.

A way to corroborate this hypothesis is to use data on the number of years that farmers have belonged to an agricultural association. If beneficiaries joined, or formed an agricultural association to qualify for the *Plataformas*, the maximum number of years belonging to such an association would be expected to be less than five years before the implementation of the surveys, which is when the *Plataformas* were introduced in Tungurahua and Chimborazo. We would expect then that beyond five years prior the survey, the levels of social capital would be very similar across groups.

To this end, the bottom part of Table 12.1 presents an additional set of social-capital variables. First, there are no statistically significant differences in the number of years of membership and frequency of meetings for participation in nonagricultural associations. However, for agricultural

associations, while the number of meetings per year is not significantly different, membership is a relatively new event for beneficiaries who have been members for 3.96 years on average, as opposed to 10.03 years for nonparticipants, and 11.06 years for noneligibles. This seems to confirm that many beneficiaries recently joined an agricultural association. Another way to corroborate this is by looking at the rate of participation for those who have been part of an agricultural association for more than five years. The next set of variables confirms this as 7 percent of beneficiaries belonged to an agricultural association for more than five years versus 8 percent for nonparticipants and for noneligibles with all differences being statistically insignificant. Looking at the maximum number of years of membership for this subgroup, the data show that there are no differences across groups. Lastly, the final set of variables shows no statistically significant differences between beneficiaries and possible control groups in the rate of participation with outside agricultural and or nonagricultural associations. Based on this information, it is reasonable to assume that the differences that exist today across the groups are likely due to joining the *Plataformas*, which implies the willingness to create or strengthen social capital. Hence, potential unobservable differences, if existing, are likely to be captured by the social-capital variables that best proxy this selection criterion.

### Indicator Variables

To test the hypotheses being tested, the following three sets of indicators are analyzed: (1) *primary indicators*, expressed by log of total harvest per hectare and gross margins per hectare; (2) *mechanisms* through which primary objectives were reached, or why they were not reached; and (3) *secondary indicators* arising from participation, particularly related to use, knowledge, and practice of precautionary measures in agrochemical applications, and other environmental impacts. Table 12.2 presents these indicators.

Among the primary indicators, the amount of potato produce harvested per hectare is the most direct indicator of productivity. The log of the quantity harvested is used and analyzed due to the expectation that the data are log normal. On average, the harvest per hectare is 7,006 kg or 7.94 in logarithms. Gross margins express returns to fixed factors of production, which provide a good indication of profitability, and are calculated as the total value of harvest minus the total variable costs incurred for their production. On average farmers earn US\$112 per hectare of potatoes harvested.<sup>5</sup>

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5 All monetary indicators are in US dollars.

**TABLE 12.2** Program impact indicators

Indicator	Whole sample
<b>Primary indicators</b>	
Log of total harvest (kg/ha)	7.94
Gross margins (US\$/ha)	112.72
<b>Mechanisms</b>	
Total potatoes sold (share of harvest)	0.45
Value of potatoes harvested (\$/ha)	763.49
Price of potatoes sold (\$/kg)	0.11
Time of transaction (hours)	1.29
Input costs (\$/ha)	650.77
Cost of paid labor (\$/ha)	97.48
Cost of seeds purchased (\$/ha)	48.55
Value of seeds planted (\$/ha)	181.45
<b>Secondary indicators</b>	
Preventive fungicide applied (kg or l/ha)	3.15
Curative fungicide applied (kg or l/ha)	4.16
Insecticides applied (kg or l/ha)	2.22
Cost of chemical fertilizer (\$/ha)	124.68
Cost of organic fertilizer (\$/ha)	46.04
Applies traps (%)	26.7
Environmental impact quotient	95.24
Can identify most toxic products (%)	34.1
Always uses plastic poncho (%)	13.0
Always uses mask (%)	6.4
Berger index of diversity	1.45
Most used variety—Fripapa (%)	29.0
<b>Observations</b>	<b>660</b>

**Source:** Authors' calculation using survey data.

There are multiple mechanisms through which farmers could increase yields and the income they generate from potato production. One key mechanism is through improved returns to potato production that can be obtained through selling more potatoes, getting a higher price for those potatoes, or requiring less time to sell. Four indicators for this mechanism are presented: (1) percentage of potato sold per hectare, (2) value of potato production, (3) price of sale, and (4) time required for sales transactions. Households on average sell almost half of their potato harvest (45 percent), which has a total value of \$763 per hectare

and sells at a price of about \$0.11 per kg. On average, it takes 1.29 hours to sell their potatoes. The *Plataformas* also worked on the input side of the supply chain, introducing and supplying the most market-demanded varieties of which INIAP-Fripapa (hereafter referred to as Fripapa) represents the main variety. Changes in gross margins could reflect a change in input costs, while changes in yields could be due to additional input use and/or better farming practices. Four cost indicators are used to explore this mechanism. The average total input cost for households is \$650 per hectare, of which \$97 is paid labor costs per hectare, and \$49 purchased seeds per hectare. The average value of seeds planted, however, is over three times that amount at \$181 per hectare, suggesting that much of the seed is not purchased.

The secondary indicators capture the possible side effects of participation. The first set, which incorporates both health and environmental impacts, is the use of agrochemicals. To avoid increased agrochemical use and minimize their negative effects, FFS introduced an IPM approach that combines good management practices, including the use of insect traps for Andean weevil (*Premnotrypes vorax*), with the use of low-toxicity pesticides. Nevertheless, to comply with standards required, farmers might be inclined to use more pesticides and chemical fertilizers to make sure harvested output is of a required physical quality (Orozco et al. 2007). To explore these possibilities, the amount of preventive and curative fungicides, the amount of insecticides, and the costs of chemical fertilizers are considered. Further, alternatives to chemical inputs, namely the cost of organic fertilizer and use of traps, are also examined.

FFSs teach the different risks associated with the toxicity of agrochemicals, how to recognize toxicity levels of a product, and what precautions to use. The expectation is that participants use less-toxic pesticides, and that farmers recognize toxicity levels and take more precautions when applying agrochemicals. The methodology proposed by Kovach et al. (1992) was used to assess the environmental impact of pesticides. The environmental impact quotient (EIQ), which accounts for the toxicity level of the active ingredients of each agrochemical, was gathered and aggregated according to the field rate and concentration of each, obtaining the total environmental impact (TEI) per ha. The average value of the TEI is 95.

An indicator of knowledge of toxicity level is also included, and on average 34 percent of farmers can identify the most toxic products. A selected set of indicators for the use of protective gear is also reported. Data show that the percentage of households that use protective measures is in general very low, with 13 percent of farmers interviewed using plastic ponchos and only 6 percent using masks.

The final secondary indicators are related to the rate of agrobiodiversity maintained at the household level—that is, how the composition and share of potato varieties change due to market participation. The *Plataformas* focus on commercial varieties, and theory suggests that as farmers shift to market varieties and begin to specialize, the overall number of varieties cultivated is reduced (Pingali and Rosegrant 1995; Pingali 2001) even though this does not necessarily imply genetic erosion (Smale 1997). The Berger–Parker index of inverse dominance, which expresses the relative abundance of the most common species (Magurran 1988; Baumgärtner 2006), is reported.<sup>6</sup> Also included is the share of potato area planted with the Fripapa variety, a key variety promoted through the *Plataformas*, which at the time of the survey was the dominant variety in 29 percent of cases.

## Analysis and Results

As noted, the approach used to select communities for inclusion in the sample focused on establishing a good counterfactual. To avoid remaining biases requires controlling for any further differences between treatment and control groups. Discussions with key informants and program leaders suggested that social capital is the key factor of program participation, and the data presented earlier support this. In particular, whether a household participated in an agricultural association for more than one year appears to capture the differences between treatment and control households. Since this is closely related to participation in the *Plataforma*, controlling for this variable in the regression model or using it in PSM should ensure controlling for those unobservables that may have driven certain households to participate. The assumption is that this variable is correlated with unobservables related to being an “organization joiner,” which compels households to join the program, and thus any bias associated with self-selection should be eliminated. This variable is included in each of the regressions.

Since there remains the possibility of potential unobservable differences and, therefore, biased impact estimates, an IV approach is also employed as per equation (6). Finding a suitable and valid instrument is often a challenge, but a common solution used in impact evaluation is to use the intention to treat (ITT), since all households in the treated communities had the option to enter the program but not everybody participated (Galasso, Ravallion,

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<sup>6</sup> Additional diversity indexes (Shannon and Margalef) were used with similar results; these are not presented here.

and Salvia 2001; Ravallion 2005; Oosterbeek et al. 2008). Provided that we control for location-specific effects which might have a direct effect on outcomes, this should be a good predictor of participation. The eligibility criteria are shown to be, indeed, a valid instrument in our case being the instrument (ITT) highly significant in the first stage and the instrumented variable highly significant in the second stage. We also checked the null hypothesis that the instrument is weak and reject this hypothesis as it passes the rule of thumb that the F statistic for excluded instruments is higher than 10. Lastly, the endogeneity test accepts the null hypothesis that *Plataformas* can be treated as exogenous to our specification, thus supporting the exogeneity assumption needed in the PSM and WLS.<sup>7</sup>

For each of the four specifications presented, all nonbeneficiaries are used as the potential counterfactual group and results are reported in Table 12.4. In general, the four approaches provide robust results suggesting impact estimates are accurate. Since all nonbeneficiaries are used for this first set of results, they may be lower bound estimates due to the possibility of spillover effects of the program on nonparticipants in the treatment communities. Even if there are spillover effects, they are likely to be small, since nonparticipants would not have obtained the benefits of market access, which appear substantial, and instead are only likely to receive indirect benefits from improved access to seed and transmission of new production technologies. Nonetheless, to make sure no spillover effects are found, we consider additional counterfactual groups within the WLS framework. These include noneligibles, nonparticipants, as well as the ITT group (beneficiaries and nonparticipants) contrasted with the noneligibles. The benefit of this last approach is that it potentially captures both direct and spillover effects. These results are presented in Table 12.5. Before proceeding with a discussion of these two sets of results, the probit on participation is first examined.

### Participation in the *Plataformas*

Table 12.3 reports the results of the probit on *Plataformas* participation with marginal effects calculated at the sample mean. The model accurately predicts

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7 With regard to the identification strategy, no tests for overidentification can be run since, given one instrument, the equation is exactly identified. To verify the endogeneity assumption, a test under the null hypothesis that the specified endogenous regressors (participation in the *Plataforma*) can actually be treated as exogenous has been run. The test statistic is distributed as chi-squared with degrees of freedom equal to the number of regressors tested and defined as the difference of two Sargan–Hansen statistics: one for the equation with the smaller set of instruments, where *Plataforma* is treated as endogenous; and one for the equation with the larger set of instruments, where *Plataforma* is treated as exogenous.

**TABLE 12.3** Probit on *Plataforma* participation

LR  $\chi^2(26) = 84.37$   
 Prob >  $\chi^2 = 0.0000$   
 Log likelihood = -375.80489 Pseudo  $R^2 = 0.1009$

Parameter	dF/dx	P> z
Land owned (ha)	-0.004	.506
Owned plots (no.)	0.031	.003***
Black soil (%)	-0.048	.451
Flat land (%)	-0.068	.216
Irrigated land (%)	-0.076	.156
Family size	0.010	.369
Average education of HH head	0.006	.338
Indigenous HH head	-0.027	.549
Female HH head	0.011	.860
Age of HH head	0.000	.964
Dependency share	0.056	.631
Livestock	-0.015	.488
Agricultural assets	0.041	.068*
Durable assets	-0.004	.876
House	-0.043	.500
Concrete/brick house	-0.131	.051*
Access to water system	-0.200	.025**
Sewage	-0.087	.258
Cook with electricity/gas	0.076	.084*
Distance to closest city (km)	-0.003	.049**
Altitude	0.000	.846
Chimborazo	-0.065	.307
Agricultural association (>1 year)	0.327	.000***
Nonagricultural association	-0.015	.774
External agricultural associations	-0.021	.786
External nonagricultural associations	-0.007	.901
Observations		660
Sensitivity (%)		34.56
Specificity (%)		90.07
Positive predictive value (%)		63.03
Negative predictive value (%)		73.75
Correctly classified (%)		71.82

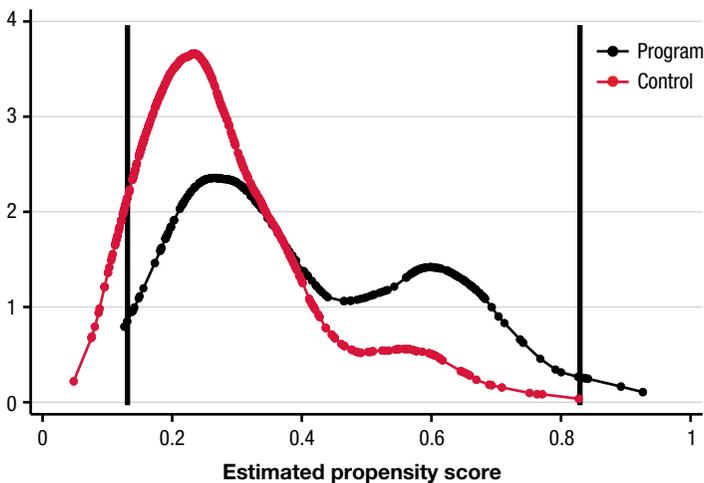
**Source:** Authors' calculation using survey data.

**Note:** HH = household.

71.8 percent of outcomes and shows the importance of a number of variables. The differences are as expected and reflect those reported in Table 12.1. Membership of an agricultural association within the community for more than a year is significant and has the expected sign.

Using the probit results, propensity scores are calculated for the treatment and control group. Figure 12.1 shows the kernel-density estimates of the distribution of estimated propensity scores for each group. The scores obtained are almost entirely in the area of common support, suggesting that nonbeneficiaries represent a reasonable counterfactual to the treated population.<sup>8</sup> Furthermore, Appendix Table 12A.1 reports the punctual test of means showing a dramatic reduction of significant differences between the two groups and demonstrating the capability of the method to balance the baseline covariates and to make the two groups highly comparable. Nevertheless, the difference in mean propensity score across the treatment and control groups (mean of 0.37 in the treatment group versus 0.29 in the control group,  $P < .000$ ) implies that simply conditioning on  $X$  through an OLS specification

**FIGURE 12.1** Kernel distribution and common support area across the two groups



**Source:** Authors' calculation using the "Linking small farmers to the new agricultural economy data" set.

**Note:** The common support area is marked within the black vertical lines.

<sup>8</sup> Figures assessing the common support for all possible counterfactual options were also constructed but are not reported as they all consistently suggested a similar area of common support, indicating high similarity across groups. For simplicity, only one figure is presented. The consistency of the common support across potential control groups is corroborated in the results of the various analyses presented in this section.

might not yield the correct average treatment effect if this effect is in fact heterogeneous. Given these results, PSM, WLS, and IV estimates are considered to ensure an unbiased estimate of impacts.

### Assessing Results

Table 12.4 presents the results of the analysis using the OLS, PSM, WLS, and IV approaches reporting the impact estimate of *Plataformas* participation ( $\alpha$ ) on the indicator of interest ( $Y_i$ ). Table 12.5 reports results using the WLS, which we think best represents and approximates impacts, for the alternative counterfactual groups. The results are remarkably consistent across specifications (Table 12.4) and make sense for the different counterfactual groupings (Table 12.5), indicating that the program effects are well identified.

Table 12.4 shows that both primary indicators, log of yields and gross margins, are positively and significantly influenced by participation in the program with the estimated differences being similar and significant across specifications. Gross margins per hectare are around \$200 higher for participants, which are substantial given average margins are only around \$100 per hectare (see Table 12.2). The findings in Table 12.5 suggest results are similar even when using different counterfactual groupings. The results using the nonparticipants suggest there are few or no spillover effects and indicate that participating in the *Plataformas* program is associated with a successful welfare improvement for beneficiary farmers.

The mechanisms leading to these results show that beneficiaries sell more of their harvest compared to nonbeneficiaries and at a significantly higher price, thus obtaining a greater value. Prices obtained are indeed about \$3 per metric quintal more than nonbeneficiaries, corresponding approximately to 30 percent higher price if looking at the differences in prices (Table 12.2). The results on the difference in the time taken for the transaction are mostly insignificant, although the IV results suggest they are lower. Table 12.4 shows that, overall, total input costs do not appear to be significantly higher for the beneficiaries; however, seeds purchased and used are significantly higher for treated households and for most specifications so are labor costs (the exception being the IV results).

Moving to the secondary indicators of Table 12.4, the increased use of some inputs suggests possible environmental and health problems if it is linked to increased use of agrochemicals. The evidence is somewhat mixed, but does not seem to imply a widespread problem. Beneficiaries do not use significantly more fungicides, but do use more insecticides (although not according to the IV results) and chemical fertilizers. Findings suggest, however, that

TABLE 12.4 Impact of *Plataformas*

Indicator	OLS		PSM, kernel		PS weighted LS		IV	
	Diff.	P> z	Diff.	P> z	Diff.	P> z	Diff.	P> z
<b>Primary indicators</b>								
Log of total harvest (kg/ha)	0.55	.000***	0.55	.000***	0.58	.000***	0.85	.003***
Gross margins (US\$/ha)	215.19	.008***	237.56	.002***	184.82	.010***	243.33	.069*
<b>Mechanisms</b>								
Total potatoes sold (share of harvest)	0.08	.002***	0.09	.005***	0.09	.001***	0.10	.070*
Value of potatoes harvested (\$/ha)	362.50	.010***	419.47	.001***	368.07	.001***	365.62	.111
Price of potatoes sold (\$/kg)	0.03	.000***	0.03	.000***	0.03	.000***	0.04	.000***
Time of transaction (hours)	0.02	.909	0.011	.947	-0.02	.876	-0.62	.041**
Input costs (\$/ha)	147.31	.272	181.91	.250	183.25	.075*	122.29	.562
Cost of paid labor (\$/ha)	49.30	.028**	72.25	.008***	44.10	.039**	-11.36	.823
Cost of seeds purchased (\$/ha)	45.51	.008***	51.45	.003***	37.86	.022**	71.62	.016**
Value of seeds planted (\$/ha)	87.59	.009***	93.04	.007***	91.44	.008***	117.24	.058*
<b>Secondary indicators</b>								
Preventive fungicide applied (kg or l/ha)	-0.50	.485	-0.36	.588	-0.28	.636	-2.16	.172
Curative fungicide applied (kg or l/ha)	-0.25	.802	0.10	.905	-0.51	.651	-5.41	.147
Insecticides applied (kg or l/ha)	1.00	.098*	0.92	.120	1.21	.051*	0.52	.538
Cost of chemical fertilizer (\$/ha)	38.50	.033**	44.66	.011**	40.67	.020**	63.33	.063*
Cost of organic fertilizer (\$/ha)	15.50	.262	18.45	.352	16.50	.162	51.30	.016**
Applies traps (%)	0.50	.000***	0.50	.000***	0.51	.000***	0.57	.000***
Total environmental impact quotient (TEI/ha)	-31.03	.343	-28.45	.401	-22.71	.356	-116.69	.081*
Can identify most toxic products (label color) (%)	37	.000***	39	.000***	36	.000***	46	.000***
Always uses plastic poncho (%)	7	.026**	7	.044**	7	.035**	7	.218
Always uses mask (%)	4	.059*	5	.055**	4	.085*	2	.560
Berger index of diversity (%)	0.00	.969	0.01	.909	0.00	.933	0.04	.724
Most used variety—Fripapa (%)	35	.000***	36	.000***	35	.000***	30	.000***
<b>Observations</b>	<b>660</b>		<b>660</b>		<b>660</b>		<b>660</b>	

Source: Authors' calculation using survey data.

Notes: Diff. = difference in means; probability: \*  $\leq .1$ , \*\*  $< .05$ , \*\*\*  $< .01$ .

TABLE 12.5 Comparison of alternative control groups (using propensity-score weighted least squares)

Indicator	Participants vs nonbeneficiaries		Participants vs noneligible		Participants vs nonparticipants		ITT vs noneligible	
	Diff.	P> z	Diff.	P> z	Diff.	P> z	Diff.	P> z
<b>Primary indicators</b>								
Log of total harvest (kg/ha)	0.58	.000***	0.73	.000***	0.47	.002***	0.47	.005***
Gross margins (US\$/ha)	184.82	.010***	170.68	.034**	186.11	.028**	110.69	.077*
<b>Mechanisms</b>								
Total potatoes sold (share of harvest)	0.09	.001***	0.10	.003***	0.09	.004***	0.07	.014***
Value of potatoes harvested (\$/ha)	368.07	.001***	417.54	.001***	414.76	.000***	232.51	.019**
Price of potatoes sold (\$/kg)	0.03	.000***	0.03	.000***	0.03	.000***	0.02	.019**
Time of transaction (hours)	-0.02	.876	-0.15	.404	0.13	.462	-0.28	.049**
Input costs (\$/ha)	183.25	.075*	246.86	.020**	228.65	.002***	121.82	.124
Cost of paid labor (\$/ha)	44.10	.039**	38.90	.164	66.03	.001***	8.71	.688
Cost of seeds purchased (\$/ha)	37.86	.022**	49.76	.002***	39.80	.064*	34.88	.005***
Value of seeds planted (\$/ha)	91.44	.008***	108.84	.004***	85.80	.007***	59.68	.026**
<b>Secondary indicators</b>								
Preventive fungicide applied (kg or l/ha)	-0.28	.636	-0.40	.551	0.31	.582	-0.68	.271
Curative fungicide applied (kg or l/ha)	-0.51	.651	-1.33	.408	1.04	.066*	-1.71	.227
Insecticides applied (kg or l/ha)	1.21	.051*	1.15	.052*	1.36	.031**	0.47	.196
Cost of chemical fertilizer (\$/ha)	40.67	.020**	53.07	.008***	34.68	.075*	37.12	.018**
Cost of organic fertilizer (\$/ha)	16.50	.162	36.52	.001***	2.82	.855	29.11	.010***
Applies traps (share)	0.51	.000***	0.54	.000***	0.49	.000***	0.29	.000***
Total environmental impact quotient (TEI/ha)	-22.71	.356	-29.67	.277	16.98	.176	-35.30	.135
Can identify most toxic products (label color) (%)	36	.000***	39	.000***	34	.000***	24	.000***
Always uses plastic poncho (%)	7	.035**	5	.159	7	.073*	3	.280
Always uses mask (%)	4	.085*	3	.295	5	.049**	1	.576
Berger Index of diversity (%)	0.00	.933	-0.02	.752	-0.02	.735	-0.02	.751
Most used variety—Fripapa (%)	35	.000***	32	.000***	36	.000***	14	.000***
<b>Observations</b>	<b>660</b>		<b>438</b>		<b>439</b>		<b>660</b>	

Source: Authors' calculation using survey data.

Notes: Diff. = difference in means; ITT = intention to treat group; probability: \* ≤ .1, \*\* &lt; .05, \*\*\* &lt; .01.

farmers are using less-toxic chemical mixes given that they are using more chemicals and the EIQ ratio is not significantly different from zero in any of the specifications, except for the IV where it is negative and moderately significant. The finding is also supported by the evidence that beneficiaries can identify toxic products better than nonbeneficiaries. This is most likely due to the training participants received in FFS. Additionally, traps for the Andean weevil are more commonly used by beneficiaries than nonbeneficiaries. Lastly, program participants are generally more likely to use protective gear as evidenced by a greater use of a plastic ponchos and masks (this result, however, does not hold for the IV result which is insignificant).

With respect to the potential losses of agricultural biodiversity as market demand pressurizes farmers to abandon traditional varieties, the evidence does not support this hypothesis as indicated by the insignificant impact on the agrobiodiversity indicator reported. Participants do seem to have switched to the Fripapa variety. Thus, *Plataformas* farmers seem to maintain the same diversity level although changing the primary market variety grown.

### **Linking Different Farmers to Market**

Different organizations implemented the field training in the FFS in the two regions of Chimborazo and Tungurahua, however all trainers used the same methodology and curriculum. Likewise the process of incorporating farmers to the *Plataformas* was the same in both regions. Although Chimborazo and Tungurahua are both relatively poor areas, it is important to note that there are significant differences between the two. Data from the Ecuadorian National Institute of Statistics and Census shows that about 54.1 percent of the population in Chimborazo lived in consumption poverty in 2006, while only 36.2 percent lived in poverty in Tungurahua (INEC, 2005–2006). These differences are reflected in our own data where land variables as well as sociodemographic indicators suggest that, although both provinces are rather poor, farmers in Tungurahua are, on average, better off than their counterparts in Chimborazo owning more land and generally having higher socioeconomic indicators. It is reasonable to assume that these differences may be reflected in divergent results in the two regions.

To determine how well the *Plataformas* perform in each area, the analysis is done for each region. Table 12.6 shows results for the two provinces and seems to suggest that the effects of the *Plataformas* participation are stronger for farmers in Chimborazo who have clearer direct impacts: larger and strongly significant gross margins and a higher impact on harvest. In Tungurahua, on the other hand, while the signs for these indicators

**TABLE 12.6** Impact by region (using propensity-score weighted least squares)

Indicator	Tungurahua		Chimborazo	
	Diff.	P> t	Diff.	P> t
<b>Primary indicators</b>				
Log of total harvest (kg/ha)	0.30	.060*	0.86	.000***
Gross margins (US\$/ha)	25.53	.686	366.47	.004***
<b>Mechanisms</b>				
Total potatoes sold (share of harvest) (%)	7	.034**	9	.027**
Value of potatoes harvested (\$/ha)	116.98	.151	672.28	.000***
Price of potatoes sold (\$/kg)	0.02	.006***	0.04	.001***
Time of transaction (hours)	-0.14	.391	0.03	.925
Input costs (\$/ha)	91.45	.109	305.80	.043**
Cost of paid labor (\$/ha)	3.26	.776	95.31	.027**
Cost of seeds purchased (\$/ha)	29.85	.021**	24.52	.375
Value of seeds planted (\$/ha)	55.72	.001***	110.23	.032**
<b>Secondary indicators</b>				
Preventive fungicide applied (kg or l/ha)	0.20	.831	-0.51	.462
Curative fungicide applied (kg or l/ha)	-1.56	.363	-0.10	.949
Insecticides applied (kg or l/ha)	1.21	.107	1.23	.150
Cost of chemical fertilizer (\$/ha)	29.51	.173	68.09	.022**
Cost of organic fertilizer (\$/ha)	4.78	.445	22.21	.339
Applies traps (share)	0.55	.000***	0.46	.000***
Total environmental impact quotient (TEI/ha)	2.35	.944	-30.14	.310
Can identify most toxic products (label color) (%)	36	.000***	43	.000***
Always uses plastic poncho (%)	10	.047**	8	.054**
Always uses mask (%)	6	.056*	3	.415
Berger index of diversity	-0.07	.332	0.09	.132
Most used variety—Fripapa (%)	31	.000***	34	.000***
Observations	314		329	

**Source:** Authors' calculation using survey data.

**Note:** Probability: \*  $\leq .1$ , \*\*  $< .05$ , \*\*\*  $< .01$ .

are positive, only the log of harvest per hectare is significantly (at 10 percent level of confidence) larger for participants. However, this difference does not translate into significantly higher gross margins. This is likely due to a combination of factors led by a smaller difference in productivity between beneficiaries and nonbeneficiaries but also by smaller differences in price of potato sold, in the percentage of produce sold, and in the value of produce harvested,

although for both the former indicators differences are significantly higher for beneficiaries in both regions. It is interesting to note that beneficiary farmers in Tungurahua purchased a greater amount of seeds spending more than the control group, while the remaining input costs do not significantly differ, as opposed to Chimborazo where participant farmers spent significantly higher amounts for inputs particularly in terms of hired labor. For the secondary indicators, the differences between the two groups are similar in both regions with the only exception of costs of chemical fertilizers that are significantly greater for participants in Chimborazo. Overall, *Plataformas* farmers are successfully adopting the new production approach in both regions, even though participation seems to be having a greater effect on participants in Chimborazo. These differences may suggest that poverty levels and/or financial constraints are more of an issue for farmers in Chimborazo. If this is the case, we might conclude that program participation is more effective for less endowed and more financially constrained farmers. However, it may be that other regional factors are playing a role.

To explore better whether the differences in results are due to greater benefits going to smallholders and less endowed participants, additional analyses by landholding size are included. Keeping in mind that generally all farmers have relatively small landholdings, we divide landholdings into small (less than 1 hectare), medium (1 to 5 hectares) and large (more than 5 hectares) landholdings. The results presented in Table 12.7 show that medium farms have been able to gain the largest benefits of the program, obtaining significantly higher yields and productivity which translates into higher gross margins. These have been achieved through a larger percentage of potato sold as well as through higher price gains of the produce sold, even though higher input costs, for both seeds and fertilizers, have been incurred. Beneficiaries with very small farms managed to harvest more than their control group and sold a significantly higher amount and share of potatoes, however these did not translate into higher gross margins. This is due to significantly higher input costs which did not lead to a high enough productivity increase, suggesting that landholding, and thus smaller total amounts harvested and sold, are insufficient to compensate the sunk costs participant farmers incur in production. To achieve higher benefits they would need either to further increase productivity or to cut costs. Importantly, it should be noted that small farmers experienced a significantly shorter time to sell their produce. Looking at relatively larger farmers, significantly higher gross margins seem to be due mostly to economies of scale. What seem to have played a major role for larger farms are the reduced per unit costs supported for each type of input and

**TABLE 12.7** Impact by land size (using propensity-score weighted least squares)

Indicator	Small farms (<1 ha)		Medium farms (1–5 ha)		Large farms (>5 ha)	
	Diff.	P> t	Diff.	P> t	Diff.	P> t
<b>Primary indicators</b>						
Log of total harvest (kg/ha)	0.45	.004***	0.67	.005***	0.06	.799
Gross margins (US\$/ha)	–23.16	.844	318.68	.004***	111.81	.068*
<b>Mechanisms</b>						
Total potatoes sold (share of harvest) (%)	13	.001***	4	.353	1	.912
Value of potatoes harvested (\$/ha)	375.79	.012**	442.69	.009***	43.34	.646
Price of potatoes sold (\$/kg)	0.03	.000***	0.03	.000***	–0.02	.119
Time of transaction (hours)	–0.40	.010***	0.19	.559	0.16	.694
Input costs (\$/ha)	398.95	.002***	124.01	.299	–68.48	.202
Cost of paid labor (\$/ha)	100.05	.042**	16.18	.608	–52.33	.005***
Cost of seeds purchased (\$/ha)	78.42	.097*	49.93	.012***	–6.67	.636
Value of seeds planted (\$/ha)	137.63	.017**	92.34	.000***	–7.88	.663
<b>Secondary indicators</b>						
Preventive fungicide applied (kg or l/ha)	–0.20	.827	0.19	.745	–0.52	.574
Curative fungicide applied (kg or l/ha)	–1.23	.630	0.25	.689	–0.71	.220
Insecticides applied (kg or l/ha)	3.31	.032**	0.23	.546	–0.13	.423
Cost of chemical fertilizer (\$/ha)	83.33	.027**	22.99	.123	–1.42	.930
Cost of organic fertilizer (\$/ha)	–2.41	.907	43.63	.005***	11.46	.011**
Applies traps (share)	0.55	.000***	0.49	.000***	0.32	.007***
Total environmental impact quotient (TEI/ha)	–11.93	.733	–8.69	.745	–18.10	.538
Can identify most toxic products (label color) (%)	35	.000***	41	.000***	20	.124
Always uses plastic poncho (%)	3	.613	7	.136	11	.050**
Always uses mask (%)	0	.888	2	.669	14	.120
Berger index of diversity	0.14	.108 s	–0.05	.422	–0.11	.478
Most used variety—Fripapa (%)	34	.000***	41	.000***	11	.262
Observations	302		263		88	

**Source:** Authors' calculation using survey data.

**Note:** Probability \*  $\leq .1$ , \*\*  $< .05$ , \*\*\*  $< .01$ .

particularly for significantly smaller labor costs. Larger farmers are also not increasing other costs compared to those with smaller landholdings. This may be due to the fact larger farmers are already relatively efficient and do not get the level gains that medium farmers experience. In sum, while for larger farmers, economies of scale are sufficient to outweigh the costs and guarantee higher gross margins, in the case of smallholders an intensification of technology adoption combined with a reduction of direct and transaction costs would be needed to guarantee that higher productivity translates into higher gross margins.

## Conclusion

In this chapter, the challenges of linking smallholder potato farmers to high-value markets are examined by looking at the experience of the multistakeholder *Plataformas* program in the provinces of Chimborazo and Tungurahua in the Ecuadorian Sierra. An empirical analysis has been conducted to assess whether the program has been successful in increasing yields and profits of potato-producing smallholders while protecting farmers' health and the environment. Mechanisms by which these objectives have been achieved were also analyzed.

To ensure a proper and sound empirical analysis, the data were collected in a way that made it possible to create a reasonable counterfactual for comparing *Plataformas* participants. Additionally, multiple econometric methods were employed to ensure results were not driven by a specific methodology. Spillover effects are also considered using different counterfactual groupings. The results are strongly consistent across the different specifications and the use of different types of counterfactuals, suggesting that the success of the *Plataformas* is well identified. Our findings show that the *Plataformas* program successfully improved the welfare of beneficiary farmers and that the benefits were limited to farmers who directly participated since there appear to be few spillover effects on nonparticipants.

Both primary indicators, namely yields and gross margins, are positive and significant for beneficiaries, with estimated differences very similar across specifications. The mechanisms through which the *Plataformas* achieve these primary benefits are through selling higher percentages and amounts of potato harvest than nonbeneficiaries in addition to selling at a 30 percent higher price. Although participant farmers incur higher input costs, particularly for seeds but also for hired labor and fertilizers, benefits are enough to outweigh these added costs. Clear benefits are achieved by medium-sized

farms while large farms achieve benefits mainly due to economies of scale. On the other hand, smallholders need to intensify technology and reduce direct as well as transaction costs to be able to achieve higher returns. The regional analysis has shown that farmers in Chimborazo, which are on average poorer than farmers in Tungurahua, have achieved higher and better results through participating in the *Plataformas*.

Results for secondary indicators are somewhat mixed. With respect to the use of agrochemicals, beneficiaries do use slightly more insecticides and chemical fertilizers, but most of the other indicators are not significantly different. Products utilized are likely to be less toxic given the TEI is not significantly different from nonbeneficiaries and in general has a negative sign. The *Plataformas* is clearly having an impact on the utilization of traps and in diffusing knowledge: a significantly higher percentage of participant farmers apply traps while a significantly higher percentage of farmers are able to recognize the toxicity of agrochemicals. This latter translates into a higher utilization of protective gears although percentages are generally relatively low.

Concerns related to potentially negative impacts on agricultural biodiversity are unfounded since results suggest that participants and nonbeneficiaries maintain the same level of diversity. Given that most of the varieties cultivated are modern, it appears that genetic erosion, if any, happened in the past due to a combination of natural causes (El Niño), agro-industrialization and farmers' preferences in response to changing market opportunities.

Overall, participation in the *Plataformas* suggests a successful way of linking smallholder potato farmers to the markets. The success of the *Plataformas* can be first explained by its intervention along the value chain. On the output side, this led to reduced transaction costs that resulted from circumventing intermediaries and making sure farmers obtain a greater share of the returns from their production. Value-chain interventions on the input side led to the introduction and supplying of market-demanded varieties, provided high-quality seeds, and taught efficient farming techniques. Secondly, the success of the *Plataformas* highlights the importance of social capital in identifying and organizing beneficiaries in a manner that effectively overcomes entrance barriers.

While this chapter has, overall, found important positive and significant impacts of the *Plataformas* on the welfare of farmers and no negative effects on farmers' health and the environment, there still remains a question of cost-effectiveness and the potential effect on efficiency. For example, Thiele et al. (2011) note one question that has not so far been addressed because of data limitations: whether there is sufficient value-added in the new market

opportunities to cover the costs of the *Plataformas* and still provide farmers with a sufficient income increment to justify program participation. The authors also observe that while the program received substantial subsidies through project funding, this was probably a reasonable investment given the positive results. In the long run and for scaling up the program, however, other funding mechanisms would need to be explored to achieve financial sustainability (Chapter 8). Although we recognize the importance of assessing costs and shedding light on the sustainability of the *Plataformas*, it is not possible with the current available data. The total investments in the program have not been sufficiently identified since they came from multiple sources. Further, sustainability would need to be assessed with a new round of data collection that would examine how the program is currently operating now that much of the external support has been withdrawn. New initiatives are under way to gather the necessary information to arrive at a more accurate answer to these important questions, presenting a clear direction for future research.

## Appendix

**TABLE 12A.1** Punctual test of means comparing beneficiaries to all nonbeneficiaries

Variable	Mean treated	Mean control	% reduction  bias	P> t
Land owned (ha)	2.55	2.41	-230.7	.622
Owned plots (no.)	3.25	3.11	68.2	.617
Black soil (%)	0.77	0.78	60.3	.884
Flat land (%)	0.38	0.36	48.6	.857
Irrigated land (%)	0.54	0.52	49.1	.659
Family size	4.79	4.82	75	.930
Average education of HH head	5.24	4.96	32.3	.462
Indigenous HH head	0.58	0.61	43.6	.532
Female HH head	0.12	0.11	-155.5	.913
Age of HH head	42.20	42.38	-22.7	.953
Dependency share	0.29	0.29	64	.958
Livestock	0.06	0.05	-113.1	.893
Agricultural assets	0.13	0.00	33.6	.788
Durable assets	0.04	0.01	30.5	.870
House	0.84	0.86	27.8	.570
Concrete/brick house	0.83	0.85	73.6	.732
Access to water system	0.92	0.93	70.1	.759
Access to sewage system	0.06	0.06	72.5	.954
Cook with electricity/gas	0.57	0.55	60.5	.751
Distance to closest city (km)	27.13	26.14	70.4	.362
Altitude (m a.s.l.)	3,447.50	3,446.00	90.4	.918
Chimborazo	0.50	0.50	-20.8	.849
Agricultural association (>1 year)	0.34	0.33	98.7	.943
External nonagricultural association	0.17	0.17	-221.9	.930
External agricultural association	0.07	0.06	3	.763
Nonagricultural association in community	0.82	0.85	-93.5	.595

**Source:** Authors' calculation using survey data.

**Note:** HH = household.

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## **LAPSES, INFIDELITIES, AND CREATIVE ADAPTATIONS: LESSONS FROM EVALUATION OF A PARTICIPATORY MARKET DEVELOPMENT APPROACH IN THE ANDES<sup>1</sup>**

Douglas Horton, Emma Rotondo, Rodrigo Paz Ybarnegaray,  
Guy Hareau, André Devaux, and Graham Thiele

### **Introduction**

Participatory approaches are often recommended to improve the efficiency and sustainability of international development programs or to contribute to local capacity development and empowerment (World Bank 1996; Chambers 2010). Participatory approaches have a long history in agricultural research and development (R&D), beginning with cropping- and farming-systems research in the 1970s and evolving to a broad array of participatory approaches for rural assessment, plant breeding, natural-resource management, and market-chain development (Collinson 2000; Scoones and Thompson 2009; Devaux et al. 2009). Despite the extensive interest in and experimentation with participatory approaches over nearly a half-century, few of these approaches have been systematically evaluated and there is little evidence of their effectiveness and benefits (Martin 2009, 276; Johnson, Lilja, and Ashby 2003, 288).

Evaluators of participatory approaches have grappled with numerous challenges, including the broad range of expected project impacts, the large number of stakeholders with often differing interests, and the limited direct influence of evaluation results on funding decisions (Lilja and Dixon 2008a, 2008b). In this chapter, we address three even more fundamental methodological challenges to the evaluation of participatory approaches: the commonly

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imprecise definition of the approaches themselves; frequent adaptation of the approaches by local implementers; and the long, complex, and little-understood pathways through which participatory approaches contribute to such development goals as food security, rural livelihoods, and environmental sustainability.

From 2007 to 2010, the Andean Change Alliance<sup>2</sup> evaluated four participatory approaches to agricultural R&D (Thiele et al. 2011). Teams in Bolivia, Colombia, Ecuador, and Peru implemented the approaches with support from specialists based in two international agricultural research centers.<sup>3</sup> A separate team (the authors of this chapter) evaluated the implementation and results of the approaches. A third team was tasked with using the evidence generated through evaluations for advocacy to promote more inclusive agricultural-innovation systems.<sup>4</sup> One of the approaches evaluated was the Participatory Market Chain Approach (PMCA), developed by the International Potato Center and its Papa Andina partnership program ([www.papandina.org](http://www.papandina.org)). The PMCA engages smallholder farmers, market agents, and agricultural-service providers in a facilitated process that builds trust among these diverse groups and promotes collective action, which in turn leads to innovations that benefit smallholders as well as other chain actors.

In this chapter, we seek to advance thinking and practice in the planning, management, and evaluation of programs that involve participatory approaches, by reflecting on three aspects of the Alliance's evaluation work with the PMCA: (1) assessment of the fidelity of implementation; (2) identification of key factors that influence implementation and results; and (3) assessment

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2 The Andean Change Alliance (Alianza Cambio Andino) was established to contribute to sustainable livelihoods in poor communities by improving their participation in innovation processes ([www.cambioandino.org](http://www.cambioandino.org)). Funding and resources for the Alliance were provided by the United Kingdom Government's Department for International Development (DFID) and by participating organizations.

3 The two international centers were the International Potato Center (CIP) and the International Center for Tropical Agriculture (CIAT) ([www.cgiar.org/about-us/research-centers/](http://www.cgiar.org/about-us/research-centers/)). Regional and national partners included: Programa para el Fortalecimiento de los Sistemas Gubernamentales de Seguimiento y Evaluación de Proyectos y Programas de Desarrollo Rural en América Latina y el Caribe (PREVAL); Asociación Colombiana de Organizaciones no Gubernamentales para la Comunicación Vía Correo Electrónico (COLNODO); Corporación para el Desarrollo Participativo y Sostenible de los Pequeños Agricultores (PBA Foundation, Colombia); Fundación para la Promoción e Investigación de Productos Andinos (PROINPA, Bolivia); and Instituto de Estudios Sociales y Económicos, Universidad Mayor de San Simón (IESE, Bolivia). The Alliance's work with the PMCA was implemented with Papa Andina ([http://cipotato.org/att\\_ui/iniciativa-papa-andina/](http://cipotato.org/att_ui/iniciativa-papa-andina/)).

4 The importance of participatory approaches in agricultural innovation systems is noted in World Bank (2012).

of the change model underlying the approach. We formulate lessons for improving future programs that employ the PMCA or other similar participatory approaches.

In the next section, we identify two contrasting perspectives found in the evaluation and innovation literatures on the importance of high fidelity of implementation versus the need for adaptation of interventions to fit local circumstances. Then, we describe the concepts and methods used in our study. After that, we describe the main features of the PMCA and then report on four applications of the approach in Bolivia, Colombia, and Peru. We then discuss the case-study results in relation to issues of fidelity of implementation, factors that influence implementation and results, and the PMCA change model, and discuss lessons for improving the planning, management, and evaluation of future programs involving participatory approaches such as the PMCA. The final section presents general conclusions.

## **Perspectives on Fidelity and Adaptation**

One of the fundamental questions that drives evaluation is “Does an intervention work? ... in the end we want to know whether a program did work, is working, or can work” (Century, Rudnick, and Freeman 2010, 199). Answering this deceptively simple question leads us to more fundamental questions such as: What is the intervention? How should the intervention be implemented? And how is the intervention expected to contribute to the intended results? The first two questions relate to what Chen (2005) calls the intervention’s “action model”—a systematic plan for organizing resources, staff, and relationships in order to deliver the intervention faithfully. The third question relates to what Chen calls the “change model”—a broader conceptual framework that links the intervention’s activities and outputs to the expected outcomes and impacts, and explains how and why the intervention is expected to lead to the desired changes.

The term *fidelity of implementation* refers to the extent to which a program’s implementation is consistent with its action model. Researchers and evaluators have proposed frameworks for assessing fidelity of implementation based on such dimensions as adherence to protocol, exposure to services, quality of delivery, and participant responsiveness. Other frameworks for measuring fidelity are based on critical components of the intervention. Structural components relate to how the intervention is structured, the people and resources it mobilizes, and the tasks carried out. Process components relate

to the principles and values underlying the intervention, the ways in which it is implemented, the skills, roles, and behaviors of the individuals involved in implementation, and the interactions among individuals and organizations (Zoch 2012). Based on the notion of critical components, Century, Rudnick, and Freeman (2010, 202) define fidelity of implementation as “the extent to which the critical components of an intended program are present when the program is enacted,” and propose a framework for assessing the fidelity of implementation built around structural and process components.

Implementation evaluations generally focus on relatively easy-to-measure structural components. However, complex process components may have a greater influence on program outcomes (Bisset, Daniel, and Potvin 2009). We assess the fidelity of PMCA implementation using a framework with both structural and process components. We identify three main reasons why implementers deviated from the initial design of the PMCA, and discuss the implications for planning and managing programs that employ participatory approaches.

Publications on fidelity of implementation often stress the value of high fidelity and give the impression that infidelity is bad. This is because most of the fidelity literature is concerned with the measurement of intervention treatment effects. As Bierman (2006, 88–90) points out, interventions may fail due to problems with the action model, the change model, or the fidelity of implementation. If an intervention is not implemented according to plan, estimated treatment effects may be biased or misleading. Therefore, evaluators seeking to measure the validity of action or change models stress the importance of high implementation fidelity.

In contrast, studies concerned with innovation and the dissemination of new practices emphasize the positive aspects of adapting program procedures to fit local circumstances. Bierman (2006) highlights the need to balance tension between “research-based fidelity versus input and program adaptations offered by community members and local service providers.” Ashley (2009, 37) notes that “diffusion theory anticipates modifications to interventions and purports that adaptability of the intervention to fit the context is critical to its adoption and maintenance over time.” Patton (2011) argues that interventions that address complex social issues need to evolve and continuously adapt themselves to changing circumstances. Consequently, local teams should not be expected to implement intervention protocols mechanically, but should be encouraged to adapt interventions to achieve the best local results.

However, if local teams are encouraged to change *any and all* aspects of an intervention, they may forgo the potential value of applying key components

of an intervention that are essential for its performance and impacts. Mowbray et al. (2003, 327) usefully highlight the importance of determining which components of an intervention are essential and which are optional:

Adaptation may be necessary due to special needs of the target population, differences in budget, community resources, or organizational factors... On the other hand, it is generally agreed that programs with higher fidelity to efficacious models produce superior outcomes... Determining which components of the program are essential, irrespective of context, and therefore require absolute fidelity to the original model, and which components may be modified, eliminated, or added, is an empirical matter.

In the work of the Andean Change Alliance, there was a continuous tension between the evaluators' desire to evaluate the validity of the PMCA action and change models and the desire of local teams to adapt the PMCA to fit their local circumstances. Reflection on this tension has helped us to distinguish between essential and optional components of the PMCA and balance concerns for fidelity and creative adaptation.

## **Study Design and Methods**

When the Alliance began its work, no action and change models were available for the participatory approaches that were to be evaluated. Guides for users and trainers (Bernet, Thiele, and Zschocke 2006; Antezana et al. 2008) laid out the main elements of the PMCA and a set of tools that could be used to implement the approach. But there was no protocol to guide implementation, nor were there indications of how the protocol should be used by individuals and organizations working with target populations within specific organizational and agroecological contexts. Similarly, PMCA specialists had general ideas about how the approach could contribute to changes at the level of individuals and groups, and how these changes could benefit smallholder farmers and other stakeholders, but these ideas had not been documented or critically assessed.

### **Elaboration of PMCA Protocol and Impact Pathway**

One of the first activities of the Alliance's evaluation group was to organize a workshop in which PMCA specialists and members of the Alliance formulated an implementation protocol and a hypothetical impact pathway for the PMCA (Alvarez et al. 2008). The initial versions of these instruments were

subsequently revised periodically on the basis of experience and knowledge gained during PMCA implementation (Table 13.1 and Figure 13.1).

Based on the *PMCA User Guide* and specialist knowledge, the implementation protocol identifies key structural elements of the PMCA and the associated implementation processes. We later developed an instrument for scoring the fidelity of implementation of the PMCA, based on the implementation protocol (Table 13.3). Workshop participants also articulated a change model in the form of an “impact pathway,” drawing on a methodology known as Participatory Impact Pathway Analysis (Douthwaite et al.

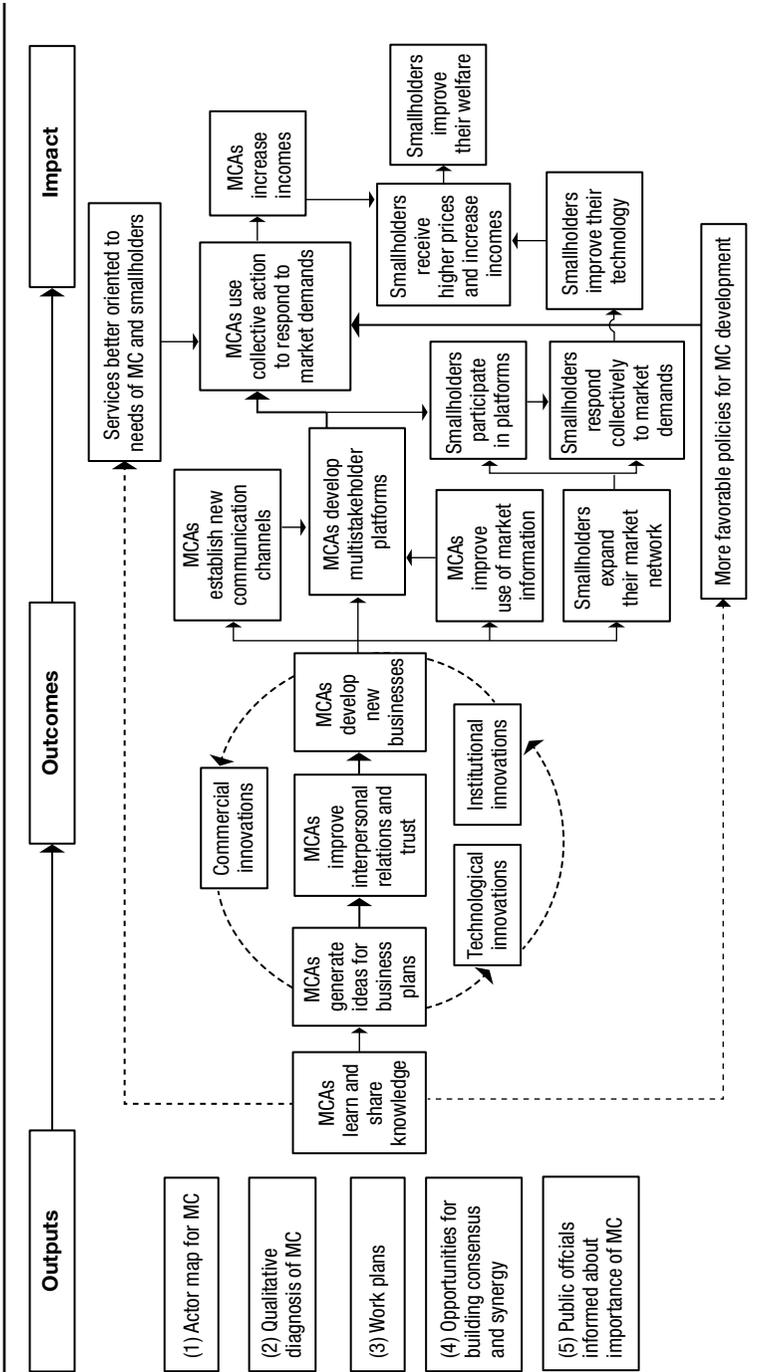
**TABLE 13.1** Participatory market chain approach (PMCA) implementation protocol

Structural components	Process components
<b>Phase 1. Diagnostic phase (3 months)</b>	
Actor mapping	<ul style="list-style-type: none"> <li>• The facilitator leads activities that generate the interest of diverse market-chain actors in participating in the PMCA exercise</li> <li>• The principal market-chain actors are identified and known</li> </ul>
Qualitative diagnosis of the market chain, to identify problems, potential business opportunities	
Public event at end of Phase 1	<ul style="list-style-type: none"> <li>• The principal market-chain actors participate in the event</li> <li>• Potential business opportunities are identified</li> <li>• Thematic groups are established</li> <li>• Results of the event are documented in a meeting report</li> </ul>
<b>Phase 2. Analysis of business opportunities (3–4 months)</b>	
Meetings approx. every 15 days with diverse market chain actors, for: <ul style="list-style-type: none"> <li>• Analysis of market opportunities</li> <li>• Market studies</li> <li>• Analysis of costs</li> <li>• Business planning</li> </ul>	<ul style="list-style-type: none"> <li>• Interaction among diverse market-chain actors to generate confidence among them</li> <li>• Development of at least one business plan</li> <li>• Facilitators should ensure the ample participation of market-chain actors, especially small farmers, in decisionmaking during Phases 2 and 3</li> </ul>
Public event at end of Phase 2	Progress is shared and new participants / allies are included, who can enrich joint activities
<b>Phase 3. Implementation of business opportunities (3–6 months)</b>	
Meeting approx. every 15 days with diverse actors, to implement business opportunities	<ul style="list-style-type: none"> <li>• Joint activities/collaboration to implement new business opportunities with market-chain actors playing a leading role</li> <li>• Communication and negotiation among market-chain actors</li> <li>• Small farmers increase their knowledge of the market chain</li> </ul>
Specific market studies	
Specific technical studies	
Product development	
Public event at end of Phase 3	<ul style="list-style-type: none"> <li>• Innovations are launched</li> <li>• Members of the press, opinion leaders, and relevant political authorities participate, to ensure ample communication and diffusion of results and support for the PMCA exercise</li> </ul>

**Source:** Authors.

**Note:** This formulation of the PMCA protocol is inspired by the framework proposed by Century, Rudnick, and Freeman (2010).

FIGURE 13.1 Hypothesized participatory market chain approach (PMCA) impact pathway



Source: Authors.  
 Notes: MC = market chain; MCA = market-chain actor.

2007; Alvarez et al. 2010). The hypothetical impact pathway illustrates the main channels and processes through which the outputs of the PMCA are expected to contribute to the welfare of smallholder farmers. On the basis of the impact pathway, we developed an instrument for scoring progress toward achievement of the goals of the PMCA (Table 13.4). The coauthors of this chapter scored the fidelity of implementation and progress along the impact pathway for each case.

### **Analysis of Factors that Influenced Implementation and Results**

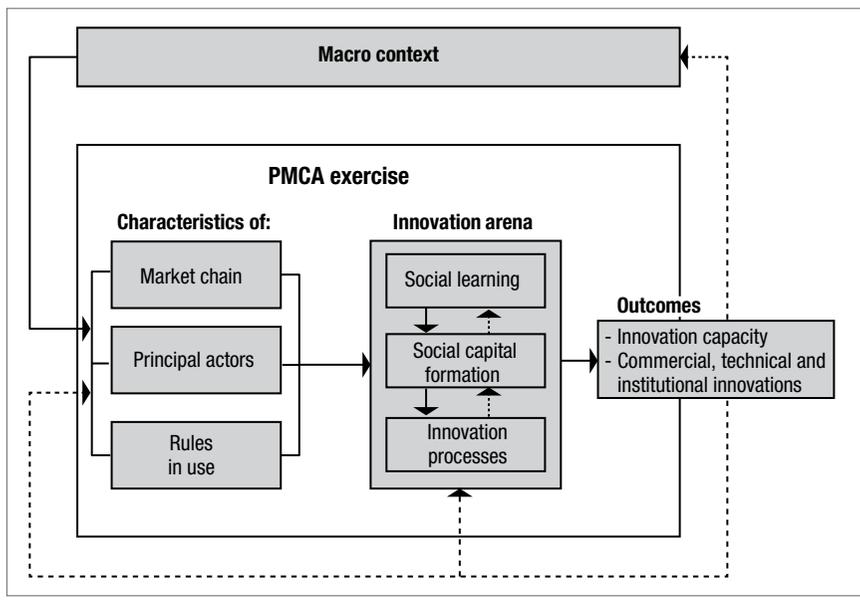
Our analysis of the factors that influence PMCA implementation and results is based on the Institutional Analysis and Development (IAD) framework developed by Ostrom (2005) and modified by Devaux et al. (2009) and Horton et al. (2011) (Figure 13.2). The innovation process is viewed as a complex system that operates within a larger “macro context.” The heart of the system is the “innovation arena” where interactions among diverse market-chain actors and service providers stimulate social learning, social-capital formation, and joint innovation processes. These processes strengthen the system’s capacity for innovation and generate commercial, technical, and institutional innovations. In this framework, innovation processes and results are influenced by four sets of independent variables:

1. *Macro context*: Includes the government policies, socioeconomic conditions, and agroecological characteristics of the region that influence market-chain development.
2. *Market chain*: Biophysical and technological characteristics of the market chain in which the PMCA is being applied.
3. *Principal actors*: Attributes of relevant market-chain actors and service providers.
4. *Rules in use*: Formal and (mainly) informal norms and customs that govern the behavior of participants.

We return to this framework in our analysis of factors that influenced the implementation and results of the PMCA in the Discussion.

### **Baseline Studies**

Before initiating work with the PMCA, baseline studies were to be carried out at each local site. Information on livelihoods and household assets was gathered for a sample of households in communities where the PMCA was to be applied

**FIGURE 13.2** Framework for analyzing market-chain innovation processes

Source: Horton et al. (2011).

and in nearby communities that were considered to be comparable, and which were intended to serve as control treatments in a quasi-experimental research design. A substantial amount of time and resources went into the planning and administration of the household surveys needed to collect the baseline data. The data collected proved useful for characterizing the communities where the participatory approaches were being tested and for ascertaining that the communities were comparable to others in the same geographic area. However, they were less useful for evaluation purposes, for four reasons: *First*, in some cases, the “control community” turned out to be substantially different from the community where the PMCA was to be tested. *Second*, planning and administering the household surveys took longer than anticipated, and in some cases the implementation teams began work with the PMCA before the surveys were completed. *Third*, in some cases, after the surveys were completed, implementation teams decided to work with different communities or groups. *Fourth*, when we planned the baseline studies there was a possibility of a second phase for the program, which would have given more time for measurable outcomes to emerge. Due to changes in funding policies for international agricultural research, this second phase never materialized, leaving us with less than two

years between program completion and final evaluation. In light of the long and complex pathway connecting the PMCA with rural livelihoods and assets, when the Alliance ended its work it was too early to expect to be able to measure changes in household livelihoods or assets.

### **Process and Outcome Monitoring and Evaluation**

The Alliance's evaluation team periodically monitored PMCA implementation processes and products, evaluated outcomes at the end of each application, and produced a series of monitoring and evaluation reports. In 2010, an external consultant led a synthesis exercise that documented overall results and drew lessons from a set of case studies (Horton et al. 2011).

### **Case Studies**

Eight applications of the PMCA were initiated under the leadership of professionals in agricultural R&D organizations in Bolivia, Colombia, Ecuador, and Peru. None of the professionals who were responsible for leading the PMCA exercises had implemented the approach previously. The Alliance organized PMCA training events and provided backstopping and coaching during the implementation of each case. Of the eight PMCA exercises initiated, five were completed (Table 13.2). There were various reasons for early termination of the other three exercises. Work with dairy products in northern Peru was one of the first cases implemented, and its supervision and facilitation were less than ideal. Rather than identifying a *market* opportunity, the group focused on a production problem. Since production problems were not the appropriate focus of a PMCA exercise, the Alliance shifted its support in Peru from the dairy case to the coffee case in San Martin, which was being implemented by the same NGO. In Santa Cruz, Bolivia, the agricultural research organization attempted to shorten the PMCA implementation period by skipping most of Phase 2, which is essential for building trust among market-chain actors. They jumped directly to joint action between farmers and processors, and were dismayed when the farmers did not accept a contract to supply peaches to a catering company. Even though the price offered was attractive, farmers would have needed more personal interaction with company representatives before agreeing to such a contract.

Our analysis focuses on the four completed cases that we believe offer the richest potential for learning within the resources available for the study:

- Case 1. Developing and marketing new dairy products in Oruro, Bolivia
- Case 2. Conserving and marketing native potatoes in northern Potosi, Bolivia

**TABLE 13.2** Participatory market chain approach (PMCA) applications associated with the Andean Change Alliance

Case	Completed	Included in this study
<b>Bolivia</b>		
Developing and marketing new dairy products in Oruro	Yes	Yes
Conserving and marketing native potatoes in northern Potosi	Yes	Yes
Fruit in Santa Cruz	No	No
Vegetables in Santa Cruz	No	No
<b>Colombia</b>		
Developing new markets for yams (north coast of Colombia)	Yes	Yes
<b>Ecuador</b>		
Promotion of native potatoes, Riobamba	Yes	No
<b>Peru</b>		
Marketing high-quality coffee in San Martin	Yes	Yes
Dairy products, Cajamarca	No	No

Source: Authors.

- Case 3. Developing new markets for yams in northern Colombia
- Case 4. Marketing high-quality coffee in San Martin, Peru

The fifth completed case (Promotion of native potatoes in Riobamba, Ecuador) was excluded from the in-depth study because there had been significant departures from the PMCA protocol, and including fieldwork in Ecuador would have entailed substantial additional expense.

Following Yin (2009), a case-study protocol guided the collection and analysis of information in the four cases. Information sources included the Alliance's extensive monitoring and evaluation reports, other published and unpublished documents, visits to each field site, and key-informant interviews with stakeholders.

### Validation of Findings

Various approaches were used to validate case-study findings, including: triangulation of information sources; presentation and feedback sessions with stakeholders at the end of each country visit; presentation and discussion of general findings in a regional workshop after completion of the four case studies; and circulation of drafts of a research report to stakeholders for comment and correction. This chapter's authors independently scored implementation

fidelity and progress along the hypothetical impact pathway and discussed reasons for differences in reaching a consensus on the scores.

## **The Participatory Market Chain Approach**

The PMCA was originally developed to stimulate innovation processes that would benefit small Andean farmers. The approach engages those who make their living from a market chain—*market-chain actors*—as well as agricultural-service providers in facilitated group processes aimed at identifying and exploiting new market opportunities in ways that benefit small farmers. The PMCA is designed to build the capacity of market-chain actors and empower them to innovate on their own. Applications of the PMCA should be guided by trained PMCA facilitators based in local R&D organizations who understand the PMCA implementation protocol as well as the principles underlying the approach.

The PMCA is implemented in three phases (see Figure 7.2). During Phase 1, facilitators should familiarize themselves with the target market chain and its actors, share this knowledge with stakeholders of the market chain, and motivate them to participate in the PMCA application. This phase is expected to take 2 to 4 months and may involve 20 to 40 interviews with diverse market-chain actors. It ends with a public event that brings together individuals who have been involved, to discuss results of the market survey, exchange ideas, and set up thematic groups. Important actors who have not been involved so far are also invited to this event, to stimulate their interest and motivate them to participate in future activities.

During Phase 2, potential business opportunities should be identified and assessed. The PMCA facilitator organizes and facilitates regular thematic meetings where market opportunities are identified and discussed. These also build up mutual trust and knowledge sharing among participants. The participation of market-chain actors other than farmers is essential to maintain a focus on market demands and opportunities. Six to ten meetings are recommended and rapid market appraisal and focus-group studies are usually carried out to assess market potential and develop product concepts. At a final event, the business opportunities are discussed with a wider audience.

During Phase 3, market-chain actors are expected to work together to develop new products and production or marketing processes, with support from research or other service organizations, such as universities or food-technology laboratories. This phase focuses on the activities needed

to launch specific innovations. The time required may vary from 3 to 6 months, depending upon the complexity of the innovation, the capacity of the group, and biophysical, socioeconomic, and institutional conditions. Phase 3 closes with a large public event where new market products and related innovations are launched. Although the PMCA formally ends with the public launch of innovations, the innovation processes may continue long afterward.

## **Four Applications of the PMCA**

This section presents summaries of four case-study reports that are available in Horton et al. (2011). Each case summary includes information on:

- *Context of the PMCA exercise:* the macro context, biophysical and technical characteristics of the market chain, attributes of market-chain actors and service providers, and the prevailing norms and customs
- *Implementation of the PMCA:* participants and the timeline of main activities
- *Results of the PMCA:* commercial, technological, and institutional innovations, changes in innovation capacity, contributions to welfare.

## **National Macroeconomic Environment**

A country's economic policies can strongly influence the use and results of market-chain development approaches, such as the PMCA. When the PMCA was being applied, the governments of Colombia and Peru pursued economic policies that promoted market-led development through promotion of competitive markets, international trade, and private-sector investment. In contrast, the Bolivian government emphasized state-led investment and regional and indigenous development, food sovereignty, and conservation of natural and cultural resources. The economic policies of Colombia and Peru could be seen as more favorable than those of Bolivia for the use of market-development interventions such as the PMCA.

### **Case 1. Developing a Local Market for Quality Coffee in Peru's High Jungle**

#### **CONTEXT**

Peru's San Martin province produces high-quality coffee for specialty export markets, but local people consume little coffee, and mostly instant coffee. The

international NGO Practical Action worked in San Martin for more than a decade to promote sustainable and equitable development of the coffee industry. Until recently, together with the regional government and local R&D organizations, they focused on improving production and postharvest practices. A “coffee round table” was set up to bring together stakeholders, market-chain actors, and agricultural-service providers. A local women’s group processed and marketed regional foods, but did not work with coffee. With the PMCA, Practical Action and the women’s group took the lead in developing a local market for locally produced coffee.

#### IMPLEMENTATION

The PMCA was applied over a period of 16 months beginning in June 2007. An employee of Practical Action played a key role in facilitating the exercise and supporting local initiatives. The women’s group led the development of the local coffee sector with other stakeholders. After completion of the PMCA, Practical Action continued to support efforts to develop the local coffee market, through establishment of an association of artisanal coffee processors.

#### OUTCOMES

Members of the women’s group gained knowledge and skills in coffee processing and marketing, and developed a new coffee brand that has now been on the local market for more than 3 years. The new brand incorporates more careful selection of coffee beans and improvements in roasting, grinding, and packaging. The PMCA exercise and follow-up since 2008 have also motivated greater networking and relationship building among different stakeholders. In 2010, a public event to promote the region’s coffee attracted local authorities, private-sector organizations, media, and about 500 members of the public. Success with coffee marketing has helped consolidate the women’s group and raise its visibility in public and policy circles, as well as in emerging fairs and markets for organic produce. They now play a much more prominent role in the local food system.

### **Case 2. Developing and Marketing New Dairy Products in Highland Bolivia**

#### CONTEXT

Agriculture and livestock herding in Oruro, Bolivia, are challenged by the cold, dry environment, and low rural population density, raising the local production costs. Over the past 30 years, micro-irrigation has stimulated small-scale cropping and dairy herding near the city. The Danish International

Development Agency and other development organizations have encouraged and supported farmer self-help groups that operate community-based dairy processing plants. Dairy specialists who worked in aid programs have established a foundation, *Fundación de Servicios para el Desarrollo Rural Agropecuario, Bolivia (SEDERA)*, which offers technical services and support to small herders and dairy processors. In recent years, the market for dairy products has become increasingly competitive as multinational firms have developed sophisticated production and distribution systems that reach Oruro, making a wide range of products available at competitive prices.

### IMPLEMENTATION

The PMCA was implemented during 20 months beginning in October 2007. SEDERA led and facilitated the PMCA application with the goal of diversifying the production of community-based dairy plants. One objective was to produce mozzarella cheese to supply local pizzerias. Bolivia's Foundation for Promotion and Research of Andean Products (PROINPA) and Papa Andina organized training events at the beginning of each phase. Technical training in mozzarella preparation was provided by cheese makers from Argentina, who adapted methods used in their country to the local environment and input supplies. Market-chain actors and other stakeholders seldom came together for face-to-face meetings, partly because small herders live scattered over the rural landscape, and partly because SEDERA was more comfortable working with farmers than with market agents. Midway through the PMCA exercise, the farmer organization withdrew because they obtained a more attractive outlet for their milk, and a new farmer organization joined the process. This slowed down implementation of the exercise.

### OUTCOMES

SEDERA and the local farmer group were successful in producing mozzarella cheese that met local quality requirements. The new cheese, marketed under the "Vaquita Andina" brand, has been available for two years in a store operated by SEDERA and in some high-end food markets, including a supermarket in Oruro. Work with the PMCA has motivated local dairy producers to diversify the types of cheese they produce and to upgrade quality and sanitary standards. Due mainly to its relatively high price, the new mozzarella cheese is not used by local pizzerias—the original goal. The main consumers are high-income households willing to pay a premium for a naturally produced local cheese. Economic benefits for small producers have been limited. SEDERA has gained expertise in market-chain analysis and in facilitating

innovation processes, and is now using a more integral, market-oriented approach to its development work.

### **Case 3. Conserving and Marketing Native Potatoes in Highland Bolivia**

#### **CONTEXT**

Known as a mining region and home to one of the poorest rural populations in Latin America, one of Bolivia's northern Potosi underexploited resources is the genetic diversity of its native potatoes. PROINPA and the Center for Agricultural Development (CAD) have worked for several years to conserve the biodiversity of the potato and other Andean crops and to reduce rural poverty.

#### **IMPLEMENTATION**

Facilitated by CAD, the PMCA was applied over 17 months (beginning in May 2007) to develop markets for the native potatoes produced by small farmers in the region. PROINPA, Papa Andina, and other service providers backstopped and also provided technical support for organic potato production and postharvest technology. CAD prioritized strengthening farmer associations and establishing a network of associations, to coordinate marketing and improve farmers' negotiating power. They assisted these groups in marketing their potatoes and developing proposals for a potato-processing plant. There was little interaction with local market intermediaries.

#### **OUTCOMES**

A new potato product branded "Miskipapa" was developed, which consists of selected and washed native potatoes sold in net bags. It has been marketed for three years in supermarkets in La Paz and Cochabamba, in the store of a mining union, in two tourist hotels, and in farmers' markets. Due to limitations in both the supply and demand of native potatoes, economic benefits to farmers appear to be small. However, increased awareness about their value has contributed to renewed efforts to conserve the biodiversity of native potatoes in the region. To market Miskipapa, farmers have improved the selection and sorting of their harvested potatoes. CAD continued to support the farmer organization with their marketing initiative. Despite the fact that they expressed interest, little support from local governmental bodies has materialized. Perhaps the most significant outcome has been the expertise gained by CAD, which prompted shifting its emphasis from production development to market-chain innovation.

## **Case 4. Developing New Markets for Yams on the North Coast of Colombia**

### **CONTEXT**

Yams were introduced together with slaves from West Africa, and are now one of the main crops grown by poor farmers on the north coast of Colombia. Here, the distribution of landholdings is extremely skewed, contributing to rural poverty and social inequality. Combined with the presence of drug-related conflict, violence erupted at the end of the 1990s and continued for nearly a decade. Despite the insecurity, a few development organizations continued to work in the areas promoting rural development.

### **IMPLEMENTATION**

The PBA Foundation is a nonprofit organization that works with international development agencies and local partners to promote participatory innovation processes among small farmers. In 2006, it launched an initiative to improve the marketing of the products produced by region's small farmers. In April 2008, the Foundation incorporated the PMCA and facilitated its implementation in seven market chains over a 13-month period. An expert from Papa Andina backstopped the work. Three potential areas for commercial innovation were identified:

- Production of yam flour for specialty uses in cosmetology and baking
- Exportation of fresh yams to the United States
- Domestic marketing of high-quality fresh yams.

A local university carried out applied technical and market research in these areas, business plans were developed, and new products were pilot tested with potential buyers. After completion of the exercise, the Foundation has worked to establish a network of local associations to promote development of the yam sector.

### **OUTCOMES**

Some progress was made in improving the domestic marketing of yams, but no distinctive new yam product was developed and marketed. To sell higher-quality yams at premium prices, small farmers have increased planting density, and improved the selection and cleaning of harvested tubers. A few shipments of fresh yams have been made to the United States, but development of this market faces steep competition from other Caribbean suppliers. Commercial

testing of high-quality yam flour has been hampered by lack of resources for construction of a pilot plant. The PBA Foundation has incorporated elements of the PMCA into its portfolio of participatory methods. In light of the small size of local farmer organizations, the PBA Foundation has worked to establish a regional network of local associations to improve the performance of marketing functions. One unanticipated result of this case has been the organization of vendors within the local market, to coordinate the flow of produce and reduce price variability.

## Discussion

This section analyzes the fidelity of implementation of the PMCA, the factors that influenced implementation and results, and the validity of the PMCA change model.

### Fidelity of Implementation

Most of the activities prescribed for Phase 1—the diagnostic phase—were implemented with reasonable or high levels of fidelity (Table 13.3). Diagnostic studies of the target market chains were carried out and the results were shared with stakeholders at public events. In three of the four cases, these public events were well attended by market-chain actors, service providers, and local policymakers, attracting 50 or more participants, reflecting stakeholder interest in developing the local dairy market chain. In Phase 2—the potential-business analysis phase—the fidelity of implementation was high in two of the cases, but lower in the other two cases. Case 2 (native potatoes in Bolivia) was particularly weak, with few group meetings and little diversity among the participants. Few market agents participated in these meetings, violating a core principle of the PMCA, which promotes innovation through the interaction of *diverse* market-chain actors, including market agents. In Phase 3—the implementation phase—the fidelity of implementation was high only in the coffee-processing case in Peru. Here, group meetings were frequently held and market-chain actors—in this case, a women’s processing and marketing group—played a lead role in new product development. In the other three cases, the facilitators continued to lead the innovation processes, rather than turning over responsibilities to local market-chain actors.

There are many possible reasons for diverging from the intervention protocol, and the cases show that not all of them are bad. Implementers often felt the need to creatively adapt implementation procedures to fit local

**TABLE 13.3** Scoring of the fidelity of implementation of the participatory market chain approach (PMCA)

Activity and quality parameter	Scores for each case			
	Case 1	Case 2	Case 3	Case 4
<b>Phase 1.</b> Diagnostic phase (3 months)				
Market chain is mapped and main MCAs are interviewed				
• At least 20–40 diverse MCAs are interviewed	3	2	2	2
• Bottlenecks and opportunities are identified	3	2	2	2
• MCAs are motivated to participate in PMCA	2	2	2	2
Public event at end of Phase 1				
• Key MCAs and service providers attend	3	1	2	3
• Results of market study are presented and discussed	3	3	3	3
• Interest in further collaboration is generated	3	2	2	3
• Thematic groups are established	3	3	3	3
<b>Phase 2.</b> Analysis of business opportunities (3–4 months)				
Meetings to analyze market opportunities and plan business				
• Meetings approximately every 15 days	3	1	3	3
• Interaction among diverse MCAs to generate confidence	2	1	2	2
• Development of at least one business plan	3	3	3	3
Public event at end of Phase 2				
• Key actors attend	3	2	2	3
• Progress is shared	3	2	2	3
• New participants are engaged to enrich joint activities	3	2	1	3
<b>Phase 3.</b> Implementation of business opportunities (3–4 months)				
Meeting for joint implementation of business opportunities				
• Meetings approximately every 15 days	3	1	1	0
• Diverse MCAs engaged in PMCA application	2	1	1	0
• Market-chain actors play a leading role	2	0	0	1
Technical and market studies carried out				
• Studies carried out	3	3	1	2
• Studies inform group decisions	3	3	1	0
New products developed				
• Prototype is tested with consumers and markets	3	3	3	1
Public event at end of Phase 3				
• Innovations are launched	3	3	3	1
• Opinion leaders and political authorities participate	3	3	3	3

**Source:** Authors.

**Notes:** 0 = absent; 1 = present with low quality; 2 = moderate quality, 3 = high quality; MCA = market-chain actor.

circumstances, while respecting the basic principles underlying the action and change models. Many useful *creative adaptations* were made. For example, in Bolivia, a single set of training workshops was organized for two different cases; on the north coast of Colombia, a single set of training workshops was held for facilitators and chain leaders in seven different market chains. Such adaptations should be encouraged to improve the cost-effectiveness and results of the intervention.

Where implementers did not fully understand the intervention protocol or the underlying action and change models, or they lacked the capacity or resources needed to implement the intervention as designed, unintended *lapses* occurred. The two cases in Santa Cruz, Bolivia where facilitators attempted to skip over Phase 2 of the PMCA are examples of lapses. In many cases, lapses can be remedied through training or assisting local implementers to gain access to the resources needed to implement the intervention as designed.

The most problematic types of divergence from the intended protocol were true *infidelities*, which occurred when local implementers intentionally violated core principles of the intervention. Such infidelities are especially problematic in participatory interventions, which seek to empower local actors. If important goals of the intervention are empowerment and innovation, then local actors should be encouraged to take responsibility and creatively adapt the intervention to fit local conditions. In Case 2 (native potatoes), the focus on working with small farmers rather than diverse market-chain actors is an example of an infidelity that reflected local implementers' belief that the intervention should focus on strengthening farmer organizations rather than bringing farmers together with market-chain actors to work on joint innovations. This view may be valid in the local conditions of Bolivia's altiplano—one of the harshest and poorest regions in Latin America. However, the point remains that *intentional* deviations from the protocol that include elimination of essential components of the intervention—such as the engagement of diverse market-chain actors in the PMCA—are both difficult (or impossible) to correct during implementation, and make it impossible to test the validity of the intervention's action or change models.

### **Factors that Influence Implementation and Outcomes**

The IAD framework suggests four main groups of factors that may influence the implementation and results of the PMCA. Our studies bear out the importance of these factors and also suggest the importance of an additional group of factors related to the strategy used to develop local capacity for use of the PMCA.

## MACRO CONTEXT

The pro-market policies of Colombia and Peru provided a more favorable environment for use of the PMCA than did the policies of the Bolivian government, which emphasize the role of the state and “communitarian socialism.” The more favorable agroecological environments in which the Colombian and Peruvian exercises were carried out also appear to have favored the implementation processes and outcomes. In the Bolivian altiplano, where poverty is more severe than in practically any other part of Latin America, there appear to be severe limits to the potential contributions of agricultural market-chain development approaches to rural poverty reduction.

## ATTRIBUTES OF THE MARKET CHAIN

Successful innovation is more likely in some market chains than in others. In the cases involving coffee, and to a somewhat lesser extent dairy, it has been possible to mobilize external knowledge to improve processing. In contrast, in the cases of native potatoes and yams, the global knowledge base is more restricted. Especially for yams, little scientific information is available in Spanish. Coffee and dairy products are also more amenable to processing, branding, and product differentiation than are potatoes and yams. Processing of native potatoes for chips has emerged as a viable enterprise catering to high-income urban consumers in Peru and to a lesser extent in Bolivia, but this type of industry is typically located in urban areas, and was not considered as a likely option for the potato case in Bolivia.

## ATTRIBUTES OF INDIVIDUALS

Our cases indicate that three distinct types of *champion* may be crucial for successful implementation of the PMCA and for mainstreaming the approach in R&D organizations. The first type of champion is the *PMCA facilitator*, who forms commodity groups and mediates innovation processes; the second type is a *senior manager / decisionmaker* who facilitates resource mobilization for the PMCA, as well as mainstreaming use of the approach; the third type of champion is a *recognized leader within the market chain*. In Case 1, the facilitator based in Practical Action played a key role in identifying and supporting local actors and facilitating change processes within the coffee market chain. A senior manager within Practical Action provided strong institutional support for the work. Within the coffee market chain, the leader of the women’s processing group led in developing the new brand of coffee and networking with others to develop the local coffee sector; leadership and capacity to invest

in the private sector are crucial for the ultimate success of efforts to stimulate market-chain innovation.

#### **RULES IN USE**

*Rules in use* refer to the social structures, mechanisms, customs, norms, and rules—both formal and informal—that guide human behavior on a day-to-day basis. In our cases, rules in use strongly influenced the marketing and innovation behaviors of individuals and groups. In fact, a central goal of the PMCA is to modify the customary patterns of behavior and interaction so as to stimulate innovation and improve the participation of smallholder farmers in dynamic markets.

The market chains we worked with were generally characterized by distrust and limited communication and interaction among the different chain actors (for example, producers, rural assemblers, processors, and retailers), which limits coordination and collaboration. Distrust, poor communication, and limited interaction were perhaps most notable in the native-potato market of highland Bolivia, where urban-based market agents consider themselves superior to indigenous farmers and discriminate against them in many ways. Notable racial and cultural differences were also present in the market chain for yams on the north coast of Colombia. In the local coffee market in Peru's high jungle, the relative absence of ethnic and racial cleavages and discrimination facilitated the interaction of diverse market-chain actors and the emergence of collective action.

The rules in use (or “standard operating procedures”) of R&D organizations are also important. The PMCA is facilitated by individuals based in R&D organizations that have particular mandates, program structures, cultures, norms, and external relationships. The mandate and culture of agricultural research organizations can pose challenges for successful application of the PMCA, because these organizations may be averse to working with private businessmen engaged in processing and marketing. The implementing organizations in Bolivia and Colombia traditionally work with farmers to improve their operations, and this helps explain why they failed to thoroughly engage processors and other market actors during the PMCA. In contrast, the implementing organization in Peru—Practical Action—has a strong tradition of working across sectors, and it readily incorporated the PMCA into its program to develop coffee markets in Peru.

### CAPACITY-DEVELOPMENT STRATEGY

The capacity-development strategy varied across the cases, explaining some of the differences in implementation fidelity and results. Some departures from the PMCA protocol occurred because facilitators lacked a thorough understanding of the principles underlying the PMCA and how they are reflected in the intervention protocol. In the Peruvian case there were no formal training events. Instead, a market-development specialist at the Andean Change Alliance traveled to San Martin to provide one-on-one training, backstopping, and mentoring for the local facilitator and the group that was applying the PMCA. In the other three cases, formal training workshops were organized for local facilitators at the beginning of each phase of the PMCA, and the Alliance's market-development specialist was less involved in these cases. In Bolivia, trainers from the Alliance and PROINPA delivered these workshops and backstopped local facilitators. PROINPA's agricultural R&D mandate appears to have biased the training and backstopping toward working with groups of small farmers rather than market agents. Experience with these and other applications of the PMCA (Horton et al. 2012; Mayanja et al. 2012) shows the value of immersion-type training and visits to sites where the PMCA has been successfully applied, so that new users of the approach can meet with people who have successfully applied the PMCA, see the results for themselves, and appreciate the importance of collective action involving diverse market-chain actors.

### Validity of the PMCA Change Model

The cases studied provide insufficient evidence to validate the change model underlying the PMCA. Nevertheless, variations in the fidelity of implementation of the PMCA and in progress along the impact pathway provide an opportunity to assess some aspects of the change model. By comparing results where the key components of the intervention were present with results where some components were absent, we may get some sense of the importance of the components. The point of departure is to gauge progress along the hypothesized impact pathway in the four cases and to identify components of the intervention protocol that appear to have influenced results. This analysis is based on the scores for fidelity of implementation and progress along the impact pathway in the four cases (Tables 13.3 and 13.4, respectively) and on the authors' firsthand knowledge of implementation processes and results in the cases.

**TABLE 13.4** Scoring of progress along the PMCA impact pathway

Outcomes and impacts	Scores for each case			
	Case 1	Case 2	Case 3	Case 4
MCAs learn and share knowledge	3	2	2	2
MCAs generate ideas for new businesses	3	2	2	2
MCAs develop new businesses	3	2	2	1
MCAs generate joint technological, commercial, and institutional innovation	3	2	1	1
MCAs improve interpersonal relations and trust	3	1	1	2
MCAs improve use of market information	2	2	2	2
Services become better oriented to the needs of MCAs	2	2	2	2
MCAs establish new commercial channels	2	2	2	1
MCAs use collective action to respond to market demands	2	1	1	1
MCAs develop multistakeholder platforms	1	1	1	1
Smallholders improve their technology to fit market demand	2	1	1	1
Smallholders expand their market network	2	1	1	0
More favorable policies for market-chain development	1	1	1	1
Smallholders expand their sales and receive higher prices	1	1	1	0

**Source:** Authors.

**Notes:** 0 = no progress; 1 = limited progress; 2 = moderate progress; 3 = substantial progress; MCA = market-chain actor.

The case that was implemented with greatest fidelity was Case 1 (coffee processing in Peru). This case, in which most activities in the intervention protocol were implemented with reasonable or high fidelity, provides the best test of the validity of the PMCA change model. In this case, the PMCA facilitator was highly motivated and capable, facilitating substantial progress along the impact pathway. Market-chain actors learned and shared knowledge on a number of topics related to market-chain innovation. They developed a new brand of coffee and developed a new business around this idea. Implementation of this new business stimulated and entailed innovations in coffee harvesting, grading, toasting, grinding, packaging, and marketing. As the PMCA was implemented, market-chain actors strengthened interpersonal relations and mutual trust, and afterward many have continued to work together on common goals. Due to the relatively small scale of the intervention in Case 1 and the time required for new practices to diffuse throughout the local economy, at the time of the evaluation the PMCA had not yet had a significant impact on the welfare of the small-scale coffee

producers. As the volume of sales of the new coffee brands increases in the future, larger welfare impacts can be expected.

In the other three cases, where the fidelity of implementation was lower, less progress was also made along the impact pathway. Useful knowledge was acquired by participants, who also made contacts with other market-chain actors and service providers. Smallholders expanded their knowledge of markets, market actors, and consumer requirements. R&D professionals learned a new approach for promoting market innovation and development, and farmer organizations were strengthened to some extent. However, in these cases, success in marketing new products has been limited. As indicated in the previous section, many factors have influenced the success of the PMCA. However, in these cases, and also in other cases studied in Uganda and Indonesia (Mayanja et al. 2012; Horton et al. 2013), success of the PMCA has been associated with one key component of the action model: engaging processors and other market agents in the PMCA exercise. Engagement of market agents seems to be the most critical single component of the PMCA.

Although high fidelity of implementation was associated with greater progress along the impact pathway, a thorough assessment of the validity of the PMCA change model would require additional evaluations where the approach was implemented with high fidelity under a range of conditions related to the macro environment, the type of market chain, personal attributes of participants, and local rules in use. Such a thorough assessment under what would constitute artificial conditions (not allowing local implementers to adapt the intervention in any way to fit local conditions and meet local needs) would be a complex and costly exercise, for which local partners and international donors have little interest. As Chen (2010) points out, such rigorous assessments of validity are of interest mainly to researchers. Potential users of the PMCA—of any development program for that matter—are primarily interested in knowing if it would be viable and effective in meeting political, organizational, and community needs under their particular circumstances. For these reasons, CIP has partnered with donors and R&D organizations in different parts of the world to test the PMCA under their own conditions and then has conducted case studies to assess the results.

## **Lessons**

In this section we present four lessons for planning, managing, and evaluating programs that employ the PMCA or similar participatory approaches.

1. *Explicit action and change models for participatory approaches, although challenging to develop, are useful aids for planning, management, and evaluation.* Participatory approaches tend to be vaguely defined, as are the ways they are expected to contribute to outcomes. The lack of explicit program theories makes it difficult to monitor implementation and evaluate results. To our knowledge, this is the first case where designers of a participatory intervention have worked with evaluators and prospective implementers to prepare an explicit implementation protocol and impact pathway. These instruments were useful guides for implementation and evaluation, and they provided a basis for reflection and learning. In development projects with limited resources and tight deadlines, it is difficult to justify the time and resources needed to develop action and change models. For this reason, developers of participatory interventions should allocate “research resources” for the elaboration of action and change models that can later be refined and tested by local implementers. The action models should include intervention protocols, as well as indications of how these should be used by implementers working with target populations in specific contexts.
2. *When introducing a new participatory approach, fidelity of implementation should be carefully monitored to detect creative adaptations, lapses, and true infidelities.* We found three types of deviations from the implementation protocol that are generally lumped together under the heading of “infidelities.” *Lapses* occur when implementers do not understand the intervention well or do not have the skills or resources to implement it correctly; *creative adaptations* are useful deviations from the implementation protocol which improve the fit of the intervention to local conditions and improve its performance. *True infidelities* occur when implementers intentionally violate basic principles of the intervention, and are, in effect, implementing another intervention. It is important for managers to know which types of deviation from the intervention protocol are occurring in order to respond appropriately. Early knowledge of lapses can allow managers to provide additional training, coaching, or resources for local teams that needed additional support. Creative adaptations made by one team could be encouraged and shared with other teams. Knowledge of true infidelities could trigger efforts to negotiate a reorientation of the work with the local team or terminate the collaboration expeditiously. Information gained through this type

of monitoring would have been useful for later interpretation of results of the cases.

3. *For participatory approaches, detailed baseline studies of household livelihood and assets may be of limited use for evaluation.* “Good evaluation practice” is often assumed to include the gathering of detailed baseline data on the welfare of target beneficiaries and control groups, which will allow measurement of the net impacts of the intervention. However, it needs to be kept in mind that in the real world, resources for evaluation are generally available only during the life of the program. In the Andean Change Alliance, baseline studies generated information that proved useful for planning and fine-tuning local interventions. But due to the long and complex pathways through which the PMCA contributes to outcomes, insufficient time elapsed during the life of the program for measurable impacts to be registered on household welfare and assets. Consequently, we derived relatively little benefit from the substantial investment we made in baseline-data gathering. Those who plan and manage programs employing participatory approaches need to consider the relative costs and benefits of alternative methods for data gathering and choose the most appropriate one for their own circumstances (Bamberger, Rugh, and Mabry 2012).
4. *Adequate capacity strengthening needs to be provided to ensure that local implementers can distinguish between core principles and essential components of the intervention and suggested procedures that may be adjusted to fit local circumstances.* Participatory R&D approaches such as the PMCA are knowledge-intensive and local implementers cannot be expected or encouraged to implement them mechanically. Variations in socioeconomic, environmental, and institutional conditions make adaptations in implementation procedures desirable. Additionally, participation is inextricably linked to notions of local autonomy, empowerment, and creativity. For these reasons, local implementers need to understand the basic principles underlying a participatory approach and know which components are essential for its success. This highlights the importance of adequate training, knowledge sharing, and related aspects of local capacity strengthening for the successful introduction of a new participatory approach.

## Conclusion

In the work reported on here, we applied evaluative thinking to assess the implementation and outcomes of a participatory approach in the field of agricultural R&D. While common in evaluation practice, the use of action and change models had not to our knowledge been rigorously applied in this field. So, although we originally published this paper in a journal on evaluation and program planning, we believe it will also be of interest to agricultural R&D professionals. Good quality of implementation of participatory approaches is vital to increase the probability that they can achieve their intended results. But what counts as “good” and how can this be achieved without stifling the creativity and adaptation needed for a participatory approach to work at all? The distinction we draw between creative adaptations, lapses, and true infidelities—grounded in the action model and making the link to outcomes in the change model—helps answer this tricky question. We believe this kind of thinking is of broader relevance both to evaluators and to practitioners of agricultural R&D.

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## USING QUANTITATIVE TOOLS TO MEASURE GENDER DIFFERENCES WITHIN VALUE CHAINS

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Lucia Madrigal and Maximo Torero

### Introduction

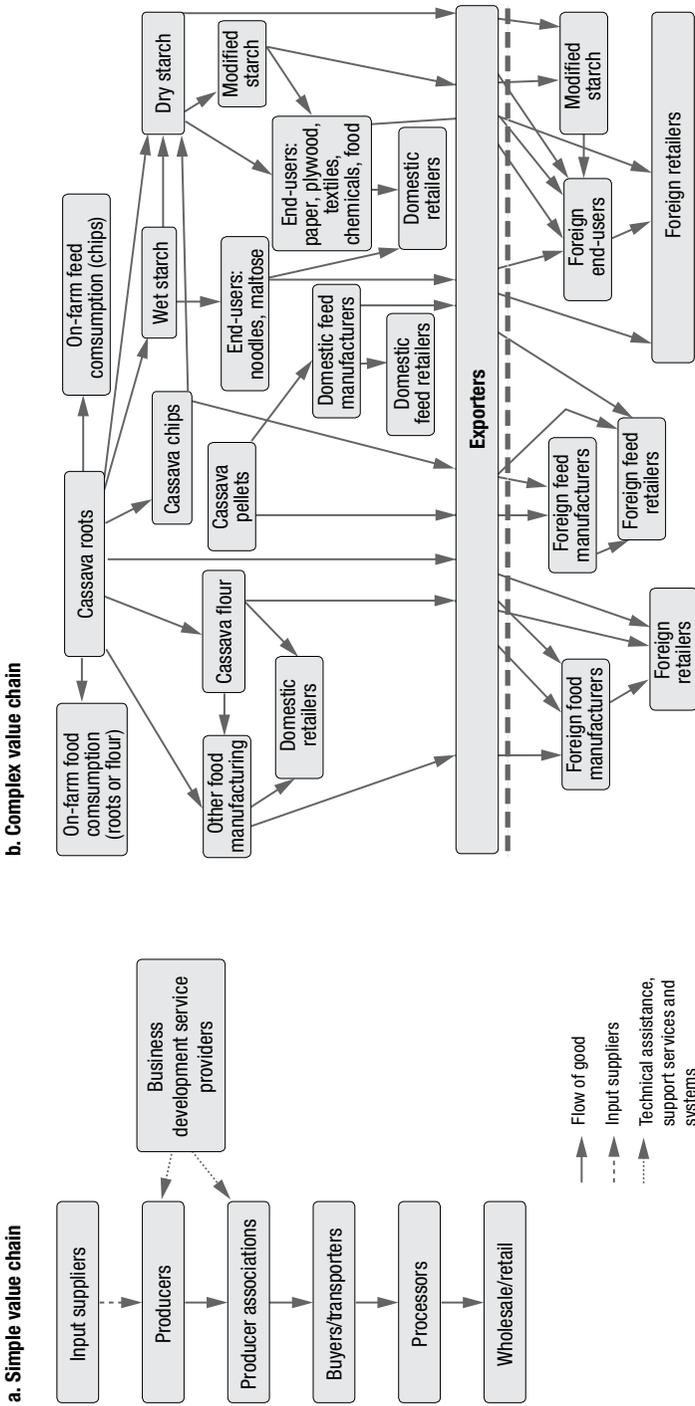
A value chain is a linked set of activities that take a product from conception through production, delivery, and finally disposal (see Figure 14.1a). While some value chains are simple and straightforward, others can be complex. Many different economic agents can be directly involved in each step of the chain; in addition, inputs used during one stage of production might re-enter the chain at another stage if their residual value is recyclable. Figure 14.1b provides an example of a more complex value chain with more than one final product stemming from the initial inputs, each following a parallel process.

Multiple barriers affect people's ability to participate in and benefit from value chains; these include a lack of access to capital and markets. Detailed study of value chains can address these barriers by identifying critical issues and bottlenecks that limit opportunities for specific populations.

One such population is women. Female workers make up a considerable proportion of the agricultural workforce worldwide, but significant gender inequalities remain when it comes to access to assets, land, labor, credit, and infrastructure (see Deere and Leon 2003 for Latin American countries; Doss 2006, and Quisumbing, Estudillo, and Otsuka 2004 for Africa south of the Sahara). Research has shown evidence of gender discrimination in wages and employment conditions in rural markets, suggesting that women could benefit from labor-market interventions (Maertens and Swinnen 2012). Further identifying such gender imbalances is the first step in improving the design of policies and interventions that will lead to greater gender equality and productivity (both labor and agricultural) in developing countries, as well as to reduced poverty and hunger.

Using quantitative tools to study gender-related questions is essential for increasing gender inclusion and promoting economic growth in developing countries. In this chapter, we look at how to use such tools to examine gender in value chains. The proposed tools (available via CRP-PIM 2015) are based on widely known methods and have a straightforward empirical

FIGURE 14.1 Value-chain maps



Source: a. Authors; b. MAP (2008).

implementation; they have been tested in several studies and haven proven to be useful indicators of gender differentials.

Specifically, we have developed indicators that quantitatively estimate the time women and men spend on diverse activities during the day, especially focusing on tasks performed at work. Measuring labor burden by gender could give useful insights into how to improve the gender balance and opportunities. When looking at the conditions in which men and women work, we present an indicator on working conditions and develop an index on equality. The objective of this index is to assess key variables that characterize access to work and working conditions. The index has two categories: variables that characterize working conditions, and variables that describe access to work. Finally, we have developed two indicators to assess differences in payments and occupations for females and males. The wage gap calculates the gender wage gap and assesses the extent to which observed gender wage gaps correspond to gaps in individuals' demographic and job-related characteristics. How different is remuneration by gender in each node/value chain? How much of that difference is due to observable characteristics? How much of that difference is due to unobservable characteristics? Finally, the Duncan Index estimates gender segregation at each node in the value chain by occupation. It could be extended to capture hierarchical segregation by occupation and tasks (skilled and non-skilled) depending on data available. Essentially, it tries to answer the question of how participation by occupation, node, or value chain differs between men and women.

In summary, these tools allow us to map different gender roles and to identify opportunities that could lead to increased productivity, cost reduction, or product upgrades that, in turn, can spur economic growth.

## **Why Is Quantitative Analysis Needed and What Can It Do?**

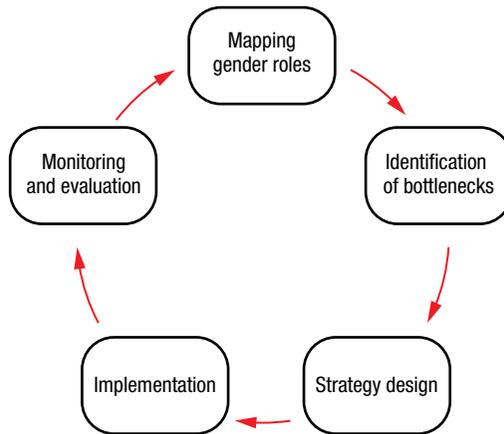
Since the mid-2000s, there has been an increasing amount of literature that seeks to integrate gender issues into the study of value chains. Much of this literature relies heavily on qualitative sources such as scoping studies (rapid field appraisals), focus groups, and diagramming tools (see Senders et al. 2012; Mayoux and Mackie 2009; Laven and Pyburn 2012; Rubin, Manfre, and Barrett 2009; Dulón 2009; Chan and Barrientos 2010). Although qualitative analysis provides the context needed to understand certain situations, it is mostly based on subjective responses that are difficult to categorize. Much of this literature fails to provide quantitative methods that can be used to

analyze information efficiently and to estimate gender differentials consistently; it also does not discuss recommended sample size for information gathering or sampling methodology. We thus see the need to enrich these existing manuals with sound quantitative analysis that can give a more precise idea of gender differentials.

To best address the issue of gender disparities in agriculture, researchers should utilize a combination of both qualitative and quantitative data. Quantitative data in which participants' responses are coded, organized, and statistically analyzed would complement and enrich the qualitative analysis, helping improve investments and program targeting and leading to more effective design, monitoring, and evaluation of policies and programs (Farnworth 2011). The quantitative tools we propose utilize indicators derived from survey questionnaires that could be easily adapted to different value-chain contexts. Implementing the modules and questions proposed would require few or no additional resources either to modify the existing sections of the questionnaire or to incorporate complete modules.

Using qualitative tools begins with identifying, or mapping, women's roles in a value chain. Mapping gender roles provides a picture of the relationships between different actors in the value chain. Understanding these relationships can help policymakers and researchers identify constraints and opportunities for women in each part of the chain and design strategies to increase gender equality. After implementation, quantitative tools can be used to track the effect of the chosen strategy and to quantify changes. Figure 14.2 shows the phases in value-chain analysis; indicators created by quantitative tools can be used to support analysis throughout the entire process.

How can quantitative tools improve analysis of a specific problem? One major gender-related issue is employment. Increasing women's equal participation in productive activities, as well as providing income-earning opportunities for both poor women and poor men through wage employment or self-employment, are essential steps in reducing poverty. Maertens and Swinnen (2012) suggest that labor-market channels are more effective in reducing poverty than product-upgrading channels. They find that women benefit more, and more directly, through labor-market effects than through product-market effects. Also, women benefit more if they are hired employees in agro-industry because they have direct access to wages and because the wages they receive improve their household bargaining power; income derived from contract farming, on the other hand, is mainly controlled by male contractors.

**FIGURE 14.2** Phases in value-chain analysis

Source: Authors.

However, few studies have looked specifically at (1) the distribution of employment by gender in a value-chain context; (2) the circumstances in which workers seek or find employment; and (3) the job conditions generated by the production of a specific commodity or livestock (Barrientos and Dolan 2003; Dolan and Sutherland 2005 are the most relevant studies). Moreover, as mentioned by Maertens and Swinnen (2012), development policies have focused mainly on the inclusion of smallholder farms in modern value chains and the promotion of smallholder contract farming, rather than on labor markets and employment by gender. Using qualitative tools to examine these latter indicators can complement existing efforts and lead to more effective, better-targeted policies.

Table 14.1 presents gender-related research questions that could benefit from the use of quantitative measurements. These questions are not meant to be all-inclusive; rather, they are designed to give a basic idea of the kind of analysis that could be done using the tools we propose. Depending on the available data, each tool can be extended to analyze different dimensions of the research question. The examples provided show some basic indicators that can be obtained with minimal data; these examples are not exhaustive, however.

**TABLE 14.1** Gender-related research questions

Quantitative tool	What questions can it answer?
Non-parametric Oaxaca Blinder decomposition analysis to measure gender-earnings gaps (Using a unit identification and employment module)	<ul style="list-style-type: none"> <li>• How is remuneration different for men and women in each node of the value chain or in the value chain as a whole?</li> <li>• How much of that difference is due to observable characteristics, such as age or skill level?</li> <li>• How much of that difference is due to unobservable characteristics, such as people's preferences or possible gender-based discrimination?</li> </ul>
Time-use analysis (Using a unit identification and time-use module)	<ul style="list-style-type: none"> <li>• Do men and women spend their time differently throughout the value chain, especially for the major tasks in each node?</li> <li>• How do women's burdens in terms of time spent compare with men's?</li> <li>• How do women's workloads in terms of leisure time, family care, and household chores compare with those of men?</li> <li>• Do transport time, transport fees, or childcare mobility form barriers for women in terms of market access?</li> </ul>
Duncan Index for occupational segregation (Using a unit identification and employment module)	<ul style="list-style-type: none"> <li>• Within each node of the value chain or within the value chain as a whole, which occupations do men have and which occupations do women have?</li> <li>• Are men and women equally represented within an occupation in proportion to their share of the population?</li> </ul>
Working-conditions/access-to-work equality index (Using a unit identification and employment module)	<ul style="list-style-type: none"> <li>• Is there unequal access to employment for men and women?</li> <li>• Do working conditions differ by gender?</li> <li>• What barriers to entry do men and women face in each node of the value chain or in the value chain as a whole?</li> <li>• Which barriers are more significant for women and which are more significant for men?</li> </ul>

Source: Authors.

## Quantitative Tools to Help Understand the Role of Gender in Value Chains

In this section, a series of quantitative tools is presented that can be used to help understand how value chains work, characterize labor distribution, and evaluate working conditions and access to work in the context of value chains and gender.

### Tool: Non-Parametric Oaxaca Blinder Decomposition Analysis

Although women have made strides in entering the global labor force since the mid-1990s, this increased participation has not translated into equal earnings. In addition, labor and gender economics literature since the mid-2000s has found that women are often in the lowest economic percentiles of income distributions and face barriers in access to income-producing opportunities (see Atal, Ñopo, and Winder 2009; Ñopo, Daza, and Ramos 2011; World Bank 2012). In order to address these disparities, it is first necessary to analyze both the size of the wage gap and the reasons behind the differences in pay. This information can then be used to generate solid gender-oriented strategies.

The objective of this tool is to calculate gender wage gaps; the tool can also be used to assess the extent to which observed gender wage gaps correspond to other observable characteristics such as demographics or job characteristics, as well as characteristics which cannot be explained by the model.

**TABLE 14.2** Data needed for nonparametric Oaxaca Blinder decomposition analysis to measure gender-earnings gaps

Minimum	Desirable for further analysis
<ul style="list-style-type: none"> <li>• Hourly wage (daily/weekly)</li> <li>• Age</li> <li>• Level of education or literacy</li> <li>• Gender</li> </ul>	<ul style="list-style-type: none"> <li>• Religion</li> <li>• Ethnicity (minority groups)</li> <li>• Marital status</li> <li>• Number of children, children's ages, health of children, gender of firstborn child</li> <li>• Registered employment (contract)</li> <li>• Payment in cash/kind</li> <li>• Benefits</li> <li>• Type of job (specific to the value chain)</li> <li>• Occupation (specific to the value chain)</li> <li>• Temporary work</li> </ul>

Source: Authors.

The goal of the Oaxaca Blinder decomposition is to estimate differences in mean wages across two groups. The wage model is assumed to be linear and separable in observable and unobservable characteristics. The estimation for females and for males generates the following counterfactual: “What would the earnings for a male (female) with average individual characteristics be if he (she) is rewarded for his (her) characteristics in the same way that the average female (male) is rewarded?” The difference in average wages between males and females is broken into two additive components: one attributable to differences in the average characteristics of the individuals, and the other attributable to differences in the average rewards for these characteristics. The latter component is thought to contain the effects of both unobservable characteristic gender differences and possible discrimination in the labor market (Blinder 1973; Oaxaca 1973; Oaxaca and Ransom 1994; Ñopo 2008).

The econometric procedure used in this tool is an extension introduced by Ñopo (2008) that uses a nonparametric matching approach. In this extension, Ñopo proposes to account for the fact that females and males do not all possess the same characteristics; he therefore creates matched groups in which it is possible to compare wages across genders and does not assume a linear relationship between variables. Additionally, he suggests a way to address the distribution of these unexplained differences, which is not possible in the standard Oaxaca Blinder decomposition.

In order to create comparable groups, females and males are only matched if they show exactly the same combination of observable characteristics (common support). Nopo (2008) explains that these matching characteristics need to be discrete. This ensures that the match is done perfectly and does away with the need to use propensity scores or any notion of distance among the characteristics. The matching procedure resamples all females without replacement and matches each observation with one synthetic male with the same observable characteristics and with a wage obtained from averaging all males with those same characteristics. This one-to-many matching generates a partition of the dataset. The observations of working males and females are grouped into three sets: (1) males whose observable characteristics cannot be matched to those of any female in the sample, (2) females whose observable characteristics cannot be matched to those of any male in the sample, and (3) matched males and females, such that the distribution of observable characteristics for males is equal to that of females.

In this way, the estimation of the four components is reduced to computations of conditional expectations and empirical probabilities without the need to estimate the nonparametric earnings equations in four separate equations, as in Nopo (2008):

$$\Delta_M = \mu^M (Unmatched) (E_{M,unmatched}[Y|M] - E_{M,matched}[Y|M])$$

$$\Delta_X = E_{M,matched}[Y|M] - E_{F,matched}[Y|M]$$

$$\Delta_0 = E_{F,matched}[Y|M] - E_{F,matched}[Y|F]$$

$$\Delta_F = \mu^F (Unmatched) (E_{F,matched}[Y|F] - E_{F,unmatched}[Y|F])$$

The wage gap  $\Delta$ , computed as the difference in average wages between males and females and expressed as a percentage of females' average wages, is then decomposed into four additive elements:

$$\Delta = (\Delta_X + \Delta_M + \Delta_F) + \Delta_0$$

$\Delta_X$  is attributed to the differences in observable characteristics between males and females (common support of both characteristics' distribution);  $\Delta_M$  is the portion of the wage gap that is due to the existence of males with combinations of characteristics that are not matched by any women;  $\Delta_F$  is the portion of the gap that is due to the existence of females with characteristics that cannot be matched to any male characteristics. The sum of the first three components,  $\Delta_X + \Delta_M + \Delta_F$ , is the portion of the gap that can be attributed to differences in observable characteristics. Finally,  $\Delta_0$  is the portion of the gap that cannot be explained by these characteristics and could be attributable to differences in unobservable characteristics, including discrimination.

The typical interpretation of the wage-gap decomposition applies, but only over the common support:  $\Delta_X$  is attributable to differences in the average characteristics of the individuals and  $\Delta_0$  is attributable to differences in the average rewards for these characteristics. In this new construction, two new additive components have been included,  $\Delta_M$  and  $\Delta_F$  (out of common support), resulting in a four-element decomposition.

In a value chain, wage differences between males and females could be calculated for each node and/or at the whole value-chain level. Depending on sample size and available information, one can also compare how results change when controlling for different individual characteristics (age, education, occupation, etc.).

This tool will produce tables and graphs like the ones shown (Table 14.3 and Figure 14.3). Our example uses only age as a control; however, it is possible to add more controls such as education and occupation, and to compare changes in the unexplained part of the wage differential.

The results can be interpreted as follows.

The overall gender gap is 11 percent ( $\Delta$ ).  $\Delta$  can be decomposed in four elements:

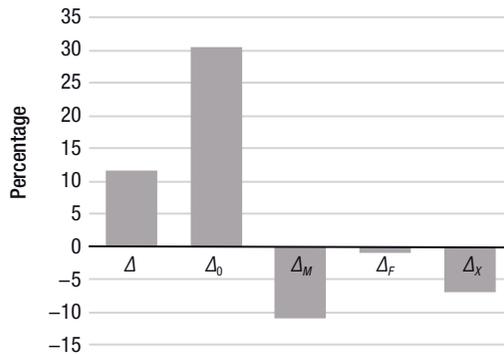
- $\Delta_0$ : Unexplained by the model. Only for the fact of being male wage increased in 30 percent.
- $\Delta_X$ : Explained by observable characteristics (common support). The age distribution for women and men in the common support is such it that reduces the gender gap by  $\Delta_X$ .

**TABLE 14.3** Gender wage-gap decomposition results

Gender wage gap decomposition	
$\Delta$	0.11459352
$\Delta_0$	0.30390245
$\Delta_M$	-0.1104065
$\Delta_F$	-0.0097561
$\Delta_X$	-0.06914634

**Source:** Authors

**Notes:**  $\Delta$  = the wage gap computed as the difference in average wages between males and females and expressed as a percentage of females' average wages;  $\Delta_X$  = the differences in observable characteristics between males and females (common support of both characteristics' distribution);  $\Delta_M$  = the portion of the wage gap that is due to the existence of males with combinations of characteristics that are not matched by any women;  $\Delta_F$  = the portion of the gap that is due to the existence of females with characteristics that cannot be matched to any male characteristics;  $\Delta_0$  is the portion of the gap that cannot be explained by these characteristics and could be attributable to differences in unobservable characteristics, including discrimination.

**FIGURE 14.3** Gender wage-gap decomposition

**Source:** Authors.

**Notes:**  $\Delta$  = the wage gap computed as the difference in average wages between males and females and expressed as a percentage of females' average wages;  $\Delta_X$  = the differences in observable characteristics between males and females (common support of both characteristics' distribution);  $\Delta_M$  = the portion of the wage gap that is due to the existence of males with combinations of characteristics that are not matched by any women;  $\Delta_F$  = the portion of the gap that is due to the existence of females with characteristics that cannot be matched to any male characteristics;  $\Delta_0$  is the portion of the gap that cannot be explained by these characteristics and could be attributable to differences in unobservable characteristics, including discrimination.

- $\Delta_M$ : Existence of men with ages that cannot be matched by any women reduces the gender wage gap by  $\Delta_M$ .
- $\Delta_F$ : Existence of women with unmatched age reduces the gender wage gap by  $\Delta_F$ .

The sum of  $\Delta_X + \Delta_F + \Delta_M$  is the portion of the gap that can be attributed to observable characteristics, which in this case is 18 percent. For technical details, refer to Nöpo (2008).

To apply this tool, it is important to control for a relevant number of characteristics and to make revisions if the common support is large enough. It is also important to consider the sampling framework and possible selection bias. As presented, the tool is calculated using the sample of employed individuals who have some characteristics that might differ from unemployed people. In this case, it is important not to extend these results to the whole population, but rather only to the employed population. When using a sample in which the entire population is available, it is necessary to correct the selected sample (see Mulligan and Rubinstein 2005; Rubli 2012). This tool could also be used to measure gaps in other individual characteristics, such as ethnicity, poverty, and education. However, further research is needed to consider selection bias using this tool.

### Tool: Time-Use Analysis

Time-use data can provide a detailed account of the time devoted to different activities and tasks during a particular period, usually a day. Collecting such information requires individuals to record their time used for each activity performed during the day; this can shed light on the time taken for various tasks within a value chain. This instrument not only describes the time that females and males dedicate to both productive and unproductive activities, it also shows differences in job activities. For example, time-use studies from Africa south of the Sahara reveal that women spend more time at work than men, particularly when their time spent on domestic and care work is included (Blackden and Wodon 2006).

The objective of this tool is to quantitatively estimate the time that women and men spend on different activities during the day, focusing on tasks performed at work. Measuring men's and women's labor burdens could provide interesting insights into how to improve gender balance and labor opportunities for both men and women. Several case studies have shown that women's burdens tend to increase in value chains with higher quality requirements (value-chain upgrading), since women typically perform quality-producing steps; however, this higher burden does not typically translate into higher remuneration. Many of the studies finding increased workload for women have relied mostly on qualitative information (Lyon, Bezary, and Mutersbaugh 2009; Bolwig and Odeke 2007).

In order to obtain time-use data, researchers must ask participants to list all activities undertaken in a typical day, from waking up to going to sleep, emphasizing time spent on different activities while at work. The questionnaire should be adapted to activities relevant to the value chain under analysis and should focus on the productive activities. A properly prepared and conducted interview can yield information on: time spent working as a whole and

**TABLE 14.4** Data needed for time-use analysis

Minimum	Desirable for further analysis
<ul style="list-style-type: none"> <li>• Relationship with head of the household</li> <li>• Gender</li> <li>• Occupation</li> <li>• Time wakes up</li> <li>• Time goes to sleep</li> <li>• Activities: preparing food, transportation, working, leisure, and other activities specific to the tasks in the value chain</li> </ul>	<ul style="list-style-type: none"> <li>• Age</li> <li>• Ethnicity (minority groups)</li> <li>• Religion</li> <li>• Marital status</li> <li>• Household size</li> </ul>

Source: Authors.

time spent on each separate activity while at work; time spent on household chores; and leisure time. From this information, it is then possible to compare and characterize differences between women's and men's time use using *t*-test analysis or regression analysis.

Depending on the value chain being analyzed, it might be important to capture the time spent on specific work tasks to assess the quality of activities performed by men and women (in other words, the division of labor in skilled and nonskilled activities: who trades, collects, loads, does marketing, sells, etc.).

The tool will produce tables and graphs like the ones shown (Table 14.5 and Figure 14.4).

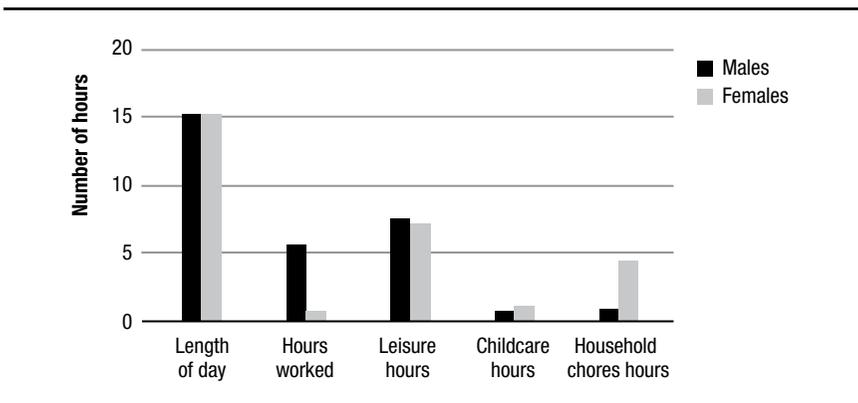
**TABLE 14.5** *t*-test for differences between females and males

Differences in time use by gender							
Variable	Males	Females	SD males	SD females	No. males	No. females	P
Wake-up time	5.03	5.26	0.9	0.76	45	53	.18
Sleep time	20.24	20.42	0.88	0.71	45	53	.30
Length of day	15.21	15.15	1.25	1.02	45	53	.80
Hours worked	5.63	0.82	3.98	2.21	45	53	.00
Leisure hours	7.69	7.25	2.6	2.67	45	53	.41
Childcare hours	0.76	1.23	0.38	0.93	9	11	.15
Household-chores hours	1.03	4.42	1.62	2.51	45	53	.00

Source: Authors.

Notes: SD = standard deviation; No. = number of observations; P = probability.

**FIGURE 14.4** Differences in time use by gender



Source: Authors.

Judging from these results, there are significant differences in the hours worked (typically outside the household) and the hours spent on household chores (typically performed by women). This distribution implies that women allocate a larger share of their time to activities that do not directly generate income.

Time allocation is a great tool to understand the dynamics of economic change and to model economic behavior. However, it has measurement errors that could complicate the results when people perform more than one activity at the same time. Since time use can also be impacted by seasonality, researchers should be careful to make repeated observations at the same time of year. Moreover, some populations may conceptualize time differently from those in industrialized countries, and illiterate individuals may have a different way of assessing their time use (see Masuda et al. 2012 for two approaches).

**Tool: Occupational Segregation Using Duncan Index**

Women continue to congregate in sectors and occupations traditionally characterized as “female”—mostly low-paying jobs. According to the World Bank (2012), removing barriers that prevent women from working in certain occupations would reduce the productivity gap between male and female workers by one-third to one-half, and would increase output per worker by 3–25 percent in some countries. This tool estimates gender segregation at each node in the value chain by occupation and can be extended to capture hierarchical segregation by occupation and task (skilled versus nonskilled) depending on available data.

**TABLE 14.6** Data needed for occupational segregation using Duncan Index

Minimum	Desirable for further analysis
<ul style="list-style-type: none"> <li>• Employment total</li> <li>• Employment by gender</li> </ul>	<ul style="list-style-type: none"> <li>• Occupation (specific to the value chain)</li> <li>• Type of job (specific to the value chain)</li> </ul>

Source: Authors.

The Duncan Index for occupational segregation (Duncan 1955) by gender in each stage of a value chain can be measured by

$$D = \frac{1}{2} \sum_i |m_i - w_i|$$

where  $m_i$  is the percentage of males (among total males employed within the value chain) in occupation (or value-chain node)  $i$ , and  $w_i$  is the similar percentage of females (among total females in the value chain) in value-chain occupation  $i$ . The values range from 0 to 100, and measure the relative separation or integration of gender across occupations (or nodes).

If the  $D$  value equals 0 percent, it means that occupations are distributed evenly between males and females. If the value is 100 percent, it means that occupations are completely segregated. If the value is 60 percent, it means that 60 percent of workers would have to change occupations to make the gender distribution equal. The benchmark for the Duncan Index for occupational segregation by gender is 25.86 percent. The tool will produce tables similar to Table 14.7.

**TABLE 14.7** Duncan Index

Node	Duncan Index (%)
Production	98
Commercialization	85

These percentages show a high level of segregation in the production node of the value chain. Ninety-eight percent of male workers would have to be replaced by female workers in order to have equal gender distribution.

The Duncan Index is a dissimilarity index; it is a measure of the evenness with which two groups are distributed across component groups (in this case, females and males) that make up a larger whole. The index score can be interpreted as the percentage of one group that would have to move to different units in order to produce a distribution that matches that of the whole. The index of dissimilarity can also be used as a measure of inequality.

But the Duncan Index does face some constraints. As highlighted by Iceland, Weinberg, and Steinmetz (2002), the dissimilarity index can be inflated by random factors when the number of minority members is small relative to the number of all potential groups (specifically they refer to the unequal distribution of social groups across aerial units of an urban area). The index is also insensitive to the redistribution of minority members among all potential groups with minority proportions above or below the overall minority proportion. Only transfers of minority members from areas in which these members are overrepresented to areas in which they are underrepresented (below the minority proportion) affect the value of the index.

However, despite its imperfections, the Duncan Index remains the most widely used measure of evenness, and no other index has achieved such widespread acceptance as a summary statistic of segregation (Iceland, Weinberg, and Steinmetz 2002). Further research could extend this segregation measure to different dimensions and could construct a Theil's-type index that could include two or more variables simultaneously.

**Tool: Working Conditions / Access to Work Equality Index**

Analyzing working conditions and equal access to work can provide information regarding specific barriers to growth within a value chain. The objective of this index is to assess key variables that characterize access to work and working conditions. The index is based on three premises: (1) measurement of gender gaps, (2) ease of computation, and (3) a final value bound between 0 (inequality) and 1 (equality) to facilitate comparisons and interpretation. It has two categories: (1) variables that characterize working conditions, and (2) variables that describe access to work.

**TABLE 14.8** Data needed for working conditions / access to work equality index

Minimum	Desirable for further analysis
1. Working conditions <ul style="list-style-type: none"> <li>• Wage (hourly/weekly)</li> </ul> 2. Access to work <ul style="list-style-type: none"> <li>• Participation (employment by gender)</li> <li>• Literacy or education level</li> </ul>	1. Working conditions <ul style="list-style-type: none"> <li>• Occupation (job activity)</li> <li>• Category (owner, worker, family worker)</li> <li>• Tenure</li> <li>• Temporary/permanent</li> <li>• Contract</li> <li>• Physical safety / risk of task performed</li> </ul> 3. Access to work <ul style="list-style-type: none"> <li>• Education level</li> <li>• Skilled, semiskilled, nonskilled</li> <li>• Requirements for job (experience, abilities, etc.)</li> <li>• Job training</li> </ul>

Source: Authors.

This index follows the empirical methodology used by Hausmann, Tyson, and Zahidi (2012), as presented below.

Step 1: Calculate ratios by gender for each variable  $X_i$  in each observation. For example, if one is working with the production node (segment) and has information on 100 farmers, a ratio needs to be calculated for each variable  $x_i$  in each farm where the variable could be for example: wages, participation, literacy, etc.

$$ratio_i = x_{i\_female} / x_{i\_male}$$

where  $x_{i\_female}$  refers to the value of the specific variable for females in the specific farm and  $x_{i\_male}$  refers to the value of the specific variable for males in the specific farm.

Step 2: Truncate at equality (1) when necessary; this must have bounds between 0 and 1, where 1 means an equal number of women and men.

$$ratio_i = 1 \text{ if } x_{i\_female} > x_{i\_male}$$

Step 3: Calculate sub-index scores (for each category of variables  $j = 1, 2$ ). To do this, it is necessary to calculate the weighted average of the variables within each category and create two sub-indices (one for working conditions and one for access to work). As mentioned by Hausmann, Tyson, and Zahidi (2012), a simple average would implicitly give more weight to the measure that has more variability; they suggest normalizing the variables by equalizing their standard deviations. Standard deviations over all farm-level data for each variable need to be calculated ( $var\_sd_i$ ); then a 1 percentage point change would be calculated:

$$var\_sd_i = 0.01/sd(ratio_i)$$

where  $var\_sd_i$  is the standard deviation for each variables and  $sd(ratio_i)$  is the standard deviation of the ratio for each variable ( $ratio_i$ ).

Sum  $var\_sd_i$  over each category  $j$ :

$$sum_j = \sum_j var\_sd_i$$

where  $var\_sd_i$  is the standard deviation for each variable aggregated over  $j$  categories which could be for example wages, and participation (employment by gender and by literacy).

To construct the weight, divide each  $var\_sd_i$  by  $sum_j$ , this will create the variable  $weight_i$ .

These values should be used as weights to calculate the weighted average of the four variables. In this way, a variable with a small variability of standard deviation gets a larger weight; therefore, when there is a large gender gap in that variable, it would be heavily penalized:

$$\overline{subindex(w)_{category j}} = \frac{\sum_i^n weight_i ratio_i}{\sum weight_i}$$

where the sum is over all variables within each  $j$  category.

Step 4: Calculate the final score. An unweighted average for each sub-index is taken to create the overall working conditions / access to work equality index. Sub-indices should include variables that characterize working conditions and variables that describe access to work.

$$Equality\ index = \frac{\sum_i^n \overline{subindex(w)_{category j}}}{n}$$

where the sum is over all  $j$  categories ( $n$ ).

This tool could be applied to separate nodes (segments) or to the entire value chain. It allows for comparisons between nodes and between value chains, since it is based on ratios rather than levels. It will produce a table like Table 14.9.

**TABLE 14.9** Working conditions / access to work equality index

Node	Working conditions / access to work equality index (%)
Production	31
Commercialization	55

Source: Authors.

In this production node, the working conditions / access to work equality index is 31 percent, suggesting a large gap between females and males in both working conditions and access to work. This implies that there is a gap of 69 percent. Similarly, for commercialization the index is 55%, which implies 45% inequality in working conditions and access to work.

This index could be more accurate if more variables describing access to work and employment conditions become available. Additionally, better analysis could be drawn if each person was interviewed individually instead of getting their information through third parties (such as the employer). Further work could find a correlation between a country's gender gap in agricultural production and its agricultural competitiveness, because women account for a large proportion of the world's agricultural workforce and thus long-term competitiveness depends significantly on whether women contribute to the sector.

## Implementation

Three things are needed to implement these tools: (1) a questionnaire module applied partially or in full; (2) a do-file with additional information on the tool and an explanation of how to construct the indicator; and (3) an Excel file with a table and/or graph produced from the results. Examples of the questionnaire and do-file are given by CRP-PIM (2015), and examples of the Excel file are available at [www.tools4valuechains.org](http://www.tools4valuechains.org).

The questionnaire module can measure either employment or time use. Additionally, a module of unit identification should also be available. Two types of modules are recommended: one for the production node and one for the commercialization node. The questionnaire provided on the website is a general example and should be adapted to the particular value chain and context under study. A list of activities that can be used as a guide to modify

and improve the list of relevant job activities (question Q2.3\_L) in the labor module, according to each value-chain node and commodity, can be found in CRP-PIM (2015).

The do-file describes the steps needed to create variables and estimate indicators using the variables in the questionnaires. Additionally, there is a raw dataset with which to perform the example described in the do-file—this dataset is only to illustrate the tool.

The Excel file uses the outcome data to produce a graph and could be used to reproduce similar outputs with specific data. This file can be downloaded from [www.tools4valuechains.org](http://www.tools4valuechains.org).

## Data Collection and Sampling

When implementing value-chain surveys to be able to measure the proposed quantitative tools, one of the biggest challenges faced by researchers is gathering appropriate gender-disaggregated data. As mentioned by Doss (2013b), gender-disaggregated data are data that are collected and analyzed separately on males and females. This typically involves asking the “who” questions in an agricultural household survey: who provides labor, who makes the decisions, who owns and controls the land and other resources, in which node of the value chains do they work, and under which conditions and wages.

### Who to Survey

When talking about gender-disaggregated data, we are not referring to comparisons of male- and female-headed households. This type of data is already commonly collected, but is problematic because it confounds gender and household structure<sup>1</sup> and we would miss important data on women living in male-headed households—the majority of the world’s women. It is in this sense that data collection for the proposed tools cannot focus solely on female-headed households, but needs to include women living in male-headed households and males living in female-headed households.

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1 As mentioned by Doss (2013a, b), male- and female-headed households are not comparable in most cases due to the way in which they are defined. *Male-headed households* generally include all households in which women are married to men, while *female-headed households* are usually those households lacking adult men. Female-headed households are often more labor and resource constrained than male-headed households, but these disparities cannot necessarily be attributed to the sex of the household head.

## How to Ask the Questions

A number of empirical studies have proposed using female interviewers to make women more comfortable when responding to surveys; questionnaires designed separately for women and men have also been used to increase accuracy and to improve data collection. Similarly, a clear strategy is needed to interview the males and females in separate environments to assure freedom of response on the part of the females. Other strategies include interviewing the spouse or another member of the household (preferably of the opposite sex) in addition to the household head to capture household composition and behavior (Fisher, Reimer, and Carr 2010). However, if it is not possible to interview multiple individuals within a household, researchers need to at least identify respondents based on their roles and responsibilities. Doss (2013b) also suggests guidelines to improve researchers' ability to capture gender disparities in specific areas such as land tenure, acquisition of land and other assets, and asset ownership.<sup>2</sup>

## Questions to Ask

Once the sampling strategy is developed and appropriate care is taken on who is going to ask the questions, data-collection efforts need to make sure that women's productive activities are considered and that their roles in agricultural value chains are identified (Doss 2013a). Deere (2005) finds that rural women commonly report housework as their principal occupation even when they are actively engaged in agricultural production. This may be due to the fact that many rural women tend to participate in subsistence, household-level activities such as raising livestock, tending kitchen gardens, and agricultural processing. Therefore, it is particularly important to include survey questions about subsistence agriculture in addition to income-generating activities.

For the proposed indicators, the minimum demographic data needed are sex, age, education level, marital status, and relationship to household head or respondent for each of the members involved in the agricultural production process of the value chain under study. In addition, and central to the proposed indicators, it is essential to collect data on labor. Collection of labor data for formal-sector employment is now standard practice and allows the collection of information on hours and days of work, wages, and benefits. The major concern is how to collect this type of information for the nonformal sector. For this purpose, for each indicator we also propose a series

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2 For more on data collection issues, see Doss (2013b).

of questions on the agricultural tasks being done disaggregated by age and sex, and important details on their subsistence agriculture activities. Similarly, the use of questionnaires to collect information on time use at the individual level helps substantially in understanding the activities of the female and male of the household. Examples of the questionnaire are given by CRP-PIM (2015), and examples of the Excel file are available at [www.tools4valuechains.org](http://www.tools4valuechains.org).

One additional important issue is to identify the owners of and the people who have access to key resources and production factors. On ownership of land, it is essential that—in addition to the typical question of title or other document for the land ownership—we ask which household member or members own the land and whose names are on the title or other ownership documents to allow for gender analysis, given that it allows us to identify the gender of the owner(s) and not just if the piece of land has a title or not.

In places where the formalization of land ownership is minimal, it will also be important to have data on both the reported ownership and the specific rights over the asset. With respect to other inputs of production, such as livestock and agricultural equipment, it is important to also put the questions of ownership, management, and control to both the female and the male. Another important aspect of quantitative data collection and sampling is repeated individual observations—that is, interviews conducted with the same individuals over a period of time. This process allows researchers to analyze the evolution of quantitative indicators and provides a better understanding of an intervention's possible effects. Conducting follow-up surveys is also important because it allows researchers to control for the impact of omitted variables and thus helps to understand people's behavior as well as any changes seen, including the reasons behind those changes.

Finally, it is important to use appropriate sampling strategies in order to gather data that are statistically representative of the value chain under analysis. In other words, each node or segment of a value chain needs to be sampled so that the complete survey is statistically representative of the value chain as a whole. This can be a challenge because tracking down the people actively involved in each segment of the chain can be difficult and time-consuming, particularly in long and complex value chains. Taking a census of all possible participants in each node of the value chain could be a first step; researchers could then draw a representative sample from this census (for example, all farmers in a particular geographical area). It should

be noted that the sampling methods chosen will have a large impact on the researcher's ability to make inferences from the sample; therefore, it is important to integrate sampling strategies in the analysis.

Depending on the sampling framework chosen, it is important to consider sample selection bias. If participants and nonparticipants are systematically different (as it is typical in the case of women and men in the household), substantive results may be biased in unknown ways, causing their external or internal validity to be compromised. A bias occurring from the use of nonrandomly selected data could distort the results. Additionally, some individuals may be lost over time due to migration, death, or other reasons—known as attrition bias. This attrition bias could bias the final sample if the individuals who are lost differ in some systematic way from the participants who remain.

The problem of bias can be addressed through the use of sample-selection models—these are a well-developed class of econometric models that can be used to detect and correct for selection bias. The use of a sample-selection model, such as the Heckman two-step estimator (Heckman 1976, 1978, 1979), should be considered in any quantitative value-chain analysis.

## **Conclusion**

The tools presented in this chapter are primarily intended to support the integration of gender in agricultural value-chain development through the use of quantitative tools. Identifying gender imbalances through quantitative analysis is the first step in improving the design of policies and interventions that will lead to greater gender equality and increased productivity in developing countries. Quantitative analysis will provide solid indicators that could be used as instruments in monitoring and evaluation processes.

The quantitative tools proposed in this chapter are built on those available in existing gender and labor economics literature and have been adapted for use in a value-chain context. They have the advantage of having already been tested in several previous studies and have proven to be useful indicators of gender differentials. These tools can help researchers and policymakers understand how value chains work, characterize labor distribution, and evaluate working conditions and access to work.

It is important to keep in mind that development interventions in agricultural value chains would benefit from additional gender analysis at different levels—for example, household-level analysis (income and expenditure management) and contextual analysis (institutions, social norms). It is

also important to ensure that female participation leads to greater productivity, not just to an increased number of women in the workforce. This could be achieved by increasing women's bargaining power in relation to other value-chain actors (Riisgard, Escobar Fibla, and Ponte 2010).

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## List of Authors

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**Adewale Adekunle** (w.adekunle@gmail.com) is the special adviser on agriculture in the Office of the President in The Gambia. His professional engagement encompasses diverse research and development (R&D) activities toward improvement in agricultural productivity and sustainability of the smallholder farming system. He received a Stockholm Challenge Award mention in 2005 for his work in information and communications technology for development, and the Africa College Prize in 2011 for his work on innovation platforms. He has many years of experience in using the innovation systems approach to implement R&D activities in Africa. Adekunle has bachelor's and master's degrees in Plant Science from the Obafemi Awolowo University in Nigeria, and a PhD in Agronomy obtained from the University of Ibadan, Nigeria.

**Jorge Andrade-Piedra** (j.andrade@cgiar.org) is a plant pathologist and epidemiologist of the International Potato Center (CIP) and the CGIAR Research Program on Roots, Tubers, and Bananas. He specializes in potato seed systems, late blight management, and innovation systems. Andrade-Piedra holds a PhD in Plant Pathology from Cornell University in New York.

**Seife Ayele** (s.ayele@ids.ac.uk) is a development economist currently working as a research fellow at the Institute of Development Studies (in the Business, Markets and the State cluster) of the University of Sussex, United Kingdom. His foci are agricultural innovation, science and technology policy and regulation, and enterprise development. He has conducted and directed research on the challenges involved in improving the livelihoods of smallholder farmers in

developing countries. He holds a PhD in International Development from the Open University, United Kingdom.

**Thomas Bernet** ([thomas.bernet@fibl.org](mailto:thomas.bernet@fibl.org)) is an agricultural economist and a senior expert for market and value-chain development of the Research Institute of Organic Agriculture in Switzerland. His expertise involves the development and use of market-oriented sector and value-chain approaches to enhance the competitiveness of rural areas. As a researcher and development practitioner, he has been involved in projects aiming to foster market-relevant capacity development in transition and developing countries. He holds a PhD from ETH Zürich, Switzerland.

**Romina Cavatassi** ([romina.cavatassi@fao.org](mailto:romina.cavatassi@fao.org)) is a natural resource economist with the Agricultural Development Economics division of the Food and Agriculture Organization of the United Nations (FAO). Her subject areas are economic development, natural resources management, and poverty reduction, with a focus on agrobiodiversity and climate change. Her areas of expertise are impact evaluation, survey design, and data collection. Over the past three years she has been in charge of managing a project on climate-smart agriculture in Malawi, Vietnam, and Zambia. Cavatassi holds a PhD in Natural Resources and Development Economics from Wageningen University, the Netherlands, and a master's degree in Environmental Assessment and Evaluation from the London School of Economics, United Kingdom.

**Beth Cullen** ([bethselinacullen@gmail.com](mailto:bethselinacullen@gmail.com)) is a social anthropologist of the Organic Research Centre in the United Kingdom. She works on agricultural knowledge exchange projects relating to natural resource management, participatory research methods, and agricultural innovation systems. Previously, she worked as a social scientist for the International Livestock Research Institute (ILRI) in Addis Ababa, Ethiopia, where she focused on developing participatory processes to involve members of farming communities and other stakeholders in research-for-development projects. Cullen holds a PhD in Anthropology from Durham University, United Kingdom, with specializations in the anthropology of development and indigenous knowledge systems.

**Marcelo Cunha** ([marcelocunha@zedat.fu-berlin.de](mailto:marcelocunha@zedat.fu-berlin.de)) is a PhD candidate of the Free University of Berlin and holds a master's degree in Economics from the University of Cologne, Germany. Previously, he worked as a researcher

at the World Agroforestry Centre (ICRAF) and the United Nations Global Compact. His recent R&D projects concern value-chain development, cost-benefit analysis, climate change vulnerability, and livelihoods analyses. His main field of study is sustainable and inclusive value-chain development, including access to natural resources and markets, based on assessments of actors' social capital and the institutional environment they are embedded in.

**André Devaux** (a.devaux@cgiar.org) is director of the Latin American Regional Program for CIP, based in Ecuador. He holds a PhD in Agriculture Science and has more than 30 years of experience in agricultural R&D in Africa, Asia, and Latin America. His fields of study have included potato production systems, innovation systems, value-chain approaches, and food and nutritional security. Devaux has worked with FAO and the Swiss Agency for Development and Cooperation (SDC).

**Jason Donovan** (j.donovan@cgiar.org) is a research leader for value chains and transformational change at ICRAF. His work examines smallholder participation in agricultural value chains and the implications for development programming in support of livelihood resilience, food and nutrition security, and gender equity. Previously, he worked at the Tropical Agricultural Research and Higher Education Center (CATIE) in Costa Rica. Donovan holds a PhD from the School of Oriental and African Studies (SOAS), United Kingdom, and a master's degree from the University of Massachusetts, United States.

**Alan Duncan** (a.duncan@cgiar.org) is a research scientist with interests in livestock feeding and the human and systems issues surrounding livestock feeding. He is currently the principal livestock scientist at ILRI and a visiting professor at Scotland's Rural College. Before joining ILRI, Duncan worked at the Macaulay Institute in the United Kingdom on plant-animal interactions. His PhD is in Livestock Nutrition from the University of Edinburgh, United Kingdom. He led the development of the Feed Assessment Tool (FEAST; [www.ilri.org/feast](http://www.ilri.org/feast)), which is now being widely used across the developing world.

**Patricio Espinosa** (poespinosa@gmail.com) is an independent consultant working on topics related to rural development, Andean crops, and evaluation of agricultural projects. Previously, he worked with CIP in the Social Science Department, and with the National Institute for Agricultural and Livestock

Research (INIAP) in Ecuador as the planning director. Espinosa holds a master's degree in Agricultural Economics.

**Raul C. Esprella** (r.esprella@proinpa.org) is a social scientist of the Foundation for Promotion and Research of Andean Products (PROINPA) in Bolivia. He has a master's degree in Sustainable Rural Development from the Universidad Mayor de San Andres in Bolivia and specializes in that subject. Esprella has led R&D projects in the fields of participatory research, inclusive value-chain development, and integrated pest management.

**John Fisk** (jfisk@winrock.org) is the director of the Wallace Center for Sustainable Agriculture at Winrock International, United States. The Center works on increasing the sustainability of food and farming systems in the United States and focuses on developing market-based solutions that link people and communities to food that is healthy and affordable. Fisk received his PhD from Michigan State University, United States.

**Paola Flores** (p.flores@cgiar.org) coordinates projects on agriculture, nutrition, and health at CIP in Bolivia. She works on topics related to agricultural R&D, innovation, gender, participatory methodologies, value chains, and knowledge management. Previously, Flores worked on similar projects and implemented gender activities with the CGIAR Research Program on Roots, Tubers, and Bananas. She holds an MBA from the Private University of Bolivia and the University of Santiago, Chile, with specialization in marketing.

**Steven Franzel** (s.franzel@cgiar.org) is an agricultural economist at ICRAF. He specializes in research on extension and advisory services, agroforestry, smallholder farming systems, and technology adoption. Franzel leads ICRAF's research on rural advisory services. His PhD is in Agricultural Economics.

**Mario González Flores** (mgonzalez@iadb.org) is an economist of the Inter-American Development Bank for the Office of Strategic Planning and Development Effectiveness, in Washington, DC, where he provides support in the design and implementation of impact evaluations for the following divisions: Rural Development and Natural Disasters, Capital Market and Finance, and Competitiveness and Innovation. His topics of interest are agriculture, rural development, technical efficiency, poverty scoring, and social

programs. He holds a master's degree in International Development and a PhD in Economics from American University in Washington, DC.

**Amos Gyau** (a.gyau@cgiar.org) is a research leader in markets and institutions at ICRAF. He holds a PhD from Georg-August-University Göttingen in Germany, and a master's degree from the University of Copenhagen, Denmark. His research focuses on strategies for linking farmers to markets, and the related institutional and policy arrangements, supply-chain management, and consumer research.

**Guy Hareau** (g.hareau@cgiar.org) is an agricultural economist in the Social and Health Sciences and Innovation Program at CIP. He leads the work on priority setting and impact assessment of technological change in agriculture. He also works with the Global Futures and Strategic Foresight initiative of the CGIAR Research Program on Policies, Institutions, and Markets (PIM). His PhD is in Economics with a specialization in agriculture, and he holds a master's degree in Agricultural Economics.

**Douglas Horton** (d.horton@mac.com) is an independent applied researcher and evaluator with more than 40 years of experience working on topics related to international agricultural R&D, innovation, and capacity development. Previously, he led CIP's Social Science Department, and served as a senior officer of the International Service for National Agricultural Research, where he worked on projects related to research planning, and monitoring and evaluation (M&E). Horton holds a PhD in Economics, with specializations in international development and agriculture.

**Matthias Jäger** (m.jager@cgiar.org) is a value-chain and marketing expert who works on topics related to value chains for nutrition, sustainable food systems, low-emission value chains, and inclusive business models. He is currently working with the International Center for Tropical Agriculture (CIAT). Previously, Jäger worked with Bioversity International's Department of Nutrition and Marketing on integrated approaches for linking underutilized agricultural biodiversity to high-value markets. He holds a master's degree in Agricultural Economics from Giessen University, Germany.

**Catherine Kilelu** (ckilelu@gmail.com) is a postdoctoral researcher jointly appointed with the Knowledge, Technology and Innovation (KTI) group

of Wageningen University, the Netherlands, and the Livelihoods, Gender and Impact program at ILRI. She is researching the role of multistakeholder processes in inclusive smallholder-focused livestock value-chain development. Kilelu holds a PhD in Social Sciences from Wageningen University.

**Laurens Klerkx** (laurens.klerkx@wur.nl) is an associate professor in the KTI Group of Wageningen University, the Netherlands. He holds a master's degree in Tropical Land Use, and a PhD in Communication and Innovation Studies from Wageningen University. His main areas of study are the roles of intermediaries in research and innovation, agricultural extension, agricultural innovation systems, and research management.

**Asamoah Larbi** (a.larbi@cgiar.org) is the chief scientist for the Africa RISING Project in West Africa and the International Institute of Tropical Agriculture (IITA) country representative in Ghana. He works on topics related to integrated crop–livestock production, food-feed crops and cropping systems, forages for feed, natural resources management, and agroforestry systems. Larbi has a PhD in Agronomy from the University of Florida in Gainesville.

**Cees Leeuwis** (cees.leeuwis@wur.nl) is currently a professor in the KTI Group at Wageningen University, the Netherlands. He focuses on approaches for developing effective socio-technical innovations in networks, collaboration between different disciplines, research-for-development policy, the functioning of innovation support systems, and the role of innovation platforms, communication, extension, and brokers therein. He holds a PhD in Agricultural Sciences from Wageningen University and works in several domains, including sustainable agriculture, natural resources management, poverty-related diseases, and inclusive value chains.

**Zelalem Lema** (z.lema@cgiar.org) is a researcher and facilitator on innovation systems for agriculture at ILRI, based in Addis Ababa, Ethiopia. With more than 10 years of experience related to multistakeholder processes, communication, and facilitation, he supports projects that focus on sustainable intensification, and agriculture and nutrition. Lema holds a bachelor's degree in Agricultural Extension and a master's degree in Agricultural Economics and Rural Development from Haramaya University, Ethiopia.

**Gaston Lopez** (glopezbenavides@gmail.com) is a consultant in marketing, innovation, and participatory methods. He has worked for various R&D organizations, including CIP, FAO, and Inter-American Institute for Cooperation on Agriculture (IICA). From 2007 to 2010, he led the agribusiness area for the Andean Change Alliance, implemented by CIP and CIAT, and from 2013 to 2014 he served as a consultant to the Papa Andina initiative. Lopez graduated from San Marcos University, Peru, in Social Anthropology, with a specialization in social management.

**Mark Lundy** (m.lundy@cgiar.org) is a senior scientist at CIAT. His work focuses on the role of markets in reducing rural poverty, including such topics as learning networks to increase nongovernmental organization (NGO) and farmer capacities for enterprise development, exploring how private companies can better partner with smallholder farmers, the role of public and donor agencies in supporting better market linkages, and how to establish and sustain effective trading relationships between buyers and smallholder farmers that add business value while reducing rural poverty. Lundy is lead author of a series of guides on participatory rural enterprise development, and he is an active participant in multistakeholder forums focused on sustainability and smallholder inclusion in Africa and Latin America. He holds master's degrees in Latin American Studies and in Community and Regional Planning from the University of Texas, Austin.

**Kurt Manrique-Klinge** (kmanriquek@yahoo.com) is a consultant on rural development, agricultural innovation, value-chain development, and social marketing in the Andean region. He worked at CIP for 12 years with the Innovation and Competitiveness for the Potato Crop in Peru (INCOPA)/Papa Andina Initiative and InnovAndes. More recently, he has also consulted with the Latin American Zinc Association and FAO on rural development and postharvest issues. Manrique-Klinge holds a master's degree in Crop Production from the Universidad Nacional Agraria La Molina (Lima, Peru) and a PhD in Plant Science from the University of Idaho with a Fulbright Fellowship. He has participated in the Hubert H. Humphrey Program as a visiting scholar at the College of Agriculture and Life Sciences at Cornell University, United States.

**Lucia Madrigal** (lmadrigal@iadb.org) works in the Labor Markets and Social Security Unit of the Inter-American Development Bank, Washington, DC,

where she provides technical leadership for the Longitudinal Social Protection Survey project in Brazil, Chile, Colombia, El Salvador, Paraguay, and Uruguay. Her research interests include pensions, informality, survey methodology, gender, and labor distortions, and she has worked on distributive analysis of social policies, employment growth, fiscal sustainability of pensions systems, and related topics in Asia, the Caribbean, and South America. Madrigal holds a bachelor's degree in Economics from Centro de Investigación y Docencia Económicas (CIDE) in Mexico City and a master's degree in Economic and Social Policy Analysis from the University of York, United Kingdom.

**Nicholas W. Minot** (n.minot@cgiar.org) is deputy director and a senior research fellow in the Markets, Trade, and Institutions Division of the International Food Policy Research Institute (IFPRI). His research is on agricultural market reform, fertilizer policy, markets for high-value commodities, contract farming, and spatial patterns in poverty, working in Benin, Bhutan, China, Egypt, Ethiopia, Ghana, Indonesia, Lao People's Democratic Republic, Malawi, Tanzania, and Vietnam. He has carried out research on agricultural marketing, household budgets, and microenterprises in Bolivia, Cameroon, Lao People's Democratic Republic, Paraguay, and Peru. Minot holds master's and PhD degrees in Agricultural Economics from Michigan State University and a bachelor's degree in International Development from Brown University, United States.

**Dagmar Mithöfer** (dagmar.mithoefer@hochschule-rhein-waal.de) is an economist, focused on sustainable value-chain governance and market-driven development. She is professor of Agribusiness at Rhine-Waal University of Applied Sciences, Germany. Dagmar holds a PhD in Economics with specializations in agriculture, environment, and international development from the Leibniz University of Hannover, Germany.

**Fabian Montesdeoca** (fabian.montesdeoca@iniap.gob.ec) is currently a PhD candidate in Natural Resource Sciences at the Universidad de la Frontera, Chile, and instructor in Management and Finance of the Faculty of Agricultural Sciences, Universidad Central, Ecuador. For nearly 30 years, he has worked for the National Autonomous Institute for Agricultural Research (INIAP) in Ecuador, and participated in numerous agricultural R&D projects centered on the strengthening of potato production and marketing, with

special emphasis on pest management and improving seed systems for small farmers.

**Michelle Frain Muldoon** ([michelle.muldoon@jhu.edu](mailto:michelle.muldoon@jhu.edu)) is a specialist in inclusive markets and business development, working independently, based in Washington, DC. Muldoon provides technical assistance and supports capacity building in the areas of food systems, food marketing, gender integration, and social enterprise development, working with historically excluded and underserved people worldwide. She has degrees in Marketing, French for International Trade, and International Management, and is completing a master's degree in Marketing at the Johns Hopkins University Carey Business School in the United States.

**Suzanne Nederlof** ([suzanne.nederlof@hvhl.nl](mailto:suzanne.nederlof@hvhl.nl)) is a senior lecturer in International Development Management of the University of Applied Sciences Van Hall Larenstein in the Netherlands. She works on topics related to food security, rural development, and innovation. Her research and experience is in rural development. Nederlof holds a PhD in Communication and Innovation from Wageningen University, the Netherlands.

**Hlamalani J. Ngwenya** ([hlamin@iburst.co.za](mailto:hlamin@iburst.co.za)) is a senior lecturer of the University of Free State, South Africa. She has broad expertise in rural development, agricultural extension, knowledge management, organization development, stakeholder engagement, and social mobilization. Ngwenya has supported a number of organizations in strategic-planning and institutional reform processes, participatory approaches to program planning, M&E, and impact assessment. Her recent work addresses issues of youth in agriculture, food and nutrition security, climate change adaptation, policy advocacy, agricultural innovation, and gender mainstreaming. Ngwenya holds a master's degree in Consumer Sciences from North West University in South Africa (formerly the University of Potchefstroom).

**Miguel Ordinola** ([m.ordinola@cgiar.org](mailto:m.ordinola@cgiar.org)) coordinates Latin American projects at CIP. From 2003 to 2015, he coordinated projects in CIP's IssAndes and INCOPA programs. These programs, implemented throughout the Andean region of South America, addressed issues of food security and nutrition through market-chain innovation and policy advocacy. The projects led by Ordinola have been recognized with numerous national and international awards, including Peru's Business Creativity Award (1998, 1999,

2003, 2005, 2008), the SEED Award for Innovation in Local Sustainable Development (2007), the United Nations World Challenge Prize (2007), and the BBC's Innovation Award (2013). Ordinola holds a master's degree in Agricultural Economics from the National Agrarian University (Universidad Nacional Agraria).

**Rodrigo Paz-Ybarnegaray** (rodrigopaz71@hotmail.com) is currently an evaluation and learning scientist at WorldFish. He is a specialist in methodological development for program planning, monitoring, and evaluation. His work focuses on fostering and facilitating collective learning and evaluation. Paz-Ybarnegaray has worked in Africa (Zambia), Asia (Bangladesh, Cambodia, and Philippines), Europe (United Kingdom), the Pacific (Solomon Islands), and South America (the Andean region).

**Hernán Pico** (caporal@andinanet.net) is an expert in development management and public administration, and manager at Empresa Pública de Tránsito de Tungurahua, Ecuador. He is an economist with a master's degree in R&D.

**Nigel Poole** (n.poole@soas.ac.uk) is a reader (lecturer) in International Development Policy of the Centre for Development, Environment and Policy at the School of Oriental and African Studies (SOAS), United Kingdom. He is also a member of the Board of Directors of the Tropical Agricultural Research and Higher Education Center (CATIE), Costa Rica. He holds bachelor's and master's degrees in Agricultural Sciences, Extension, and Economics, and a PhD in Agricultural Marketing Economics from Wye College, University of London, United Kingdom. His research is on agriculture and nutrition in South Asia, with a focus on the political economy and market linkages between food production and health.

**Manuel Pumisacho** (Pumisacho59@hotmail.com) is on the Agricultural Science faculty of the Universidad Central del Ecuador, and is coordinator of the university's linkage unit. He received his bachelor's degree in Agricultural Engineering from the Universidad Central del Ecuador. His postgraduate studies are integrated with his position in the Instituto Nacional de Investigaciones Agropecuarias (INIAP) in Ecuador, working with smallholders of the Ecuadorian Sierra through the Colegio de Posgraduados in Mexico. He is a member of a multidisciplinary team of the Potato Program,

and teacher/facilitator of the farmer field school methodology (Escuelas de Campo de Productores).

**Matin Qaim** (mqaim@uni-goettingen.de) is professor of International Food Economics and Rural Development of the University of Göttingen, Germany. He has a PhD in Agricultural Economics from the University of Bonn, Germany. His main research areas relate to the economics of poverty, hunger, and malnutrition, and to technological and institutional change in the small-farm sector of developing countries. Qaim is a member of various scientific and policy advisory committees.

**Iván A. Reinoso Reinoso** (ireinosor@hotmail.es) is an agricultural researcher at INIAP in Ecuador. He has a master's degree in Agricultural Economics from New Mexico State University, with a specialization in social sciences.

**Emma Rotondo** (emma.rotondo@gmail.com) is an international evaluation consultant. From 2004 to 2015, she was executive director of the Regional Platform for Evaluation Capacity Building in Latin America and the Caribbean (PREVAL). Rotondo has a bachelor's degree in Social Sciences from San Marcos National University in Peru. She is licensed in Social Anthropology, also from San Marcos National University, and has performed postgraduate studies in Logotherapy Counselling from the Instituto Peruano de Logoterapia y Análisis Existencial of the Universidad Norbert Wiener in Peru.

**Christoph Saenger** (saengerc@ebrd.com) is a senior economist of the International Coffee Organization (ICO) in London, conducting research on coffee value chains in Africa, Asia, and Latin America. He holds master's degrees from Universität Hohenheim, Germany and the University of California, Davis, United States, and a PhD in Agricultural Economics from Georg-August-Universität Göttingen, Germany.

**Bradley Sawyer** (b.sawyer@cgiar.org) is a senior research assistant in the Markets, Trade, and Institutions Division at IFPRI. His research is on international development and agricultural and environmental economics. Sawyer has a bachelor's degree in International Relations from Michigan State University, and a master's degree in Public Policy from the University of California, Berkeley, United States.

**Dietmar Stoian** (d.stoian@cgiar.org) is principal scientist on value chains and private-sector engagement at Bioversity International and based in Montpellier, France. His work focuses on the integration of smallholders in value chains through diverse institutional arrangements with private- and public-sector and civil society organizations, and a multi-chain approach aimed at livelihood resilience, food and nutrition security, and gender equity. Previously, he worked as leader of the Competitiveness and Value Chains Program at CATIE. Stoian holds a PhD in Forest Economics, with a specializations in tropical forestry and anthropology.

**Werner Stür** (werner.stur@aciarc.gov.au) is a research program manager for livestock production systems at the Australian Centre for International Agricultural Research (ACIAR) in Canberra, and a livestock scientist. His research is on feeding animals in smallholder livestock farming systems in Southeast Asia. The research for his chapter was conducted when he was working with CIAT, based in the Lao People's Democratic Republic. Stür holds a PhD in Tropical Agriculture from the University of Queensland, Brisbane, Australia.

**Kees Swaans** (k.swaans@gmail.com) is a human-oriented academic with a special interest and expertise in the management of socioecological systems, research for development, innovation, and reflexive monitoring and action, at the interface of agriculture, health, and environment. Swaans is currently working as an independent researcher/consultant based in Hanoi, Vietnam. Previously he worked as a scientist on innovation in livestock systems at ILRI, and for Oxfam as a regional program officer for a global seeds biodiversity program on food security and climate justice. Swaans holds a master's degree in both Agricultural Sciences and the Management of Agricultural Knowledge Systems, and a PhD in Innovation and Communication in Health and Life Sciences.

**Truong Tan Khanh** (tankhanh.dhtn@gmail.com) is the vice dean of the Faculty of Animal Production and Veterinary Science at Tay Nguyen University, Vietnam, and an animal science and animal nutrition and feeds researcher. He holds a PhD in Animal Production from Vietnam National University of Agriculture. Tan Khanh has been a long-term research partner on an international research project at CIAT and ILRI.

**Graham Thiele** (g.thiele@cgiar.org) is director of the CGIAR Research Program on Roots, Tubers, and Bananas (RTB), led by the International Potato Center (CIP). Thiele is a social scientist and expert in targeting, priority setting, and impact and adoption studies of new agricultural technologies. He previously worked as the Leader for Social and Health Sciences at CIP and with DFID. Thiele has worked in Bolivia, Ecuador, Peru, Tanzania, Kenya, Benin, Rwanda, Indonesia, and the Philippines. He helped develop, implement, and assess several novel participatory methodologies designed to link farmers with markets, inform research agendas, and promote innovation in policies, products, and technology uptake. Thiele holds a PhD in Social Anthropology and an MSc in Agricultural Economics.

**Alice Thomann** (alicethomann@gmail.com) is a development worker with a specific interest in culture and governance issues. She has been working with the Swiss Agency for Development and Cooperation (SDC). She leads the SDC team on culture and development. Thomann also works on corporate social responsibility within value chains at CIP in Lima, Peru. She received a master's degree in Translation from the University of Geneva and a master's degree in Development Studies from the Ecole polytechnique fédérale de Lausanne (EPFL).

**Maximo Torero** (m.torero@cgiar.org) is the director of the Markets, Trade, and Institutions Division at IFPRI, and leader of the theme on linking small producers to markets in the CGIAR Research Program on Policies, Institutions, and Markets (PIM). His major research work analyzes poverty, inequality, and the importance of geography and assets (private or public) in explaining poverty and poverty alleviation, based on the role played by infrastructure and institutions. He also studies technological breakthroughs and how farmers benefit. His experience encompasses Africa south of the Sahara, Asia, and Latin America. Torero received his PhD from the University of California, Los Angeles. He is a professor on leave from the Universidad del Pacífico in Lima, Peru and an Alexander von Humboldt Fellow at the University of Bonn, Germany. He has twice won the World Award for Outstanding Research on Development given by the Global Development Network (GDN). Torero has published widely in top disciplinary and interdisciplinary journals, and has received several academic prizes.

**André F. van Rooyen** (a.vanrooyen@cgiar.org) works for the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), based in Zimbabwe. He works within the region and focuses on crop–livestock integration and intensification using multistakeholder platforms to bring together local experts and stakeholders to facilitate positive change along value chains. Van Rooyen’s work tests the role and contribution of output markets in increasing investment in both crop and livestock production. He holds a PhD in Rangeland Ecology from the University of KwaZulu Natal, South Africa.

**Claudio Velasco** (c.velasco@cgiar.org) is the research coordinator for Latin America and the Caribbean at CIP. His work experience has focused on managing innovation projects in agriculture and on the development and use of participatory approaches to foster innovation, collective action, knowledge management, and learning. Velasco holds a bachelor’s degree in Agricultural Science, a master’s degree in International Cooperation, and a PhD in Development, Policy and Practice from the Open University, United Kingdom.

**Paul Winters** (winters@american.edu) is the director of strategic planning and impact assessment of the International Fund for Agricultural Development (IFAD) in Rome, and a professor in the Department of Economics at American University in Washington, DC. He previously worked at CIP in Lima, Peru, at the University of New England in Australia, and at the Inter-American Development Bank in Washington, DC. He has published numerous journal articles and working papers in the areas of impact evaluation, migration, cash transfer programs, and smallholder agriculture.

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Governments, nongovernmental organizations, donors, and the private sector have increasingly embraced value-chain development (VCD) for stimulating economic growth and combating rural poverty. *Innovation for Inclusive Value-Chain Development: Successes and Challenges* helps to fill the current gap in systematic knowledge about how well VCD has performed, related trade-offs or undesired effects, and which combinations of VCD elements are most likely to reduce poverty and deliver on overall development goals. This book uses case studies to examine a range of VCD experiences. Approaching the subject from various angles, it looks at new linkages to markets and the role of farmer organizations and contract farming in raising productivity and access to markets, the minimum assets requirement to participate in VCD, the role of multi-stakeholder platforms in VCD, and how to measure and identify successful VCD interventions. The book also explores the challenges livestock-dependent people face; how urbanization and advancing technologies affect linkages; ways to increase gender inclusion and economic growth; and the different roles various types of platforms play in VCD.

*Innovation for Inclusive Value-Chain Development* will be useful to agricultural researchers, decision makers in research or development organizations, and the private sector who wish to support appropriate policies, institutions, and markets for inclusive agricultural growth.

**André Devaux** ([a.devaux@cgiar.org](mailto:a.devaux@cgiar.org)) is the director of the Latin American Regional Program at the International Potato Center (CIP), based in Ecuador.

**Maximo Torero** ([m.torero@cgiar.org](mailto:m.torero@cgiar.org)) is the director of the Markets, Trade, and Institutions Division at the International Food Policy Research Institute, Washington, DC.

**Jason Donovan** ([j.donovan@cgiar.org](mailto:j.donovan@cgiar.org)) is a research leader for value chains and transformational change at the World Agroforestry Centre, based in Peru.

**Douglas Horton** ([d.horton@mac.com](mailto:d.horton@mac.com)) is an independent applied researcher and evaluator currently working with CIP, based in the United States.



2033 K Street, NW, Washington, DC 20006-1002 USA  
T. +1-202-862-5600 | F. +1-202-467-4439 | Email: [ifpri@cgiar.org](mailto:ifpri@cgiar.org)

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