WORKING WITH SMALLHOLDERS

THIRD EDITION

A handbook for firms building sustainable supply chains

INTERNATIONAL FINANCE CORPORATION

WORLD BANK GROUP

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A HANDBOOK FOR FIRMS BUILDING SUSTAINABLE SUPPLY CHAINS (THIRD EDITION)

International Finance Corporation

WORLD BANK GROUP

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FOREWORD

Smallholder farmers are the stewards of over 80 percent of the world's farms. According to United Nations Food and Agriculture Organization (FAO) estimates, these small family businesses produce around one-third of the world's food. In the International Finance Corporation's (IFC's) key markets in Africa and Asia, smallholders dominate the production of food crops, as well as export commodities such as cocoa, coffee, and cotton. Yet smallholders and farm workers remain among the poorest segments of the population and are on the frontline of climate change. The past few years have been particularly challenging; the multiple crises of the COVID-19 (Coronavirus) pandemic, Russia's invasion of Ukraine, and extreme weather have caused market disruptions and price volatility for food crops, fuel, and agricultural inputs.

One of the great development challenges is meeting the food needs of 9.7 billion people by 2050 while simultaneously reducing agriculture's environmental footprint. Achieving this requires the sustainable intensification of agriculture: producing more food on less land, with less water, while building resilience to external shocks and climate change.

Given the dominance of smallholders in the food systems of low- and lower-middle-income countries, raising farm-level productivity is

a key priority. The overwhelming majority of smallholder farmers face constraints in accessing inputs, finance, knowledge, technology, labor, and markets. And all farming must contend with a changing and unpredictable climate.

The market for food is also changing, which can have a positive impact on smallholders. Economic growth and urbanization in emerging markets are increasing the demand for higher-quality food products. Consumer concerns about sustainability and the provenance of food products are opening new business possibilities for private firms along the entire value chain. In parallel, emerging agricultural technologies ("agtech") can lower costs, increase efficiencies, build resilience, and dramatically reduce the environmental impact of agriculture. Ingenuity, innovation, and considerable investments will be needed for decades to come. The future of agriculture requires new and pioneering partnerships among different stakeholders in the food system.

Since the first edition of this handbook was published in 2014, IFC has almost doubled its agribusiness investment portfolio from around US$2 billion to $3.9 billion at the end of fiscal year 2022. In September 2022, IFC launched a new US$6 billion Global Food Security financing facility to strengthen the private sector's ability to respond to the crisis and help support food production.

Firms increasingly need to establish and expand ways of working with consumer groups, governments, research institutes, civil society organizations, and the millions of smallholder farmers—especially in emerging markets—who are critical to the future supply of many agricultural products, including livestock, coffee, cocoa, vegetables, dairy, and palm oil. New and emerging legislation in the European Union and United States requires firms to be more accountable for their supply chains and demonstrate that they are sustainable, do not contribute to deforestation, and are free of child labor. Based on our experience, we believe firms can build traceable and transparent supply chains while significantly contributing to better economic outcomes for all.

This new edition of the handbook—produced with the support of Global Agriculture and Food Security Program—is a practical guide for firms that wish to expand their supply chains in emerging markets by working with smallholder farmers. The purpose is to enable more productive interactions between private firms and smallholders, creating value in all parts of the supply chain. The handbook is action-oriented

and offers practical solutions as part of our contribution to the development of sustainable agribusiness. Our vision is a food system in which sustainable production is the norm, and food and nutritional security is secured for future generations.

Wagner Albuquerque de Almeida
Director
Global Manufacturing, Agribusiness, and Services
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PREFACE

Smallholder farmers are becoming more important players in global food chains as agribusiness companies seek to secure future food supplies for the world's growing population. For some crops, smallholders are already an important source of production, but their role is expanding as land constraints limit the potential for growth in plantation agriculture and as the locus of future food market growth shifts to emerging markets. Those markets face increasing demand for affordable, nutritious foods for low-income urban populations.

These shifts offer opportunities—particularly for economic growth and poverty alleviation in rural areas—but also pose challenges to upgrade and integrate smallholder agriculture against a backdrop of climate change and increasing water scarcity. Moreover, agribusiness companies, under increasing pressure from consumers, shareholders, governments, and other stakeholders, are making important public commitments on sustainability, including the adoption of environmental and labor standards. Meeting these competing demands will require new ways of working and new partnerships to deliver change, including with the integration of agricultural technologies that can enhance operational efficiencies and reduce costs.

This handbook encourages agribusinesses to work with smallholders whenever possible, and it highlights the key opportunities in doing so, as well as details on how to overcome the major challenges. Mainstreaming the concepts addressed in this book can help agribusinesses to modernize

their supply chains and operations, working more effectively with smallholders and other players in a profitable and sustainable way.

This handbook is written for the operational managers in agribusiness companies responsible for integrating smallholder farmers into value chains as suppliers, clients, or customers. These managers include the following:

- Product and sales managers for input manufacturers, distributors, wholesalers, and retailers
- Field managers for financial institutions and their small business clients
- Service providers who train smallholders
- Supply chain and sustainability managers for off-takers
- Sustainability managers for processors and food companies
- Company managers responsible for engagement via public-private partnerships.

Although written principally to outline training and assistance needs and opportunities for the private sector—whether in high-income, frontier, or low- and middle-income markets—the handbook may also be useful to the staffs of governmental or nongovernmental agricultural development programs working with smallholders, as well as to academic and research institutions.

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ABBREVIATIONS

4C	Common Code for the Coffee Community
AC	activation coordinator
AE	Agri-Entrepreneur (program)
AfCFTA	African Continental Free Trade Agreement
ag-energy	agricultural-energy
AGRA	Alliance for a Green Revolution in Africa
agtech	agricultural technology
AI	artificial intelligence
ALP	Agribusiness Leadership Program
alt-protein	alternative protein
AMEA	Agribusiness Market Ecosystem Alliance
AMR	antimicrobial resistance
AOPP	Association of Professional Farmers' Organizations
ARPU	average revenue per user
ARS 1000	African Regional Standard on Cocoa (draft)
AS	Advisory Services (IFC)
ASEAN	Association of Southeast Asian Nations
AVCF	agricultural value chain finance
B2B	business-to-business
B2C	business-to-consumer
B4ICA	Banking for Impact on Climate in Agriculture
BaaS	banking-as-a-service
BCI	Better Cotton Initiative, also known as Better Cotton
BLF	Better Life Farming

BLFA	Better Life Farming Alliance
bn	billion
BSF	black soldier flies
BSI	Better Sugarcane Initiative
C.A.F.E	Coffee and Farmer Equity (Practices)
CAPEX	capital expenditure
CAPI	computer-assisted personal interview
CAR	Cadastro Ambiental Rural
CC	Caribbean coast
CCC	Crops-Care-Community
CEO	chief executive officer
CFAF	West African franc
CFS-RAI	CFS Principles for Responsible Investment in Agriculture and Food Systems
CGAP	Consultative Group to Assist the Poor
CGIAR	Consultative Group on International Agricultural Research
CH_4	methane
CNOP	National Coordination Agency for Farmers' Organizations of Mali
CO_2	carbon dioxide
CoCo	Connect Online Connect Offline
COFCO	China Oil and Foodstuffs Corporation (International)
COP21	21st United Nations Climate Change Conference of the Parties
COP26	2021 26th United Nations Climate Change Conference of the Parties
COP27	2022 27th United Nations Climate Change Conference of the Parties
COSA	Committee on Sustainability Assessment
COVID-19	Coronavirus
CSA	climate-smart agriculture
CRM	customer relationship management
CSPO	Center for Sustainable Palm Oil
CSR	corporate social responsibility
DDE	Dairy Development Executive
DFI	development finance institution
DFS	digital financial services
DJSI	Dow Jones Sustainability Index
DLEC	Developing Local Extension Capacity (project)
DLTP	*Don't Lose the Plot* (reality TV show)

DVD	digital video disc
E&S	environmental and social
ECHOES	Empowering Cocoa Households with Opportunities and Education Solutions
EM	emerging market
EMDE	emerging markets and developing economies
ESG	environmental, social, and governance
EU	European Union
EUCORD	European Cooperative for Rural Development
EY	economic yield
FACT	Forest, Agriculture and Commodity Trade (Dialogue)
FAO	Food and Agriculture Organization (of the United Nations)
FCS	Food Consumption Score
FENAFER	National Federation of Rural Women (Mali)
FENAJER	National Federation of Rural Youth (Mali)
FFO	formal farmer organization
FI	financial institution
FIES	Food Insecurity Experience Scale
fintech	financial technology
FIRA	Fideicomisos Instituidos en Relación con la Agricultura
FLEGT	Forest Law Enforcement, Governance and Trade
FLO	Fairtrade Labelling Organizations International
FMCG	fast-moving consumer goods
FPIC	free prior and informed consent
FRI	Farm Radio International
FSA	Farm Sustainability Assessment
FSC	Forest Stewardship Council
FSP	financial service provider
FTA	free trade agreement
FTAW	Fair Trade Accountability Watch
FTC	farmer training center
FtMA	Farm to Market Alliance
GAFSP	Global Agriculture and Food Security Program
GBV	gender-based violence
GCP	Global Coffee Platform
GDP	gross domestic product
GEMS	Global Environmental Monitoring System
GHG	greenhouse gas
GIS	geographic information system

GIZ	German Agency for International Cooperation (Deutsche Gesellschaft für Internationale Zusammenarbeit)
GLEAM	Global Livestock Environmental Assessment Model
GMAP	Global Map of Environmental and Social Risks in Agro-Commodity Production
GMO	genetically modified organism
GPS	global positioning system
GRSB	Global Roundtable for Sustainable Beef
GS	Guarantee System
$GtCO_2E$	gigaton of carbon dioxide equivalent
GTPS	Brazilian Roundtable on Sustainable Livestock
GTSF	Global Trade Supplier Finance (program)
ha	hectare
HBSC	Heineken Breweries Share Company
HCV	high conservation value
HNT	Health and Nutrition (Program)
IADB	Inter-American Development Bank
ICS	internal control system
ICT	information and communication technology
ICT4Ag	information and communication technology for agriculture
IDH	Sustainable Trade Initiative (Dutch)
IFAT	International Fair Trade Association
IFC	International Finance Corporation
IFG	informal farmer group
IFOAM	International Federation of Organic Agriculture Movements
IFPRI	International Food Policy Research Institute
ILO	International Labour Organization
INP-HB	Institut National Polytechnique Félix Houphouët-Boigny
insurtech	insurance technology firms
IoT	internet of things
IPCC	Intergovernmental Panel on Climate Change
IPO	initial public offering
IPODS	Indonesian Palm Oil Development Scheme for Smallholders (IPODS) (Project)
IRRI	International Rice Research Institute
ISCC	International Sustainability & Carbon Certification

ISEAL	International Social and Environmental Accreditation and Labeling (Alliance)
ISO	International Organization for Standardization
ISSB	International Sustainability Standards Board
IT	information technology
ITC	International Trade Center
ITCZ	Intertropical Convergence Zone
IVR	interactive voice response
KALRO	Kenya Agricultural and Livestock Research Organization
kcal	kilocalorie
kg	kilogram
Kg CO_2 eq	kilograms of CO_2 equivalent
KHCP	Kenya Horticulture Competitiveness Project
KPI	key performance indicator
KYC	know your customer
LAC	Latin America and the Caribbean
LEAF	Linking Environment and Farming
LEAF	Lowering Emissions by Accelerating Forest Finance (Coalition)
LED	low-emission development
LIFT	Leading Innovation and Farmers' Traceability (program)
LMICs	low- and middle-income countries
LSMS	Living Standards Measurement Study
LTG	Loc Troi Group
m^3	cubic meters
M&E	monitoring and evaluation
MC	microcollector
MFI	microfinance institution
MIGA	Multilateral Investment Guarantee Agency
MIS	management information system
ML	machine learning
MM	Musim Mas
MMI	Missing Middle Initiative
MNO	mobile network operator
MOU	memorandum of understanding
MPOA	Malaysian Palm Oil Association
MPOC	Malaysian Palm Oil Council
MSMEs	micro-, small, and medium enterprises

MSP	multistakeholder partnership
$MtCO_2E$	metric ton of carbon dioxide equivalent
MTN	Mobile Network Operators
MK	Malawian kwacha
NBFI	nonbank financial institutions
NBS	nature-based solutions
NERICA	New Rice for Africa
NGO	nongovernmental organization
NO_2	nitrogen dioxide
N_2O	nitrous oxide
OCP	Office Chérifien des Phosphates
OECD	Organisation for Economic Co-operation and Development
OFIS	Olam Farmer Information System
OPEX	operating expenditure
OPHI	Oxford Poverty and Human Development Initiative
P4P	Purchase for Progress
PA	productive alliance
PACT	Paris-Aligned & Climate Transition (Indices)
PAYGO	pay-as-you-go
PCG	partial credit guarantee
PCV	permanent capital vehicle
PDD	Pinduoduo
PE	private equity
PEFC	Program for the Endorsement of Forest Certification
PESTLE	political, economic, social, technological, legal, and environmental
PLP	Production Landscape Program
PO	producer organization
PPP	public-private partnership
PrSW	Private Sector Window
QR	quick response
RAI	responsible agricultural investment
R&D	research and development
RCT	randomized control trial
REDD+	Reduce Emissions from Deforestation and Forest Degradation
RFID	radio frequency ID
RFP	request for proposal
ROI	return on investment
ROSCA	rotating savings and credit association

RSF	risk-sharing facility
RSPO	Roundtable on Sustainable Palm Oil
RSSF	RSPO Smallholder Support Fund
RTRS	Round Table on Responsible Soy (Standard)
SaaS	software-as-a-service
SACCO	savings and credit cooperative
SAI	Sustainable Agriculture Initiative
SAN	Sustainable Agriculture Network
S&P	Standard & Poor's
SANE	Strengthening Agricultural and Nutrition Extension
SARRSB	Southern Africa Region Roundtable for Sustainable Beef
SASSP	Sélection Avicole de la Sarthe et du Sud Ouest
SDGs	Sustainable Development Goals
SHF	smallholder farmer
SHWG	Smallholder Working Group
SIB	Société Ivoirienne de Banque
SMART	specific, measurable, achievable, relevant, and timebound
SMEs	small and medium enterprises
SMS	short message service
SocGen	Société Générale Côte d'Ivoire
SOYPSI	Soy Producer Support Initiative
SRI	socially responsible investing
SRP	Sustainable Rice Platform
SSA	specific surface area
SSA	Sub-Saharan Africa
SSE	Sustainable Stock Exchanges
SWIFT	Survey of Well-Being via Instant and Frequent Tracking
t	metric ton
t/ha	metric ton per hectare
TA	technical assistance
3G	third generation
TRR	Thai Ruang Roong (Group)
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNICA	Brazilian sugarcane industry association

UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
USSD	unstructured supplementary service data
VAS	value-added services
VC	venture capital
VSLA	village savings and loans association
VSA	verified sourcing area
WBA	World Benchmarking Alliance
WCF	World Cocoa Foundation
WEAI	Women's Empowerment in Agriculture Index
WEF	World Economic Forum
WFP	World Food Programme
WFTO	World Fair Trade Organization
WHO	World Health Organization
WII	weather index insurance
WRF	warehouse receipt finance
WRI	World Resources Institute
WWF	World Wildlife Fund
Ya	average yield
YEY	technically efficient yield
Yg	yield gap
Yg-E	exploitable yield gap
Yp	potential yield
Ypi	partially irrigated yield potential
Yw	water-limited yield potential

CHAPTER 1
THE IMPERATIVE FOR CHANGE

Ashley Elliot

KEY MESSAGES

- The overriding tasks for small-scale farming in the coming decade are to complete the transition from semisubsistence to "farming as a family business" and enhance the volume and quality of food production to meet evolving demand, while simultaneously reducing agriculture's environmental footprint and adapting to a changing climate.
- This challenging landscape also presents opportunities for smallholders to join commercial supply chains and contribute to food security, poverty reduction, and economic growth. In the context of scarce arable land and increasing food demand, small farms are set to attract increased investment, while business-model innovations and advances in scale-neutral technologies are expanding the spectrum of opportunities through which both farmers and large-scale firms can benefit from greater engagement. Global stakeholders also increasingly recognize the central role smallholders play as stewards of environmental sustainability and conservation.
- For agribusinesses, the key drivers for working closely with smallholders are to secure supply of produce, capitalize on smallholder advantages in producing certain crops, enhance food quality and safety, and/or generate income by selling inputs and services to farmers. Often, these factors create firm-level incentives to prioritize

investment into smallholder sourcing even where the option of directly owned plantation-based farming is available.

- In addition, supply chain sustainability and equity represent an increasingly important motivation for smallholder engagement. Sustainability issues have become mission critical for farmer-facing firms with the transformation of supply chains by consumer demand for responsible sourcing, the emergence of more differentiated end-markets, the development of new technologies and regulations,[1] and the growing importance of climate and deforestation goals.
- With the spotlight on sustainability, firms with smallholder suppliers are focused on ensuring the following:
  - More complete traceability of supply to safeguard and build brand equity
  - Demonstration of positive social impact in smallholder supply chains—including actions that support farmers to achieve stable living wages and investments that close gender gaps in agricultural value chains
  - Implementation of voluntary certification requirements to unlock access to premium markets and to meet ambitious environmental, social, and governance (ESG) objectives
  - Utilization of smallholder supply arrangements to demonstrate corporate action on climate change, including partnering with smallholders to protect biodiversity and lower carbon footprints.

The Imperative for Change

The global food system is in crisis. The compounding effects of the COVID-19 (Coronavirus) pandemic, the Russian Federation's invasion of Ukraine, and climate change have led to supply disruptions and price rises in fuel, fertilizers, and staple foods such as wheat. In the longer term, one of our greatest challenges will be meeting the food needs of 9.7 billion people by 2050 while simultaneously reducing agriculture's environmental footprint. This will require the sustainable intensification of agriculture: producing more food on less land, with less water, while building resilience to external shocks and climate change.

Across the world's most populous and fast-growing economies, farming remains dominated by smallholders managing farms of two

hectares or less. There are an estimated 608 million smallholder farmers globally, contributing approximately 35 percent of total global food supply (Chang 2022), and about 80 percent of the farms in low- and lower-middle-income countries are smaller than two hectares. These are located predominantly in East Asia and the Pacific, South Asia, and Sub-Saharan Africa (Lowder, Sanchez, and Bertini 2021).

Smallholders typically operate in a semisubsistence mode, with part of the farm's production retained for the farm family's own consumption and part sold commercially to meet cash needs. Because smallholder farming has competitive advantages over industrial farming in certain contexts—often demonstrating higher crop diversity, per capita land productivity, and social and environment impact— many commercially important crops are dependent on smallholder production and supply. These include cocoa, 70 percent of which is produced by smallholders (IISD 2022); coffee, at 60 percent (Siles, Cerdán, and Staver 2022); and cotton, at 75 percent (IDH n.d.); as well as a range of protein-rich pulses, among others. In Africa and Asia, smallholders also produce most of the staple food crops such as maize and rice, which are consumed domestically rather than traded internationally. In addition, smallholder farming accounts for 60 percent of employment in Africa and 50 percent in East Asia and the Pacific, producing up to 70 percent and 80 percent of the food consumed in these regions, respectively. Smallholder farming also takes the largest share in agriculture's contribution to gross domestic product (GDP): 23 percent in Africa and 28 percent in Asia (ADB 2021; Goedde, Ooko-Ombaka, and Pais 2019; IFAD n.d.).

Smallholder Farmers as Change Agents on the Climate Frontline

Over the coming decades, the warming climate will overturn established models of farming and generate unprecedented impetus for global companies, governments, and nonprofits to invest in smallholder supply chain resilience and adaptation. Smallholders stand on the climate frontline in several respects simultaneously—on the one hand, they are set to endure among the earliest and most damaging impacts of climate change, and on the other, they are arguably best positioned to reduce agriculture's contribution to greenhouse gas (GHG) emissions—which currently stands at 24 percent of total global emissions (Tubiello et al. 2014)—leading the transition to sustainable agriculture while growing food output to meet accelerating demand (see box 1.1).

As each chapter in this handbook demonstrates, ensuring an equitable transition to more sustainable and climate-resilient production that

BOX 1.1

Impact of Climate Change on Smallholder Supply Chains

While many in the global agribusiness community appreciate the central role smallholder production and market systems can play in addressing linked climate and biodiversity challenges, a much broader stakeholder community is now recognizing the opportunity to address climate change through empowering small farmers (1) to grow more nutritious and climate-resilient crops and (2) to serve as stewards of biodiversity and climate mitigation. As former United Nations Secretary General Ban Ki Moon stated,

> Around the world, there are more than 500 million smallholder farms, . . . [and] agriculture provides 40 percent of jobs in Sub-Saharan Africa and Asia. Yet smallholders often lack secure land tenure and access to markets and finance. They are also bearing the brunt of multiple crises of climate change, conflict, and economic downturn, as well as the impact of Covid-19. . . . If we want a world free of hunger and poverty while adapting to and mitigating the climate crisis, we need to put smallholder farmers right at the center of our efforts to "build back better."[a]

A growing body of evidence backs this up. A recent meta-analysis published in the journal *Nature*, for example, demonstrated that smaller farms, on average, have higher yields and harbor greater crop and noncrop biodiversity at the farm and landscape scales than do larger farms (Ricciardi et al. 2021).

A Multidimensional Challenge and Opportunity

The multidimensional role smallholder farmers play in the context of the climate crisis can be unpacked into three primary areas:

1. *Food production risk and price volatility:* Smallholders are central to global efforts to prevent the climate crisis from placing the global food system at risk by undermining food production and distribution. Because most small-scale agriculture in emerging markets is rainfed and is configured for past climates, smallholders are highly vulnerable to increasingly common climate stresses such as changing rain patterns; altered seasonality; and more extreme drought, heat, salinity, and weather events. Small-scale farmers do, however, have strong potential to adopt climate-resilient crops and practices, provided the right financing, tools, and services are in place. This will be necessary not just to avoid crop failure and livestock deaths but to reduce climate change–induced price volatility.
2. *Emissions and mitigation:* Although global emission reduction efforts have traditionally focused on energy and transportation, agriculture emits more greenhouse gasses (GHGs)

box continued

BOX 1.1

Impact of Climate Change on Smallholder Supply Chains *(Continued)*

than the world's cars, trucks, trains, and planes combined (figure B1.1.1) (Albright 2014). These include not only carbon dioxide (CO_2) but other GHGs such as methane—a gas that received little attention half a decade ago but is now a key focus of net zero policy. By the same token, however, smallholder farmers are well placed to spearhead many of the solutions that are projected to provide one-third of the climate mitigation needed between now and 2030 to keep global warming below 2°C. (Albright 2014). However, this potential is currently hamstrung by a lack of (1) integrated agricultural development planning and institutional capacities that adequately consider maladaptation risks and investment needs and (2) access to affordable climate finance for farmers and agribusinesses to invest in low-emission practices and technologies, as well as regenerative agriculture and—where applicable—carbon sequestration (GCF 2021).

In principle, the solutions for lowering farmers' environmental footprints exist. The range of options is impressive—including the electrification of on-farm machinery and improved equipment maintenance, low or no tillage and dry direct-seeding practices, breeding and genetic selection focused on reducing GHGs, controlled-release and stabilized fertilizer applications, conversion from flood to drip or sprinkler irrigation, animal feed mix optimization, and sector-specific interventions such as optimal varietal selection and improved straw and paddy management in the rice sector. Indeed, one recent survey concluded that "if implemented at scale, several existing practices could reduce emissions from animal, rice, and crop production by about 20 to 25 percent of annual agricultural production emissions; [and] if all the available GHG-efficient production practices were implemented at full scale, the global food system could see cost savings of more than US$50 billion annually" (Bora and Prabhala 2020).

FIGURE B.1.1.1 Major Contributors to Agriculture Emissions

Major contributors to agriculture emissions include:

Source: Aminetzah et al. 2019.

box continued

BOX 1.1

Impact of Climate Change on Smallholder Supply Chains *(Continued)*

The challenge, however, is the cost and sequencing of investment. The return on investment for small-scale farmers on most of these GHG-efficient practices is currently unattractive, given that costs are high compared to the economic benefit delivered. This is especially true of animal protein production, for example. As such, large-scale and well-coordinated investments in supporting technology, infrastructure, and financing will be required to reduce the cost to a level that makes financial sense for farmers. And even where farm-level investments in GHG-efficient farming practices are net profitable, external support will often be required to address cash-flow challenges (that is, high up-front costs) (Bora and Prabhala 2020).

3. *Biodiversity preservation and loss:* A large proportion of small farms already grow a more diverse range of crops than larger commercial farms; they are thus in a position to help reverse the abrupt global decline in nature and biodiversity witnessed over recent decades. This is especially important in the face of mounting evidence that climate change and threats to biodiversity will fall hardest on smallholder agriculture-focused regions like Sub-Saharan Africa, East Asia and the Pacific, South Asia, and Latin America—regions that host the planet's richest carbon sinks (including tropical and old-growth forests) and most biodiverse wetlands, peat lands, mangroves, and marine ecosystems.

a. The quotation is from Ban Ki-Moon (2021) and has been edited for brevity.

meets the world's food and commodity needs cannot be achieved without unlocking the full potential of smallholder farming communities. Effectively mobilizing and coordinating the investments required to do so represents perhaps the most pressing challenge facing the global food system today.

Smallholder Livelihood Strategies In a Changing World

A significant, underappreciated attribute of the small farms that produce four-fifths of all food consumed in developing countries is their ability to mitigate and manage risks in a changing agricultural system (Chikava 2021; FAO 2011). Strong knowledge of local growing and market conditions, combined with flexible and motivated family labor, can enable smallholder farmers to manage change while generating per-unit farm output that often exceeds the efficiency of larger farms (Fan and Rue 2020). This resilience and adaptability has never been more necessary: across every continent and crop category,

smallholder farming now faces an unprecedented moment of crisis and transition—driven by a confluence of long-standing constraints and emergent threats.

Challenges that can undermine smallholder livelihood strategies include the following:

- *Overreliance on traditional cultivation methods*, some of which degrade soil fertility and cause erosion
- *Limited physical and economic access to markets*, which is compounded by a lack of modernized storage infrastructure, high transport costs in rural areas, and poor access to market and price information
- *Low organization at the production level*, with only about 19 percent of Latin American farmers, 14 percent of Asian farmers, and 7 percent of African farmers being members of agricultural cooperatives, which could improve market access through collective ownership of trucks and storage facilities
- *Land insecurity*, including a lack of formal land title ownership, which makes it difficult for smallholders to consolidate landholdings or use their land as collateral for financing
- *Weak access to credit* due to farmers' poor collateral and the seasonality of their produce, among other factors
- *Low literacy and numeracy*, as many smallholders have little formal education, which limits their ability to keep adequate written records or educate themselves about improved agricultural practices
- *Inefficient intercropping techniques,* because subsistence and cash crop cultivation are often combined on the same farm in ways that can reduce marketable yields

Against the backdrop of these constraints around human capital and market infrastructure, a set of more dynamic and largely external threats is emerging related to demographics, urbanization, market volatility, and—above all—climate and biodiversity. These evolving trends have the potential to destabilize traditional smallholder farming methods at increasing speed, creating a time-bound imperative to transition to a food system based on more sustainable, adaptable, and market-integrated models.

As outlined in box 1.1, climate change represents the first and most consequential threat to the status quo. Smallholders who rely on traditional cultivation techniques face enormous challenges as they try to adapt to the accelerating impacts of changing weather patterns, heat stress, water

scarcity, environmental degradation, extremes of weather, and heightened crop pest and disease incidence. As climate change reconfigures the growing conditions of entire regions, unpredictable rainy seasons reduce farmers' confidence in planting crops at the traditional time. Traditional varieties may produce low yields or fail altogether during drought or flooding. Changes in temperature and humidity increase the prevalence of pests and diseases, such as maize lethal necrosis and fall armyworm, while smallholders who rely on groundwater for irrigation increasingly find that water tables are dropping beyond their reach. Unless these threats are proactively mitigated, average global crop yields for maize, for example, may see a decrease of 24 percent by late century, if current climate change trends continue (SubbaRao and Jaegermeyer 2022).

In Africa, the agricultural zones that currently account for 70 percent of crop production by value are likely to be devastated by severe or extreme aridity and heat stress by 2050. This pace of change means that "rising temperatures, shifting weather patterns, and the more extreme weather events accompanying climate change are transforming conditions faster than many smallholder farmers can possibly keep up with" (Chikava 2021).

A second and related trend is increasingly poor soil fertility. Most smallholders live in tropical zones with naturally low soil fertility and high acidity. Farmers have further stripped nutrients from the soil during decades of harvests with inadequate fertilizer use, and many smallholders do not know how to improve their soil fertility because they lack an understanding of soil systems and have inadequate soil testing services. Again, it is the African continent where these challenges appear most pronounced: some 46 percent of Africa's land area suffers from degradation, affecting at least 485 million people and costing US$9.3 billion per year, according to the Intergovernmental Panel on Climate Change (IPCC). Approximately 75 percent of land under cultivation faces the threat of degradation, with losses of 30 to 60 kilograms of nutrients per hectare, per year (Sakho-Jimbira and Hathie 2020).

Third, the population of smallholder farmers is aging. With alternative economic opportunities available to youth in urban areas, traditional farming methods have lost their appeal among the next generation. Moreover, population growth compounds the challenge of making farm ownership and management attractive to the next generation—for example, the shrinking size of farms owing to growing rural population density and fragmentation due to inheritance can force smallholders to cultivate their fields continuously, thus worsening already severe soil fertility issues (Sakho-Jimbira and Hathie 2020).

Fourth, the frequency and severity of global economic shocks is increasing, with cascading impacts on smallholders. The COVID-19 pandemic placed more than 30 million people in extreme poverty, redoubling the significance of small-scale agriculture as a pathway out of poverty—in particular in developing countries where growth in agriculture can reduce poverty more than twice as fast as growth in nonagricultural sectors (Chikava 2021). The pandemic also dislocated essential supply chains and temporarily choked off access to key end-markets for farmers' produce in countries where movement restrictions were imposed. Meanwhile, Russia's unprovoked invasion of Ukraine has caused a sharp spike in fertilizer prices, leading to fertilizer shortages that could prompt a decline in food production across Africa of up to 20 percent (Shah 2022).

The final trend line with accelerating impacts on smallholder farming is the requirement to adjust agricultural systems to meet the increased food demands of a growing and more urbanized population. With a global population that is projected to reach 9 billion by 2050 and more than 11 billion by the end of the century (UNDESA n.d.), vast changes will be needed to ensure existing food systems can meet a projected doubling of demand for agricultural crops by mid-century. Enhancements in not just quantity but quality will be required. Food production will need to provide sufficient carbohydrates, proteins, and fats for the estimated 870 million people who currently lack food security. Concurrently, rising incomes and urbanization will drive increased consumption of meat, dairy, and biofuels. This is especially the case in Africa and Asia, the two fastest urbanizing continents.

The Transition to Efficient, Resilient, and Inclusive Food Systems

Despite the breadth and severity of the challenges facing traditional models of small-scale farming, the changing landscape also presents opportunities for smallholders to join global supply chains and contribute to food security, poverty reduction, and economic growth. In a global context of scarce arable land and increasing food demand, smallholders are set to attract greater investment from large-scale firms than ever before. Meanwhile, business model innovations and advances in scale-neutral technologies are expanding the spectrum of opportunities where both farmers and firms can benefit from greater engagement. Perhaps most importantly, all key stakeholders—from global consumers to corporates and regulators—are increasingly recognizing the central role smallholders have to play as stewards of environmental

sustainability, conservation, and diversification, including in the world's most important and biodiverse ecosystems.

In the following section as well as following chapters, this handbook explains how the same pressures driving the smallholder transition are also strengthening the case for agribusinesses to invest in smallholder supply chains, creating unique opportunities to solve many of the pressing challenges confronting the global food system this century.

Firm-Level Incentives for Investing in Smallholder Supply Chains

Key Drivers

Key drivers incentivizing agribusinesses to work with smallholders include the need to do the following:

- Meet growing global food demand by capitalizing on smallholder competitive advantages
- Boost produce quality and prevent contamination and food-borne illness
- Respond to demand for increased sustainability
- Access relatively untapped markets for inputs and services in developing and emerging markets

Driven by these incentives, a wide range of firms have developed models of direct engagement with smallholder farmers—not only specialist agribusinesses, consumer-facing brands and publicly listed companies, but also entities often typecast in the past as "intermediaries," such as commodity and trading companies. Indeed, several global commodity houses are today at the vanguard of efforts to build mutually beneficial on-the-ground smallholder relationships in developing countries.

Meeting Demand and Securing Supply

For firms needing to secure a supply of agricultural commodities—in terms of volume, quality, and consistency—smallholders often represent the most viable means for increased sourcing. In crops such as cocoa, coffee, and cotton, smallholders are the main source of supply, so firms must—by default—work closely with smallholders to access meaningful

volumes. In the case of cocoa, 70 percent of the world's US$9 billion annual output is produced by hand by smallholders (Voora, Bermúdez, and Larrea 2019); while in the coffee sector, 80 percent of production is accounted for by the industry's 25 million smallholder farmers worldwide (Fairtrade Foundation 2022).

For other crops, when production is split between smallholder and larger-scale commercial farming, the most frequently cited reasons for firms to purchase from smallholders include the following:

- Access to enhanced supply volumes
- Lower purchasing costs
- Higher sales prices for end products derived from smallholder-produced crops (TechnoServe 2021)

Across the board, a key long-run structural trend incentivizing firms to work with smallholders is the growing level of global food demand—set to double by 2050 (Albright 2014)—in the context of constrained arable land availability. Much of the world's 1.4 billion hectares of suitable arable land not yet used for crop production is concentrated in just seven countries,[2] and competition to secure supply within food value chains builds every year, as world demand for crops outpaces the much slower rate of expansion in crop area.[3]

There is considerable scope to increase yields among the world's 500 million smallholders, and with increasing pressure to meet the demand for raw materials through higher yields and cropping intensity, smallholder agriculture is becoming more and more important in global supply chains (box 1.2). These farms produce roughly one-third of global food—including 75 percent of dairy production, 60 percent of meat supply, and 50 percent of world cereal supply (Dioula et al. 2013).

The question for an increasing proportion of global firms operating in food supply chains—from integrated agribusinesses to consumer goods conglomerates—is therefore, not whether, but how they should invest in direct and structured off-taker arrangements with smallholder farmers.

Moreover, in sectors where smallholders dominate production, the farmer population is invariably aging, with many young people choosing to migrate to urban areas. This dynamic creates further pressure to enhance productivity through investment in strengthened smallholder supply chains in order to maintain production volumes.

BOX 1.2

Smallholder Farming Makes an Outsized Contribution in Markets Where Demand Is Growing Fastest

Smallholder farming occupies the largest share of agricultural land and food production in the markets across Africa and Asia where food demand is set to increase most dramatically. In a global food system where 85 percent of food is produced in the country where it is consumed, agricultural output in Sub-Saharan Africa and South Asia will need to more than double by 2050 to meet increased demand, compared to a global average increase of one-third above current levels (FAO 2017).

Agriculture represents a high percentage of GDP in most African and Asian economies (between 15 percent and 30 percent, respectively, compared to a global average of 4 percent) and accounts for approximately 40 percent of jobs (Ban Ki-Moon 2021). In China, nearly 98 percent of farmers cultivate farms of two hectares or less, while in large African markets such as Egypt and Ethiopia, nearly 90 percent of farms are smallholdings. In India this figure drops to 80 percent, and in Latin America, the proportion falls to between 20 percent in Brazil and 50 percent in Mexico (Rapsomanikis 2015).

Even in agricultural sectors where large-scale farms are an available option to source from, smallholders can in some circumstances be more efficient and effective. The reasons include the following:

- Lower costs of labor supervision—that is, smallholders are their own supervisors and generally rely on highly motivated family labor
- Greater ability to bring a differentiated product to market (such as higher-quality or niche-market products destined for fair-trade, organic, or boutique markets)
- Production efficiencies in crops with high seasonality
- Lower fixed costs in crops that lack any preexisting medium- or large-scale supply base
- Smallholder access to subsidized government or nongovernmental organization (NGO)–provided resources not available to large-scale farms
- Intensive local, often hyperlocal, knowledge—around soil and growing conditions, for example
- Greater resilience in the face of weather shocks and other external shocks that may induce crop failure, given the risk-reducing effect of smallholders' geographic dispersion

Sectors where one or more of these competitive advantages often apply, thereby bringing smallholder production to the fore despite the presence of alternative options, include the cut flowers industry, the dairy sector, and high-value fruit and vegetable crops produced for export.

However, it should be noted that agronomic characteristics and return-on-investment (ROI) dynamics render it challenging in some crop categories for firms to invest in deep working relationships with smallholders. For example, the agronomic maturity profile of certain agroforestry and tree crops creates a significant, multiyear time lag between cost outlays to implement inclusive sourcing models and tangible financial results. This gap can be bridged in some instances via innovative financing mechanisms or partnerships with NGOs and "ecosystem connectors,"[4] but the underlying point remains valid—namely, that smallholder sourcing may not be profitable and viable in all cases, given the cost and complexity of managing supply from large numbers of small producers. This highlights the importance of using a pilot to test assumptions when developing a smallholder sourcing model, as well as the need to keep costs low and technologies simple and user-friendly, while ensuring there is strong management buy-in across the implementing organization (extending beyond country units and sustainability teams to include central finance, legal, marketing, and executive functions).

Mitigating Risks Associated with Land Deals

In crop categories and geographies where large-scale plantation-based farming is theoretically feasible, the desire to avoid potential legal, operational, and reputational risks associated with large-scale land ownership can tilt the balance of risk/reward in favor of investing in smallholder supply chains. As one flagship study observed, "alternatives to smallholder production models, such as plantations, carry their own unique operational risks and costs that smallholder sourcing can mitigate" (TechnoServe 2021). Lack of available arable land and, in many places, local resistance to large-scale privatization of land represent an increasingly common impediment to establishing large-scale farming models. In this context, it is often less costly and less risky to source from smallholders for a defined and profitable market opportunity than to invest directly in new, capital-intensive plantations.

The decision to source from smallholders frees up capital that otherwise would be locked into long-term land deals, while also creating flexibility to increase or decrease production without incurring high

fixed costs. More importantly, it ensures diversity in the supply base, thereby averting a scenario in which interruption at a single large plantation chokes off a substantive proportion of supply volume. And as foreign ownership of plantation land becomes more complex and contested in many developing countries, such scenarios become more common. In Africa, for example, one recent study highlighted that while the continent "continues to be highly targeted for large agricultural land deals, with more than 420 deals comprising 10 million hectares completed between 2000 and 2016, few of the deals have gone into implementation, and the simple numbers suggest that land expansion will not be a major factor in increased production" (Goedde, Ooko-Ombaka, and Pais 2019).

Commonly arising risk factors associated with direct corporate ownership of large-scale farms in developing and emerging markets include the following:

- Opaque land registration processes that create uncertainty over enforcement of rights
- The risk of land title revocation or contract frustration in an evolving political and policy environment
- Differing interpretations of land rights between central and local governments
- Tensions over shared land and resource use relating to customary land rights, water access, and pastoralist groups, among other factors

Across the board, these risks are typically higher for foreign land buyers than local owners.[5]

Unlocking the Market for Smallholder-Focused Agricultural Inputs and Services

Smallholders' share of market demand in input markets is expanding, as is their need for technical advice and technology-enabled market access channels. For providers of agri-inputs, financial services, or market information and integration services, the business case for smallholder engagement is driven by the opportunity of reaching a large-scale—albeit fragmented—customer base at service delivery costs that become more manageable year-on-year thanks to improved backbone connectivity infrastructure in emerging markets (EMs) and higher levels of farmer adoption of mobile technology. Although individual farmers' needs may be small, as members of farmer cooperatives, they can command

significant buying power—and as chapter 4, "AgTech," in this handbook shows, technology platforms are increasingly able to aggregate a geographically dispersed user base. Increasing the use of technology could also attract the next generation to take over family farms and run them more professionally and productively.

In addition, for global firms seeking to tap into the food or feed sales potential of the domestic and subregional marketplace in EMs, local sourcing may be their most competitive option. This dynamic is potentially reinforced by (1) the advantages of shortened supply chains in a global economy susceptible to cross-border supply disruption caused by shocks such as COVID-19 or so-called trade wars and (2) the proliferation of regional trade agreements and tariff regimes within EM regions, such as the African Continental Free Trade Area (AfCFTA) agreement inaugurated in January 2021, which aims to connect 1.3 billion people across 55 countries with a combined GDP of US$3.4 trillion (Maliszewska et al. 2020).

Ensuring Food Quality and Safety

Investing in more closely integrated working relationships with smallholders can also enable agribusinesses to boost produce quality and prevent contamination and food-borne illness, as robust and transparent smallholder supply chains allow for traceability and direct monitoring of standards compliance.

Contaminated foods cause an estimated 1.5 billion illnesses and 3.0 million deaths per year worldwide, with the most frequent causes of foodborne illness being diarrheal disease agents, particularly norovirus and *Campylobacter spp*. (WHO 2015). While the number of officially reported and documented incidents is much lower, the reputational risk for firms and the potential for economic losses are significant. Understanding and mitigating risks to food safety is therefore a key priority, and often a legal requirement, for firms.

Food contamination can occur during production, post-harvest, or processing. For example, a common food safety concern is unapproved or improperly used pesticides. Another concern is aflatoxin, a carcinogen produced by mold that grows on improperly dried or handled crops. The toxin can also be transmitted to livestock through contaminated feed. In the Kenyan market, for example, maize contaminated with aflatoxin has caused several hundred cases of liver failure and more than 150 deaths across multiple incidents in recent

decades, presenting major health risks to consumers as well as a liability to suppliers and buyers.[6]

Firms that engage with smallholders to develop traceable supply chains are better able to monitor all the steps involved in production, harvest, and processing, ensuring a complete picture of product origin and flow. When problems are detected, such as improper crop drying that could result in mold growth and aflatoxin formation, firms will already have systems in place to train farmers rapidly and effectively on improved practices.

Moreover, advances in technology (covered in detail in chapter 4) are expanding the scope of the opportunity to increase transparency in smallholder supply chains. New mobile-friendly digital applications and emerging data generation, processing, and analytics capabilities can enable real-time visibility and verification of smallholder produce at low cost, not only ensuring safety and compliance, but also opening up the ability for firms to reward small-scale farmers and cooperatives with premium prices for high-quality products (Marie 2022). A recently launched blockchain-based application, developed by IBM and Farmer Connect, focused on coffee and cocoa production in Latin America, provides just one example among many other emerging applications demonstrating the potential for technology to enhance to supply chain traceability and sourcing (Marie 2022).

Responding to Demand for Increased Sustainability

While the traditional drivers for smallholder engagement relating to the security, price, quality, and safety of supply still hold, what has changed markedly since the previous edition of this handbook is the step-change increase in attention given to sustainability as a component of the business case for strengthening smallholder supply chains. Previously deemed "nice to have" by some global firms, sustainability credentials have become mission critical as food supply chains are transformed by the following:

- *Growing consumer demand for responsible sourcing, positive social impacts, and a fairer distribution of value through the supply chain:* This entails actions that support farmers to achieve stable living wages and improved labor conditions, and investments that close gender gaps in agricultural value chains (for example, targeting increased incomes and asset ownership in women-run farms).
- *The emergence of less commoditized and more differentiated end markets for agricultural products:* This gives rise to certification price premiums

as well as commodity branding that spotlights the role of small-scale farmers.

- *Increased prominence and expectations around corporate action on climate goals:* These exist alongside recognition of the role smallholders play both as stewards of biodiversity and as victims of adverse climate impacts.[7]
- *The emergence of new technologies, regulations, and global initiatives that mainstream sustainability into food and agriculture markets*
- *Growing opportunities for firms to access lower costs of capital:* These forms would demonstrate measurable positive social impacts in their supply chain, thanks to the mainstreaming of impact investing and development finance tools such as blended finance (see chapter 14, "Future Outlook") (TechnoServe 2021).

Taken together, these factors mean that market access for agribusinesses is, to an increasing extent, directly linked to the scale and suitability of companies' investments in sustainability and inclusion. See box 1.3. for an example.

BOX 1.3

Sustainability Innovation Drives Structural Change in Palm Oil Markets

Sustainability is moving into the spotlight in some value chains faster than others. So-called forest risk commodities such as soya, livestock, palm oil, and cocoa, alongside a range of brand-led niche commodities, are in the vanguard. Several recent pieces of global legislation introduce mandatory supply-chain due diligence for these commodities, as detailed in chapter 7, "Managing Risk for Sustainability and Resilience," with additional impetus provided by the 2021 Glasgow Leaders' Declaration on Forests and Land Use, in which some 141 countries—accounting for about 90 percent of global forest cover—committed to halt and reverse deforestation and land degradation by 2030.[a]

The palm oil sector, where consumer and investor pressure has prompted some producers to abandon environmentally and socially damaging sourcing practices, presents a tangible example. Zero deforestation is now a stated commitment among most leading palm oil suppliers, and palm oil deforestation has been trending downward every year over the past half decade, even as deforestation for soy and beef production continues to rise.[b]

box continued

BOX 1.3

Sustainability Innovation Drives Structural Change in Palm Oil Markets *(Continued)*

Many leading integrated palm oil firms now maintain a dedicated sustainability office with board-level representation, supported both by dedicated field staff residents on the company's estates and by accredited independent sustainability specialists. These investments into a more sustainable sourcing model also benefit companies' bottom line: According to the World Wildlife Fund (WWF), many palm oil companies have secured substantial benefits via the price premiums available for sustainable sourcing, including through the *certified sustainable* scheme by the Center for Sustainable Palm Oil (CSPO) overseen by the Roundtable on Sustainable Palm Oil (RSPO) and backed by independent field-level verification.[c] While imperfect, this structural shift in the market for one of the world's largest cash crops demonstrates how companies can effectively differentiate themselves by collaborating around long-term sustainability objectives (Funk 2021).

a. Glasgow Leaders' Declaration on Forests and Land Use (accessed May 25, 2022), https://ukcop26.org/glasgow-leaders-declaration-on-forests-and-land-use/.
b. World Resources Institute, 2020, cited in Funk (2021).
c. For more information visit RSPO's website, https://rspo.org/who-we-are/.

From the perspective of large-scale food and agriculture companies, the just-listed trends bringing sustainability into the mainstream translate into the following supply chain investment priorities:

- Investments in smallholder supply arrangements that enhance *traceability of supply* to protect and build the firm's brand equity and to mitigate environmental and social risks such as *deforestation and child labor*
- Investments in hands-on operating models that ensure smallholder supply arrangements meet *sustainability standards and certification requirements* in order to unlock access to premium end-markets[8]
- Provision of technical assistance and capacity building for smallholder suppliers to *adapt to climate change* and other external shocks
- Rollout of more *agile procurement processes* to match fast-evolving consumer trends, ensure greater product differentiation, and accelerate speed to market
- Investments to unlock *new revenue streams or sources of funding* created through partnerships with smallholders on large-scale landscape-based projects focused on biodiversity preservation and carbon sequestration (see chapter 12)

Of these priorities, the opportunity to partner with smallholders on carbon projects—projects designed to achieve quantified and documented reduction or sequestration of atmospheric carbon—is perhaps the most recent and transformational. While many in the global agribusiness community appreciate the central role that smallholder production and market systems can play in addressing linked climate and biodiversity challenges, a much broader stakeholder community is now recognizing the opportunity to address climate change through empowering small farmers to serve as stewards of biodiversity and climate mitigation. As the World Economic Forum has stated, "Smallholder farms are central to restoring the health of our planet and stemming climate change. . . . [S]ome of the best investments we can make to combat climate change are in sustainable agriculture and small farms [in Africa]" (WEF 2021). Chapters 12 and 13 and box 1.4 explore the opportunity for smallholder participation in carbon projects in detail, highlighting the emergence of

BOX 1.4

Carbon Markets: A Growing Commercial Opportunity for Farmer-Facing Agribusinesses

As frameworks for farmer-focused climate finance and carbon projects mature, we anticipate a step-change increase in commitments from the public and philanthropic sectors to promote private-sector engagement with smallholders, including via funding for public-private partnerships. This represents significant commercial opportunities for agribusinesses that are invested in deep, structured smallholder relationships to develop new revenue streams while also boosting smallholder incomes and capabilities. Indeed, globally and regionally integrated food and agriculture companies often represent the most organized, well-funded, and trusted of all farmer-facing institutions, as they have relatively long-term investment horizons and a mutual interest in delivering the technical assistance and infrastructure required for small-scale producers to cope with a changing climate. As one investor focused on deploying patient capital into African agricultural markets observed, "The private sector can be a highly effective mechanism for delivering support—responsible companies whose own financial performance depends on improving the local farmers' yields and quality in a sustainable way."[a]

Practical examples include, but are not limited to, the following:

- Training on improved agricultural practices to safeguard and improve smallholder productivity in the context of increasingly unpredictable weather

box continued

BOX 1.4

Carbon Markets: A Growing Commercial Opportunity for Farmer-Facing Agribusinesses *(Continued)*

- Technical assistance to switch to lower emission cropping practices (for example, upland rice production as a lower methane alternative)
- Introduction of new products and varieties to diversify what small-scale farmers produce, in order to reduce the concentration of climate-related risks
- Investment into modernized storage and locally based processing to limit postharvest losses
- Access to improved inputs tailored to boost climate resilience
- Provision of real-time market and weather information to manage volatility

Brokering of carbon project development platforms brings together three key stakeholders: global investors specializing in carbon projects, agribusinesses, and smallholder farming communities. This type of partnership has the potential to generate a pipeline of investable carbon projects that deliver not only new revenue streams for agribusinesses and smallholders but also real, permanent, and verifiable reductions in GHGs—for example, through habitat restoration activities where farming communities play a custodial or stewardship role.

a. See https://www.agdevco.com/news/article-tackling-the-impacts-of-climate-change-in-africa-can-improve-agricultural-production-and-get-more-cash-into-the-pockets/.

both farmer-led carbon projects and nature-based solutions (NBS), an approach to protecting, restoring, and managing the world's most climate-critical ecosystems in a sustainable and market-oriented way.

Food and Agriculture Companies Are Approaching a Tipping Point on Sustainability

Table 1.1 illustrates the greater prominence of sustainability goals in firm-level decision making on smallholder sourcing models across a range of areas, with gray text representing the traditional, long-standing benefits of working with smallholders and blue text representing emergent opportunities linked to the rise of sustainability issues or new technologies.

In summary, while pressures to increase sustainability have existed for decades, they have in the past often been confined to the back pages of company annual reports—to be addressed under a "Corporate Social Responsibility" heading. Today, by contrast, the global food system stands at a tipping point where firms with a leadership position[9] on

TABLE 1.1 The Benefits of Working with Smallholders

Firm type	Short-term benefits	Medium-term benefits	Long-term benefits
Input and equipment suppliers	• Increased sales • More effective use of inputs, leading to a preference for genuine products, which may be more costly than counterfeits	• More efficient distribution through groups • Opportunity to sell tailored and higher value products based on customer insights (for example, biopesticides, soil-specific fertilizers) • Opportunities to sell precision agriculture technologies that enhance input use, such as soil and moisture sensors	• Markets for new products designed for smallholders • Localized market intelligence on how climate shocks are changing farmer needs and product requirements • Growing market for modular mechanized equipment, internet of things (IoT)–enabled connected assets
Financial institutions	• Large numbers of potential customers in untapped segments of the population • Ensuring robust sustainability credentials and compliance with environmental, social, and governance lending criteria and whole-of-supply chain know your client requirements	• Development of out-grower arrangements to facilitate repayment • Retaining support from socially and environmentally conscious stakeholders or counterparties	• Accessing underserved segments in smallholder agriculture through new digital financial services (credit, insurance, savings, and so on), enabled by improved connectivity infrastructure and digital literacy • Loyalty among emerging medium-scale farmers
Agricultural information, technology, and training providers	• Large numbers of potential customers, reachable via mobile-enabled technology • Data as an asset class in its own right	• Partnership with off-takers or input suppliers who pay for services • Value chain integration opportunity by leveraging connectivity infrastructure and digital financial services to match previously fragmented supply with a fragmented buyer-vendor landscape	• Access to real-time data needed to develop more precise and efficient farming techniques • Potential to build "super platforms," that is, online marketplaces that generate revenue not just from users but also by taking a share of the value (for example, access fees, advertising) created for intermediaries and partners

table continued

TABLE 1.1 The Benefits of Working with Smallholders *(Continued)*

Firm type	Short-term benefits	Medium-term benefits	Long-term benefits
Off-takers and processors	• Greater production for the same area • Better quality • More efficient logistics • Agility and responsiveness in procurement processes to match evolving consumer trends (including demand for greater value chain transparency)	• Access to premium end markets through effective participation in traceability and certification schemes • Reduced environmental and social risk • Preemptively addressing food safety and animal welfare concerns • Product or brand differentiation and access to premium markets	• Stability of supply • Increased supplier loyalty • Addressing fragility in the supply chain by partnering on climate adaptation

Source: Original table for this book provided by IFC.
Note: Blue text represents emergent opportunities linked to the rise of sustainability issues or new technologies. Gray text represents the traditional, long-standing benefits of working with smallholders.

sustainability can unlock material commercial opportunities (from premium market access to enhanced positioning in the competition to secure scarce supply). Companies that are slow to change increasingly face binding constraints to market access, supply chain stability, and even long-term financing options.

Notes

1. Chapter 4, "AgTech," maps out the fast-evolving landscape for new agricultural technologies, assessing the potential for tech-enabled business models to transform smallholder supply chains at scale across emerging markets.
2. The seven countries are Angola, Argentina, Brazil, China, the Democratic Republic of Congo, Mozambique, and Sudan. Much of this theoretically suitable land is located in fragile sociopolitical environments and far from ports and roads.
3. World demand for staple crops is projected to grow by 60 percent by 2050 (using 2010 as a baseline), while crop area is likely to grow by only 10 percent (Fischer, Byerlee, and Edmeades 2014).
4. One recent study observed that "Investors should consider establishing agricultural investment vehicles with longer investment horizons than the typical Venture Capital or Private Equity timeframes. An example of such a structure is a Permanent Capital Vehicle (PCV) which has no set time for exiting an investment. PCVs provide the time and flexibility for investments to generate returns at their own rate which can be an agronomic necessity" (TechnoServe 2021). The same study notes the rise of "ecosystem connectors and intermediaries" that advise public, private, and philanthropic partners on knowledge sharing in smallholder

supply chains. Examples highlighted include the Sustainable Trade Initiative (IDH) "Farmfit and their work on Service Delivery Models; Bain and Company, who have recently published about Farmer Allied Intermediaries; and TechnoServe and their work on inclusive supply chains. These same organisations, along with ISF Advisors and the Mastercard Foundation Rural and Agricultural Finance Learning Lab, have begun advancing typologies to best understand business and sourcing models in the context of their value chains (TechnoServe 2021).

5. Some of these risks apply equally to smallholders, many of whom face insecure land tenure due to the lack of digitized land registration systems. Nevertheless, from the perspective of global firms seeking to secure supply, it is often advantageous to work via smallholders and cooperatives rather than investing directly into plantation land deals.
6. In 2021, the government of Kenya temporarily banned importation of maize from neighboring countries in an effort to address aflatoxin contamination, illustrating how food safety issues can also impose barriers to cross-border agricultural trade.
7. According to a study in the *Harvard Business Review*, in the "agriculture, food, and beverage sector, the impacts of climate change have the potential to alter growing conditions and seasons, increase pests and disease, and decrease crop yields. Disruptions in the supply chain may affect production processes that depend on unpriced natural capital assets such as biodiversity, groundwater, clean air, and climate." The article cites the Rainforest Alliance certification as an example of how large corporations seek to address these threats along their supply chain, noting that "companies like Mars, Unilever, and Nespresso have invested in Rainforest Alliance certification to help farmers deal with climate volatility, reduce land degradation, and increase resilience to drought and humidity" (Whelan and Fink 2016).
8. It is important to note that shareholder-driven environmental, social, and governance (ESG) objectives and requirements often surpass the minimum requirements for voluntary certification schemes and/or for regulations in countries where production is located.
9. See the website of the World Benchmarking Alliance. https://www.worldbenchmarkingalliance.org/.

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CHAPTER 2
YIELD GAPS

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KEY MESSAGES

- This chapter is intended for farmers, field agents, project designers, and agribusiness supply chain operators seeking to understand what drives production performance more completely and to accurately estimate potential yield, yield gaps, and potential performance. Readers will learn:
  - What a yield gap is, why it is important to consider yield gaps, and a practical yield gap measure to use
  - What some of the major factors are that influence agricultural performance and hence yield gaps; in other words, the context in which yield gaps need to be considered when targeting the gaps and their reduction
  - What some of the key academic research says about yield gaps
  - What some of the sources are for comparison of production performance
  - How to frame the factors that influence yield gaps
  - Practical cases that illustrate the factors

Background

This chapter is intended for farmers, field agents, project designers, and agribusiness supply chain operators seeking to understand what drives production performance and how to accurately estimate potential yield (quantitative), yield gaps, and potential performance (qualitative and quantitative). The notion of an agricultural yield gap often frames the discussion about the potential or necessary increase in yield to reach some outcome per land unit, generally in metric tons (t) per acre or hectare (ha). That framing differs between agronomists and economists, and between academic measurement and practical application. For instance, "agronomic assessments of the yield gap tend to focus on the biophysical and physiological determinants of crop production, but they do not account for socioeconomic constraints such as prevailing market conditions, infrastructure, risk attitude, and institutions. Economists, in contrast, emphasize the role of prices, markets, and efficiency as determinants of agricultural production, but they often fail to take into account the biophysical opportunities and constraints that are highly locally specific" (van Djik et al. 2017, 90). Recognizing the increasing global demand for food crops, some have suggested moving from outcome per land unit to number of people nourished per land unit (Cassidy et al. 2013), among other variations.

This chapter relies on a particular measure of yield gap, that is, *achievable yield gap*, and explores how to define it and reduce the gap by identifying and addressing contributing factors. Whether and how much yield gaps can be reduced depends on understanding what drives yield gaps and whether the interests of all parties can be aligned. The definition of achievable yield gap provides a practical target that is essential for identifying cause and effect when planning how to reduce the yield gap.

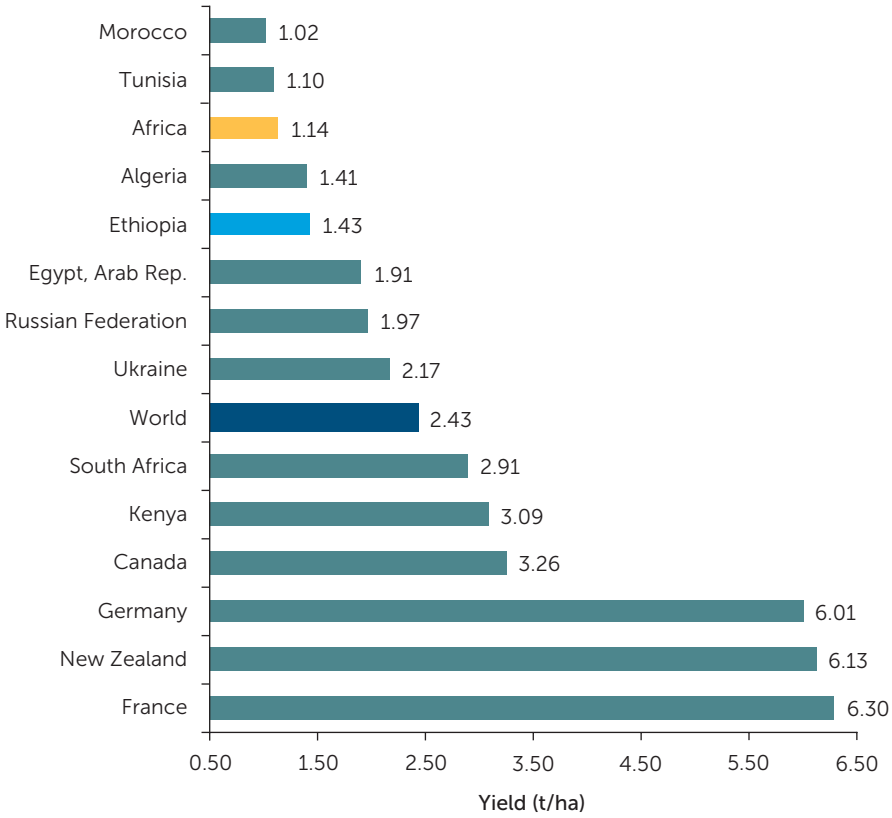
Establishing realistic goals is an essential first step when designing and implementing approaches to reducing a yield gap in a given period of time. Comparing yields across countries, across regions within a country, or to a global average may identify a substantial gap. Stakeholders seek to reduce yield gaps in as short a time as possible; however, substantial improvements in very short time periods are frequently unrealistic or unsustainable. For instance, yields are highly unlikely to double in a year, two years, or even three years through typical interventions based on measures including training. Behavioral change, rehabilitation of land, and establishment of new production systems typically take years. Increases from paradigm shifts or new technologies are possible, but even in these cases, ongoing mentoring and support are usually needed

to sustain yield increases and ensure adoption of operational changes. Fertilizers are also frequently sought as a quick solution and, while contributing to yield improvements, excessive use of fertilizers exposes farmers and their environment to risks such as soil damage, contamination, and greenhouse gas (GHG) emissions. Decisions about interventions should therefore consider both short- and long-term consequences. Sustainable changes entail the expectation that small immediate increases in yield will build, harvest by harvest, and as various factors constraining them are addressed.

The barley yields in Ethiopia are a good example of these concerns. A 2015 International Food Policy Research Institute report provides a nice visual showing average yields across the world, Africa, and several major barley-producing countries (Rashid et al. 2015). For example, average barley yields (amount per hectare) in Ethiopia are higher than average yields across Africa; they represent roughly 58 percent of the world yield rate, but less than half of the yield rate in South Africa or Kenya (figure 2.1). Obviously, these yields could be increased, as the report states: "On the supply side, there is a high potential for increasing productivity through improved farm practices and the application of modern inputs" (Rashid et al. 2015, 2). Further, the gross potential yield from four improved varieties tested at a local research station a decade before were in the range of 4 metric tons per hectare (t/ha) and an additional four had yield potential of up to 5 t/ha. A simple target of 4 t/ha (or 4.5 t/ha, midway between the two groups) might seem attainable. However, according to the report, "Despite the development of a number of varieties 'arguably' suitable for various agroclimatic conditions, more than 80 percent of barley production has been confined to only two regions, Amhara and Oromia. Finally, despite a 5 percent average yield growth per year, the gap between the potential and actual yield in barley remains vast, reaching more than 200 percent for some varieties" (Rashid et al. 2015, 2). A number of factors must be slowing adoption and cultivation of those improved varieties and thus keeping yields relatively low.

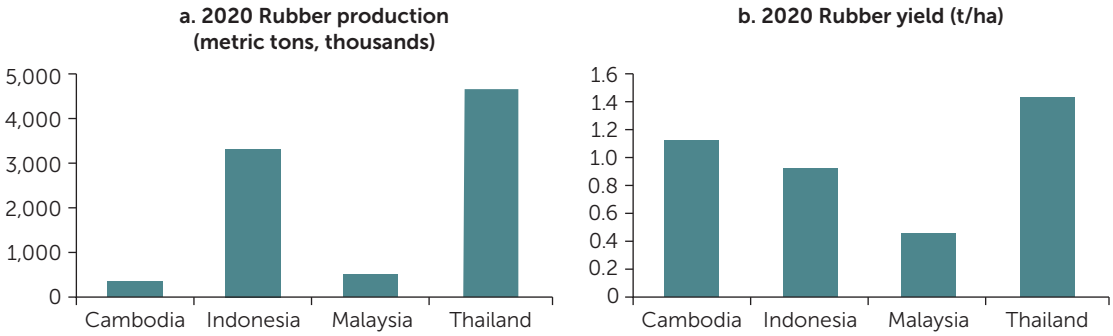
There are other crops for which direct comparison is not always useful. Natural rubber is one example. It is an important smallholder crop in Asia, where Thailand is the world's largest producer and Indonesia the world's second largest producer (figure 2.2). Thailand's yield was 1.43 t/ha in 2020, while nearby, Cambodia's was 1.12 t/ha, Malaysia's was 0.47 t/ha, and Indonesia's was 0.92. Setting a target for Cambodia to increase its yield by 50 percent to meet Thai production may seem reasonable, but examination of Thai farming shows a very different situation than in Cambodia. For example, a 2011 report shows that over

FIGURE 2.1 Major Barley-Producing Countries Globally



Source: FAOSTAT data reported in Rashid et al. 2015.
Note: t/ha = metric tons per hectare.

FIGURE 2.2 Comparative 2020 Production and Yields of Rubber in Asian Countries



Source: Based on FAOSTAT data (accessed May 4, 2022), https://www.fao.org/faostat/en/#data/QCL.
Note: t/ha = metric tons per hectare.

85 percent of Thai rubber was grown monoculturally using clonal planting material at standard planting densities (Ehui and Penot 2011).

Baseline yields may also differ from year to year. For instance, table 2.1 and table 2.2 provide data from the Food and Agriculture Organization (FAO) of the United Nations FAOSTAT data for 2018 and 2020, respectively, for several key smallholder food and export crops: global yields of those crops and yields in several selected producing countries and regional yields. The tables show that there are differences between several of the 2018 and 2020 crop averages; it is important to be aware of which year is chosen as a reference.

Modern agriculture has introduced significant changes in yields, as exhibited by the Third Agricultural Revolution, or the "Green Revolution" from roughly the mid-1960s until around 1990. (In the Neolithic or First Agricultural Revolution, humans transitioned from hunting and gathering

TABLE 2.1 Yields (t/ha) of Key Smallholder Food and Export Crops in 2018

2018 (t/ha)	Rice paddy	Wheat	Cassava	Maize	Sugarcane	Sugar crop
World	4.58	3.42	10.90	5.75	72.80	70.18
Africa region	1.94	2.93	8.85	2.05	62.77	61.46
Asia region	4.82	3.36	21.57	5.38	73.79	71.97
African country	4.34	5.30	34.85	5.39	103.62	103.62
Asian country	7.22	5.42	28.61	6.10	80.20	80.20
African country	Kenya	Namibia	Zambia	South Africa	Zambia	Zambia
Asian country	Japan	China	India	China	India	India

Source: Based on FAOSTAT data (accessed February 3, 2022), https://www.fao.org/faostat/en/#data/QCL.
Note: t/ha = metric tons per hectare.

TABLE 2.2 Yields (t/ha) of Key Smallholder Food and Export Crops in 2020

2020 (t/ha)	Rice paddy	Wheat	Cassava	Maize	Sugarcane	Sugar crop
World	4.61	3.47	10.72	5.75	70.64	68.46
Africa region	2.21	2.53	8.62	2.10	60.62	59.13
Asia region	4.82	3.42	21.89	5.54	68.15	67.22
African country	6.40	7.37	28.34	5.86	103.52	103.52
Asian country	7.04	5.74	30.75	6.32	79.43	77.35
African country	Kenya	Zambia	Zambia	South Africa	Zambia	Zambia
Asian country	China	China	India	China	China	India

Source: Based on FAOSTAT data (accessed February 3, 2022), https://www.fao.org/faostat/en/#data/QCL.
Note: t/ha = metric tons per hectare.

to agriculture and settlement; in the British or Second Agricultural Revolution, there were unprecedented agricultural increases in Great Britain resulting from high labor and land productivity). During this period, countries ranging from India to Mexico adopted a combination of new technologies and practices. This holistic approach included (1) technology—especially high-yielding varieties of wheat and rice in the Green Revolution's[1] early years—and access to capital to accelerate adoption, (2) scaling up of modern methods of farming, (3) breeding and introduction of high-yielding varieties of seeds adapted to local conditions, (4) the use of the right amount of synthetic fertilizers at the right place and right time and in the right amount, (5) a consolidation of land holdings to allow economies of scale, and (6) the introduction and use of machinery to reduce additional labor requirements in excess of family capacity. These factors narrowed or closed yield gaps in many Asian countries such as India and the Philippines, with breakthroughs in Latin America, especially Mexico. Africa, however, was not as successful and continues to face physical barriers of access to water, soil diversity, and topographical challenges, in addition to a fragmented political landscape.

Today the private sector has incorporated many of the Green Revolution's principles in its operations, and this chapter reflects a theory of change and provides several examples of success from a range of institutions. The core principle arising from the Green Revolution remains the requirements for an integrated and holistic approach that addresses a range of inhibiting factors. The following sections are intended as guidelines for the reader to assess potential factors that affect yield, ranking significance, and creating a priority order for solutions to be developed. A checklist at the end of the chapter reinforces this.

Why Is It Important to Consider Yield Gaps?

In addition to the producer-level business case for considering yield gaps, as the International Finance Corporation (IFC) described in the second edition of this handbook (IFC 2019, 172), the increased demand for food due to population growth, changing dietary preferences, and increased reliance on food crops for use besides feeding people has led many people to suggest that global food production will have to increase by 50 percent, double, or even more by 2050 to meet demand. With little additional land available for expansion, food loss and waste amounting to about one-third of total global food production, and selection of crops by farmers driven primarily by near-term consumer preferences,

increasing production on available land is the primary means of addressing the increase. Although productivity per unit of land is usually the most appropriate measure for smallholders, low productivity per unit of labor, unit of fossil fuel, or unit of water could also lead to yield gaps. For producers of animals and animal products, productivity is usually measured per animal per unit of time (liters of milk per cow per day).

In the second half of the twentieth century, the global supply of food increased even faster than population growth, from some 2.47 billion people in 1950 to around 6.06 billion in 2000. Due in large part to the Green Revolution–led adoption of improved varieties, expansion of irrigation, increased use of chemical fertilizer and pesticides, and complementary technological advances, global cereal yields roughly doubled to 3 t/ha by the late 1990s from the 1960s (Southgate, Graham, and Tweeten 2007, 58). (Cereal yield is a convenient if crude measure of global food yields, given that cereals are a source of more than half of the food that people eat when livestock is factored in.) Per capita food supply rose from about 2,200 kilocalories (kcal) per day in the early 1960s to more than 2,800 kcal per day by 2009, a roughly 27 percent increase for each person. While the global population growth rate is now decelerating, total global population is still projected to rise to some 9.7 billion people by 2050 (UN 2020).

Although global cropland grew from 1.22 billion ha in 1950 to 1.51 billion ha in 2000 (total agricultural land grew from 3.84 billion ha to 4.83 billion ha during that period), the growth in yield was the primary reason that the supply of food increased faster than the demand for food during the last 50 years of the last century. According to the Organisation for Economic Co-operation and Development (OECD), productivity improvements will be key to sustainably feeding the growing global population. Up to 87 percent of the necessary increased production is projected to come from yield growth, while 6 percent will come from expanded land use and 7 percent from increases in crop intensity. "By closing yield gaps in the current irrigated and rain-fed cultivated land, about 24% and 80% more crop calories can respectively be produced compared to 2000. Most countries will reach food self-sufficiency or improve their current food self-sufficiency levels if potential crop production levels are achieved" (Pradhan et al. 2015). Achieving potential crop production levels will require an increase in crop yields through improved inputs.

Along with the increase in human population and the corresponding increase in food need, the effects of climate change as temperature increases and rainfall becomes more variable are projected to

significantly lower yields of staple crops. Rising temperatures and changing rainfall patterns may require the selection of alternative crops or the introduction of varieties better able to adapt to the new conditions. Shifting staple crop production into currently colder climatic zones in northern latitudes or higher elevations may be possible, but at the risk of significant changes in natural habitats. A study (Jägermeyr et al. 2021) on climate change and agricultural production models projected that crop-specific yields will be impacted unevenly, with the greatest potential declines in key crops such as maize and increases in wheat. Globally, maize could decline by 24 percent while wheat could increase by 17 percent by 2030.

These gaps are significant given the correlation between yield gaps and poverty gaps, especially in relation to the increase in total area under cultivation. From a sustainability perspective, these gaps also drive deforestation and, when caused by poor resource utilization (soil degradation, water pollution, and so forth), leave long-term damage that reduces farmers' ability to benefit from their land and increase their prosperity. Improved input use, such as fertilizer and seed, accounts for closing the gap in some countries: for example, in India, which saw significant yield improvements during the Green Revolution. However, many countries, particularly in Sub-Saharan Africa (SSA), continue to face a range of challenges that have not yet been addressed. In fact, agricultural productivity growth in SSA over the past four decades averaged only 2.4 percent compared with 4.0 percent in the rest of the developing world (World Bank 2013).

Despite the range of challenges, global progress toward greater yields per unit area of land and in absolute volume of crop production continues, with cropland expansion and improved access to inputs such as fertilizer and higher-yielding seeds helping gross production increase by 11 percent between 2010 and 2016 (OCP 2023). However, these gains were not shared in all regions, with poorer countries typically facing a broader range of challenges to be overcome while also offering the greatest potential yield improvement from a lower baseline. A holistic strategy is therefore required to continue to increase productivity to meet increased and projected demand.

What Is a Yield Gap?

Simply defined, a yield gap is the difference between potential and yields that are achievable with current practices at a given level (plot, field, farm, country, region, or global). However, this simple definition does

not explain what may be achieved at a given farm due to a variety of factors that are often combined to influence yields. Several factors can be addressed in the short to medium term, but others are fixed for longer periods. Furthermore, yields are influenced by a combination of factors that are perceived or defined in different ways based on the stakeholders' interests and resources.

A combination of social, financial, economic, and agronomic insights can provide usable technical definitions that break down yield gaps into various components that can be expressed in relative and level terms. The annex to this chapter lists various measures of potential yield.

Setting Targets Based on Yield Gap

This chapter uses the term "achievable yield," which is the yield that smallholders can achieve with good practices and currently available technologies, taking into account factors outside of their control, such as climate change. Potential yields for a given crop are the yields that can be achieved with cutting edge technology and practices, which may not be applicable or available to smallholders at reasonable cost. As the cost of new technology comes down, achievable yields should approach potential yields.

Factors Affecting Yield Gaps

Both private- and public-sector actors may see closing yield gaps as desirable. However, public-sector interests in food security at a household level are more closely aligned with those of farmers and may not fully account for the additional marginal cost of increasing production, whereas profit maximization is key in the private sector. In some cases, private-sector interests align with economic interests, such as maximizing government taxes, and with farmer income. A range of common factors may affect the gaps, no matter the perspective taken. The key yield gap factors are discussed in the next sections.

Land Rights

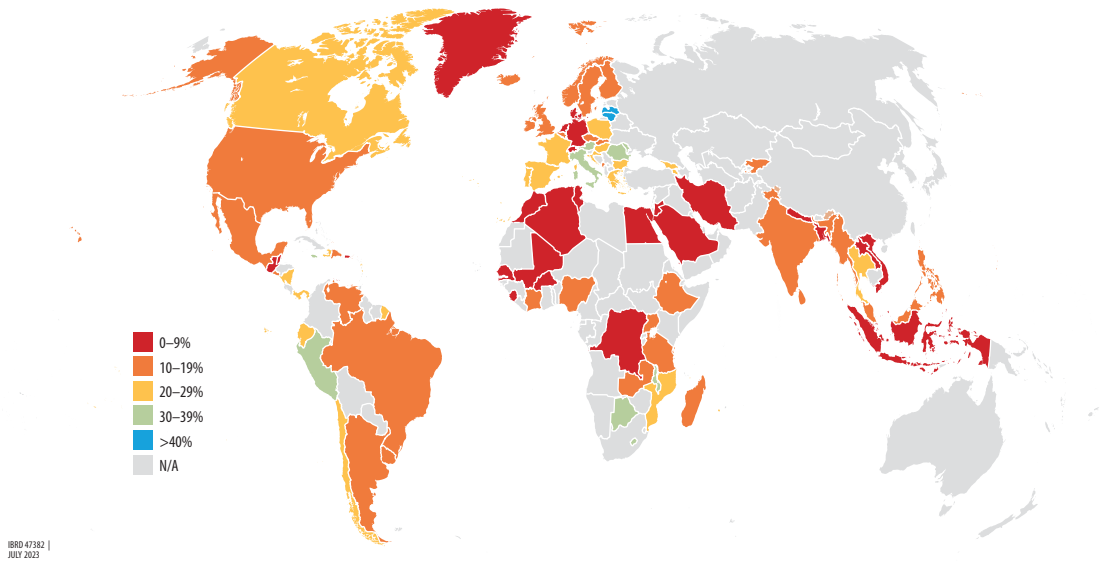
Land rights in many developing countries remain poorly defined in rural communities. This constraint affects many smallholder families who lack the security of formal land tenure, limiting access to finance. There is also an important gender dynamic related to land rights. Globally, less than 15 percent of all landholders are women, despite their making up

over 40 percent of the global labor force in agricultural production. Cultural differences in land rights also exist, with the distribution of women landholders ranging from 5 percent in the Middle East and North Africa to 18 percent in Latin America and the Caribbean (FAO 2018). In FAO studies (FAO 2020a), similar land assets when controlled by women were found to provide increased food security and higher levels of nutrition. The potential yield increase that could be achieved by giving equal access and tenure to land has been estimated at 20–30 percent, with the potential to raise total agricultural production in developing countries by 2.5 to 4.0 percent.

Land is often the core household asset, gained through inheritance, purchase, or allocation from local government. Thus, updating land rights practices is a critical step in improving yields for women and at a national level (see map 2.1).

In addition to private land ownership rights, community land access is also an issue for women in many countries. See box 2.1 for a case study on women's access to land in Niger. For a comparison of farm outputs and inputs on male- versus female-owned farms, see map 2.2.

MAP 2.1 Distribution of Agricultural Landholders by Sex, Global, and Regional Averages



Source: FAO, Gender and Land Rights Database, Rome (accessed May 5, 2022), https://www.fao.org/gender-landrights-database/en/.
Note: The statistics are based on 104 countries, for which census data were available: 20 from Sub-Saharan Africa; 2 from North America; 20 from Latin America and the Caribbean; 8 from the Near East and North Africa; 14 from Central, East, and South Asia; 34 from Europe; and 6 from Oceania. The regional averages are weighted by the total number of landholders in each country.

BOX 2.1

Case Study: Gender—Niger Irrigation Project

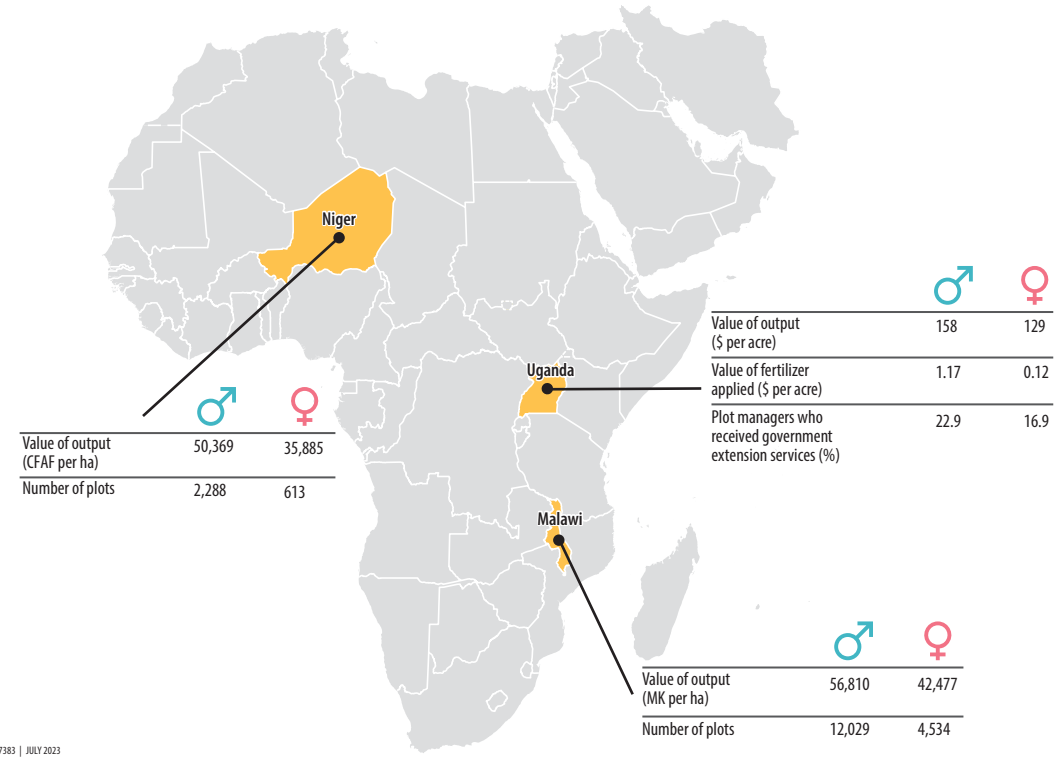
In the Niger Irrigation Project, women were given access to communal land during the dry season, a time of year when carrying water adds a significant labor burden and creates a disincentive for men to practice agriculture. Land rights were found to correlate with a willingness to invest by women farmers, with strong rights providing the basis for a decision to invest in weak or nonexistent rights leading to no investment by women. In cases where land was only seasonally secured, despite highly profitable production, investments in irrigation infrastructure requiring more than one season for full repayment and profit incentive were not possible.

- The yield of a range of established dry season crops increased by more than 26 percent, and revenue increased by over 31 percent due to the premium price for dry season crops.
- Entirely new sources of income were developed from crops that had not previously seen growth.
- Water consumption decreased by 56 percent, comparing surface irrigation to drip irrigation.

For many smallholder farmers, land ownership also provides a key source of collateral for loans that allow seasonal investment in inputs such as seed or agrichemicals and fertilizers critical for higher yields. The links among land rights, access to finance, and the ability to purchase or rent equipment, inputs, and irrigation is directly proportional to yields for women. According to the Food and Agriculture Organization, women make up 43 percent of the agricultural labor force in developing countries (SOFA Team and Doss 2011). If these women had the same access to finance as men, agricultural output could rise by up to 4 percent in 34 countries. The difference is even more stark in certain crops and countries, for example, India: A recent International Finance Corporation study on gender in the rice supply chain found that 60–80 percent of labor was provided by women with a significant opportunity to increase yields if they had access to finance.

More broadly speaking, statistics on financial inclusion in rural areas, even from formal resources, are very weak and rarely disaggregated by gender. Additional work is needed to mainstream access to finance by women in rural, agriculture areas at the private-sector level, by the financial sector and agribusiness off-takers, and at a public-sector level to incorporate women into national financial inclusion strategies, programs, and projects aimed at promoting development in rural and agricultural areas. Based on the combination of relatively increased productivity by women farmers and the impact of access to finance on yields, identifying and addressing issues and constraints for women in rural areas could potentially unleash significant yield increases.

MAP 2.2 Outputs and Inputs on Farm Plots Managed Exclusively by Men or Women



Source: OBG 2021.
Note: CFAF = West African franc ha = hectare; MK = Malawian kwacha.

Technology

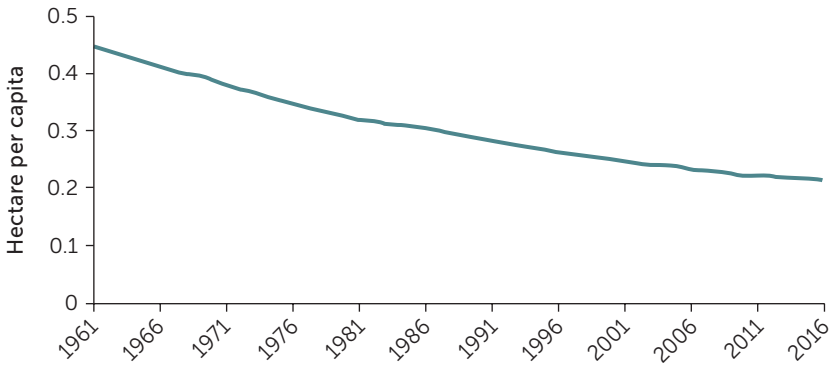
The use of technology has increased land productivity and labor productivity in developed countries, where it plays a role in monitoring and evaluating growing conditions and thus encourages optimal decision-making. However, most commercially available technologies and machinery are optimized for use at scale, and modern technology is designed for use in conjunction with data transfer of large quantities or speeds. Examples are the use of automated irrigation controls based on soil and water conditions and the use of nutrient testing to determine the optimal timing and composition of fertilizers for application on a specific crop and location. Without access to such technology in the field, fertilizers are often inappropriate or applied at an ineffective time or moisture condition, leading to lower-than-expected results and ongoing yield gaps.

Mechanization

The achievable increase in yields should also take into account the physical limits of the labor available for planting, harvesting, and transforming crops. Farmers are often constrained by a lack of funds to hire labor or the lack of suitable labor resources except at harvest. This leads to inadequate weeding, irrigation, and pest control during the crop cycle, as well as delayed harvests, which further reduce yields. Herbicides are among the commonly used tools that combat weeds, allowing farmers to reduce weeding labor, machinery use, and fuel consumption where these alternatives are more expensive (Haggblade et al. 2017). Increased mechanization offers a solution to lack of labor. However, many smallholders are constrained by the high cost of purchasing and maintaining equipment, as well as the insufficient economies of scale mentioned. One exception to this trend is with horticultural crops, where the crops are delicate and may be better suited to hand harvesting to maintain top quality. Economies of scale are of particular concern as the global population rises and the cropland per capita falls (figure 2.3), creating an urgent need for effective mechanization solutions designed for smallholders. This challenge includes meeting the needs for mechanization equipment to be robust, low cost, and easily maintained with spares widely available.

There are several models of mechanization proposed through private-sector support that provide for greater economies of scale, including pay per service, community ownership, leasing models that eliminate capital costs, and rental models that allow for short-term use (see box 2.2).[2] These services may result in unequal availability as farmers

FIGURE 2.3 Global Cropland per Capita, 1961–2016



Source: FAO 2020b.

BOX 2.2

Case Study: Hello Tractor

Reaching more than half a million farmers across Africa, Hello Tractor is an agritech company that enables farmers to plant their crops 40 times faster than through traditional labor. This is essential, because each day that a farmer plants late is equivalent to a loss in yield of 1.5 percent. Hello Tractor has discovered that in Nigeria, farmers typically plant 30 days late, which results in significant money lost on the field, according to the founder and chief executive officer, Jehiel Oliver.[a]

Not only is Hello Tractor speeding up the work of farmers, but it's also making farming more affordable for them. Typically, farm labor costs US$200 per hectare, but a tractor brings the cost down to US$75 per hectare. The company reaches farmers through short message service (SMS) texting and utilizes global positioning system (GPS) technologies to pair up available tractors with requests from farmers through a pay-as-you-use, "Uber-like" model. This ultimately helps farmers with their bankability, as they begin to build a credit history of transactions.

Source: See "Hello Tractor Case Study," YouTube video, 2017, https://www.youtube.com/watch?v=tzIu6MYPuUM. See also the Hello Tractor website, https://hellotractor.com, and "Hello Tractor," a pamphlet describing its services, https://static1.squarespace.com/static/5acdc066c258b4bd2d15050b/t/5fbe08bc1972c46e3c66466d/1606289607555/Better+Finance%2C+Better+Food+-+Case+study+catalogue+50.pdf. The company is based in Nairobi, Kenya, and has an office in Abuja, Nigeria.
a. World Bank Live, April 19, 2017, https://live.worldbank.org/experts/jehiel-oliver.

compete for them during planting and harvesting. Other solutions include the use of smaller equipment that is commercially available in middle-income and some developed markets. For example, minitractors used in Japan and India are now becoming available in some parts of Africa, where they are well suited to smaller land sizes.

Irrigation

Irrigated agriculture represents approximately 20 percent of the globally cultivated area and 40 percent of total food production, making irrigation a factor that on average doubles land productivity. This doubling accounts not only for yield increases, but also for additional cropping cycles that can be grown under irrigation per year. Land under irrigation is not evenly distributed, with Asia accounting for 70 percent, the Americas 16 percent, Europe 8 percent, and Africa 5 percent of the global area irrigated.

For smallholder farmers, the lack of available water in the soil at critical crop growth stages is a major reason for reduced yields. The early stage of growth in most crops depends on either suitable rainfall (amount and timing) or irrigation to ensure that water is available to the seed for germination, emergence, and initial root development. At the earliest stages of a crop's growth, yield losses can be absolute, with a lack of water for five days or more leading to complete crop failure in most crops. The lack of water can affect yields at later growth stages when water stress can lead to a partial or total loss of the harvestable component of the plant due to lack of flowering and fruiting. Despite this relationship of crop growth to available water, a mere 6 percent of the continent's arable land is irrigated, which means that most smallholder farms remain vulnerable to increasingly unpredictable rainfall patterns, as well as prolonged periods of excessive heat, droughts, floods, and intense rainfalls events. Although the change in climate has been gradual thus far, it is accelerating as global warming drives weather to extremes. The introduction of irrigation provides several advantages for small farmers, including the ability to get water on demand to reduce stress and ensure that crops survive short intervals of rainfall deficits and the ability to plan for fertilizer application to increase nutrients for crops. Small-scale irrigation, also known as farmer-led irrigation, is highly effective if water is applied as a supplement to rainfall. Recent projects to support the uptake of farmer-led irrigation have demonstrated significant benefits by delivering solutions that match local constraints and are therefore scalable, resulting in lower costs per unit area and thus faster adoption than with more traditional, large-scale irrigation system development (World Bank 2021). One example of this is the Ramthal Drip Irrigation Project (box 2.3).

Inputs

Seeds and Planting Materials

The development of hybrid, genetically modified, or improved seed production standards have led to increased vitality and germination rates. Access to cloned high-yielding plant materials have increased yields in many countries, especially in Asia. However, much of Africa remains reliant on seed carried over from one cropping season to the next. This locally sourced and stored seed may confer advantages in terms of resilience to local climatic factors and

BOX 2.3

Case Study: Ramthal Drip Irrigation Project

The Ramthal Drip Irrigation Project in Karnataka, India, is the largest drip irrigation project in the world, created to alleviate water scarcity–related issues for 14,000 farmers. Under community irrigation systems such as the one in Ramthal, water is supplied through fully automated drip irrigation systems with a mix of fertilizers and pesticides. Automated alerts are sent by SMS (short message service) texts to farmers regarding irrigation application schedules, crop alerts, and other agronomical practices. This combined technology, training, and service delivery system improves water efficiency, reduces pesticide and fertilizer usage, and increases crop yields.

As a result of drip irrigation technology, yields have increased by 25 percent in areas using a community irrigation approach.

Source: Orbia 2019.

lowered costs, but it often falls short on yields. The gap between achieved and potential crop yields around the world thus widens further. In some cases, the weak financial case for supplying improved seed to smaller markets where current demand is low leads to a reluctance from the private sector to develop or supply seed from larger companies. However, nongovernmental organizations (NGOs) have demonstrated that seed materials can be commercially introduced under certain operating models. One example of this is the approach taken by Fair Planet (box 2.4), which developed a system to pool seeds from multiple seed technology companies and conduct "blind" trials in smallholder farmers' fields within a high potential target market.

Fertilizers

The availability of good-quality fertilizers that supply nutrients and meet the demands of the crop and the soil type is essential to closing smallholder yield gaps. Many reference yields are based on the assumption that these inputs are universally available and of consistent quality. However, use of fertilizers in many developing countries remains low. (See figure 2.4 for an overview.) The World Bank in Uganda carried out

BOX 2.4

Case Study: Fair Planet

Fair Planet developed a system to pool seeds from multiple seed technology companies and conduct blind trials in smallholder farmers' fields within a high potential target market. Fair Planet identified the most successful seed in meeting local growing and conformity requirements and supported the relevant seed company to sell its seed in that market to meet the demand that had been created during trials and demonstrations. This blind-test market entry strategy ensured that a critical mass of demand had been created and that the results achieved by any given seed variety would be realistic for farmers—setting an achievable yield rather than a pilot farm yield as the basis for return-on-investment calculations.

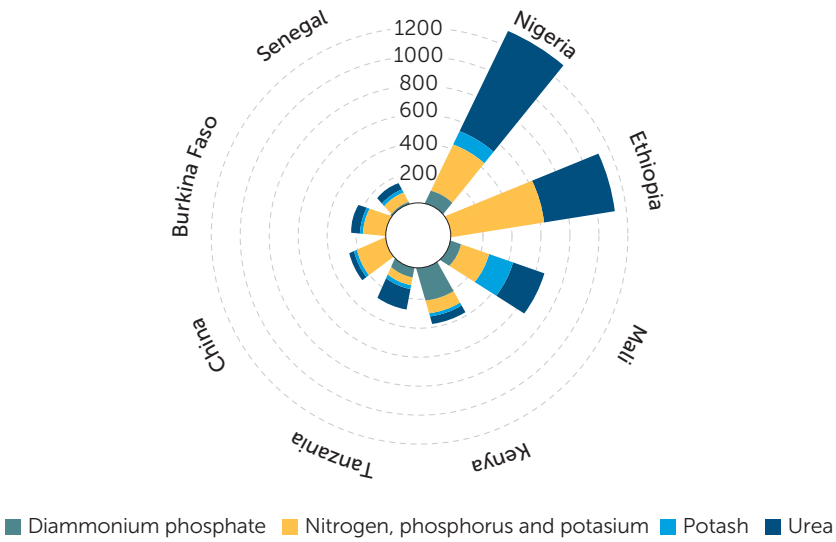
When Fair Planet conducted its trial in the Butajira region of Ethiopia, 90 percent of the 16,000 targeted farmers used high-quality seeds. Their resulting yields were four times higher for tomatoes and eight times higher for peppers. Additionally, many of the farmers doubled their annual income during the trial season (compared to the prior season).

The use of tissue culture methods to improve uniformity, yields, and resistance to disease also offers significant opportunities. Several crops are already commercially supplied to smallholders, including potatoes, cassava, banana, rice, pineapples, and date palms. The Africa Rice Centre assessed crosses between several Asian and African species of rice, aimed at conserving African rice climate resilience and Asian rice yields (African rice species average 1 metric ton per hectare [t/ha], and Asian species average 5 t/ha). These New Rice for Africa (NERICA) species can be created only by using tissue culture methods. Despite the yield advantages, adoption of the NERICA varieties has been slow due to pest infestations and extreme weather events that have caused losses and the increased risks and challenges of accessing finance for smallholder farmers.

Source: Fair Planet website, https://www.fairplanet.ngo/.

an assessment of the impact of inputs on yields and found that despite the substantial output price volatility, yields and profitability both increased with use of inorganic nitrogen fertilizers (Hill, Mejia-Mantilla, and Vasilaky 2018). However, there are also risks from increased use of fertilizers, including potential environmental consequences if training is not provided on appropriate use, such as formulation and timing of application based on soil, crop, climate, and soil needs. Improved seed varieties also had a direct impact on yields, although the cost of using

FIGURE 2.4 Fertilizer Use by Country, 2018 (tons, thousands)



Source: OBG 2021.

some types of hybrid seeds exceeded the extra revenue gained. Quality of inputs was also found to be a major factor, with 30 percent of herbicide samples containing less than 75 percent of the advertised quantity of active ingredient (Ashour et al. 2016). Hybrid maize seeds were also lower in quality, with many sources supplying blends containing 50 percent hybrid and 50 percent traditional. Finally, the nitrogen content of fertilizer was found to be 30 percent lower than advertised (Bold et al. 2017). These combined quality gaps suppressed the use of improved inputs and delivered a negative return on investment (ROI) with reduced yield gain from using hybrid seeds and nitrogen, delivering only 75–87 percent of targeted yield. Fertilizer availability is also highly varied, with a recent study conducted for the Office Chérifien des Phosphates (OCP) identifying a subsequent wide range of utilization OBG (2021).

Crop Protection

Significant yield gaps can also be caused during crop production by invasions of seasonal pests and diseases. In recent years, locusts and African army worms devastated crops in Africa and Asia. During the locust crisis of 2020, the World Bank estimated locust-related crop damage—including staple crops, livestock production, and asset damages—to be US$8.5 billion for countries in the wider East Africa region,

Djibouti, and the Republic of Yemen. A similar, but smaller-scale locust eruption occurred in the same year in West Africa, from northern Sudan to Senegal, and in Southwest Asia, stretching from the Islamic Republic of Iran through Pakistan across India. Under such cases, the sheer mass of insects requires a combination of biological, chemical, and physical pest control to match the attack and to serve the needs of many of the smaller-scale farms that cannot cover their whole area in chemicals alone or prepare for the rolling waves of attack over many months.

The range of pests also requires different approaches, with some that reduce yields in a single crop, such as stem borers, which attack maize, to less discriminating pests, such as locusts of the African army worm, which devastate all plants found in their path.

Viral and bacterial diseases may also become amplified in larger mono-cropped areas, for example, aflatoxin in maize and groundnuts and rice blast fungus. However, more widespread fungal diseases such as the rusts (*Puccinia spp.*) can reduce yields of crops ranging from high-altitude coffee in Colombia to river delta rice in Vietnam. The growth of entire crop sectors can either (1) be driven forward for smallholders in new growing areas where diseases are nonexistent and thus yields can be maintained at a high level or (2) collapsed when disease sets in and cannot be eradicated effectively within the smallholder base. Solutions to these challenges vary according to the cause and range from integrated pest management, which uses techniques such as biological control, habitat manipulation, modification of cultural and mechanical practices, and use of resistant varieties, to the use of chemicals, which require careful storage and application management techniques as well as awareness of post-harvest residues and environmental impacts on pollinators.

Storage

Yield gaps may also occur post-harvest, when crops that were harvested in good condition with a measured and recorded yield are placed into storage prior to sale or transformation into food products (see box 2.5). Significant losses include those that make the crop unsuitable for processing due to spoilage; over-drying of a crop leading to weight reduction; crop characteristics such as color, taste, or smell quality reduction; nutritional value losses; and seed viability losses. These physical and biological losses convert into the reduced value of the crop and associated commercial losses. The problems faced in storage facilities may be attributed to a range of common factors such as fungal, pest, and

BOX 2.5

Case Study: Food and Agriculture Organization (FAO) Post-harvest Storage

FAO supports a range of projects focusing on post-harvest storage, typically at the community level. Members with access to FAO's storage facilities are able to maintain the quality of their seeds between seasons, reducing losses caused by pests between harvest time and market sale. Seeds may also be sold to other farmers in the community directly from the storage facilities, thus providing benefits outside the direct member group.

In Mozambique, seeds from high-value and high-risk crops such as maize, common beans, cowpeas, peanuts, pumpkin, cucumber, and sesame are stored in simple containers such as bottles and small plastic boxes, which are sealed to reduce access by insects. In Uganda, a design was developed for low-cost, 30-ton-capacity warehouses, which increased incomes by enabling smallholders to safely maintain the weights and quality of crops so they could market their production surplus at opportune times for higher profits.

In Pakistan, FAO estimates that the building and maintenance of storage facilities could greatly enhance the production of wheat, which is the country's most important crop. Pakistan's economy loses somewhere between US$76 and US$90 million annually because of the lack of quality wheat storage. Each new modern grain elevator is predicted to have an internal rate of return of 29 percent based on a 25-year project life (Prikhodko and Zrilyi 2013).

physical damage. The capital costs of upgrading storage are often high for individual farmers, although cooperatives or community seedbanks often provide a suitable way for farmers to aggregate crops under better storage conditions. This is particularly notable in crops such as cereal grains, where as much as 60 percent of volume can be lost during storage. At a smallholder level, this yield gap may move to the point of sale rather than point of harvest, where yields would have been recorded at a higher value.

Natural Resources

Soil

Soil is a fundamental resource for agriculture. However, the intensification of agricultural focus on cash crops for export, combined with poor cultivation practices, has led to a decline in soil health and its ability to be productive. Declines in fertility occur across all geographies, with a recent United Nations report on the status of global soil resources finding that "the majority of the world's soil resources are in only fair, poor or very

poor condition" (Borrelli et al. 2017). In addition to poor cultivation practices and a lack of inputs to replace the nutrients extracted in cropping, significant harm is caused by exposing soil to accelerated soil erosion through climate-change-driven severe weather events, deforestation, overgrazing, tillage, poor land management, and excessive use of inputs. The FAO-led Global Soil Partnership has estimated a loss of 75 billion tons of soil per year through erosion, which equates to an estimated financial loss of US$400 billion per year based on reduced yields. Strongly eroded and nutrient-poor soils directly impact the potential for a crop to reach optimal yields. Measurement of soil fertility and soil profiling remain expensive, and thus most smallholders are not able to utilize these processes.

Water

The majority of smallholder food crop production, upward of 60 percent of food and 80 percent of land in developing countries, remains based in rainfed production systems that rely on predictable and adequate rainfall patterns. Despite significant benefits, the cost of accessing, transporting, and applying water for irrigation remains capital intensive; less than 20 percent of arable land is irrigated in developing countries, yielding 40 percent of crops and above 60 percent of water-sensitive crops such as cereals. A growing emphasis on farmer-led supplementary irrigation systems promotes smaller, more flexible irrigation systems that can be used at critical points in the crop cycle and is often able to double yields, creating the largest reduction in yield gaps.

Climate

The realities of climate change are becoming more evident with continued changes in rainfall patterns and increased frequency and intensity of extreme weather events. To understand the effects of climate change on yields, it is important to distinguish baseline climate conditions and volatility arising from climate change.

Shifts of monsoon rainfall patterns in Asia and changes in the timing and duration of the Intertropical Convergence Zone (ITCZ) in Africa make crop management decisions more difficult. Farmers are unable to determine optimal times to sow and harvest as patterns change. This problem is more acute farther from the equator, with the duration, amount, and reliability of precipitation decreasing. Changes in rainfall limit the yield potential based on latitude and elevation; North African countries such as Tunisia and the Arab Republic of Egypt and

mountainous countries such as Nepal in Asia face significant volatility and risk from climate change.

The shift in climate also impacts daytime and nighttime temperatures, which are critical to flowering, fruit setting, and seeding in many commercially cultivated crops. For instance, a 2004 study shows that rice grain (the edible portion of rice) yield declined by 10 percent for each 1°C increase in growing-season minimum temperature in the dry season, whereas the effect of maximum temperature on crop yield was insignificant (Richard et al. 2004). These decreased rice yields are directly linked to global warming and are changing the optimal growing zones for many crops, forcing agribusinesses to seek new sourcing areas to diversify risks and sustain supply chain volumes. However, smallholder farmers cannot relocate easily, and new crop options more adapted to their new climatic realities must be found to ensure that yield gaps do not result in negative returns (box 2.6).

Rising temperatures are also contributing to the loss of productive land through desertification, the permanent degradation of land that was once arable. As temperatures and population pressure rise and yields fall, smallholders are forced to expand onto new land and clear protective shrubs and trees, which further accelerates the process of land degradation. Current rates of degradation are now estimated to be 30 times higher than historically (UN n.d.). This challenge is particularly acute in the northern

BOX 2.6

Case Study: Integrated Agricultural Productivity Project, Bangladesh

In Bangladesh, 25 percent of the population experiences high rates of extreme poverty. Over 60 percent of the population and 85 percent of poor people live in rural areas. The country is highly impacted by climate change: in the south, vulnerable low-lying land is hit by tidal surges and sea-level rise that causes salinization of the land and flash flooding, and in the north, irregular rainfall leads to drought. These are challenging conditions for predominantly rainfed farming.

The Integrated Agricultural Productivity Project is working with farming communities to address these challenges. Through a combination of climate-smart agricultural technologies, agronomic practices, crop varieties, and production technology packages designed to address changing climatic and environmental conditions, more than 250,000 farmers were reached and a yield gap was closed by 15 percent.

Source: GAFSP 2018.

Sahel and Maghreb regions of Africa, which border the Sahara desert, and in Burkina Faso, Mali, Morocco, Niger, and Senegal, productive land is estimated to be lost at a rate of 2 million ha per year.

Not only do crops themselves respond to climate change, but also the influence of pests and diseases rises and falls with temperature and humidity conditions. Locusts are particularly sensitive to climate: Swarms have been recently triggered by climate change linked to ocean warming and cyclones that create conditions conducive to an extreme locust-breeding season. The subsequent shortage of food and favorable weather support swarming, which can eliminate entire crops.

Climate change has also driven an increase in the frequency of extreme weather events such as floods, droughts, high winds, and extreme temperatures. In contrast to more gradual changes in weather patterns, these extreme events are more easily measured and can be directly linked to food production declines and losses. Measured declines of more than 2.5 percent have accelerated from 1 in 12.5 years (1982–2006) to 1 in 2.5 years (2007–16) (Ehui, Kray, and Mghenyi 2020). One survey of farmers that addressed this subject showed that some 32 percent of those affected by an extreme weather event in the past decade reported being food insecure following the event, and 27.5 percent reported losing more than half of their household income (Harvey et al. 2018).

Climate-Smart Agriculture

The Sustainable Agriculture Initiative (SAI) Platform has developed a detailed list of sustainable agriculture related principles and practices.[3] Standards setting and assessment tools bring opportunities for advisory services while also giving room for self-assessment of gaps and development progress. SAI's Farm Sustainability Assessment (FSA) is a toolset in accelerating sustainable agriculture on the ground as well as supply chain collaboration and alignment (SAI 2014).

Spotlight is an online facility to connect SAI members (global off-takers) with stakeholders (SAI n.d.). It aims to transform agricultural supply chains faster, from the farmer to the retailer, and drive precompetitive collaboration, empowering members to put in place sustainable practices that are locally relevant and globally significant.

Analogous to SAI, the Sustainable Rice Platform (SRP) and its members provide support for rice farmers to assess the gaps and to build capacity for sustainable rice cultivation.[4] Impressive success is being achieved regarding increased farmers' income (10–15 percent), improved environmental parameters (−20 percent water use, −50 percent GHG emissions), and corporate social responsibility (CSR) contributions valued by off-takers and marketers, and eventually rewarded

by consumers. The SRP Standard for Sustainable Rice Cultivation comprises 46 requirements under eight themes, each aimed at a specific sustainability impact at smallholder level (SRP 2020c). Each requirement is relevant, practical, and under the farmer's control. The standard is complemented by a set of 12 quantitative SRP Performance Indicators (SRP 2020b). Since 2020, GLOBALG.A.P.[5]—a brand of smart farm assurance solutions developed by FoodPLUS GmbH with cooperation from producers, retailers, and other stakeholders from across the food industry—manages the approval process of the SRP Assurance Scheme (SRP 2020a) verification bodies.

SAI and SRP, their private sector networks, and their institutional supporters represent economical and efficient partnership solutions to working with and supporting smallholders for backward integration of sustainable and inclusive value chains. Compliance with sustainability guidelines and measures has led to economical input use, increased yields and farmers' income, reduced burden to the environment, and increased sales and profitability for the agribusinesses who implemented it. This is further demonstrated with the case study of the Loc Troi Group's Sustainable Rice Platform project in Vietnam, which is presented in box 2.7.

BOX 2.7

Case Study: Loc Troi Group, Sustainable Rice Platform (SRP), Vietnam—Building Sustainable Rice Supply Chains through Farmer Trainings and Application of SRP Standards

Vietnam is one of the largest rice exporters in the global market, engaging around 15 million smallholder farmers and producing on average 40 million tons of rice per year. In response to the growing demand for staple foods, Vietnam's rice sector focused on improving yields and achieved the highest productivity level among the Association of Southeast Asian Nations (ASEAN) countries. Nonetheless, low returns to farmers, highly fragmented production with several intermediaries, and unsustainable agricultural practices (heavy use of fertilizers and chemicals) characterized the sector. Therefore, Vietnamese rice brands are barely familiar to international consumers. Recognizing this, the Loc Troi Group (LTG) became committed to establishing a sustainable rice supply chain and promoting a Vietnamese rice brand. LTG embarked on a project with the International Finance Corporation (IFC) and the International Rice Research Institute (IRRI) to

box continued

BOX 2.7

Case Study: Loc Troi Group, Sustainable Rice Platform (SRP), Vietnam—Building Sustainable Rice Supply Chains through Farmer Trainings and Application of SRP Standards *(Continued)*

develop a sustainable and traceable rice supply chain that implements Sustainable Rice Platform (SRP) guidelines and standards. With this intervention, LTG aimed at building an internationally recognizable high-quality Vietnamese rice brand.

LTG's project sought to increase know-how and application of improved agricultural practices for farmers through the SRP program. At the firm level, the project developed training modules focusing on capacity building for LTG's extension workers for implementation and monitoring of SRP practices, data collection, and performance measurement. At the farm level, the project delivered trainings on sustainable agriculture practices, which were developed from SRP criteria through training and coaching at farmer field schools. Trainings were first provided to extension workers, then to farmers, and finally to warehouse operators and mill operators on post-harvest handling practices and best practice standard operating procedures. In addition to trainings, supports were provided to install an aeration system for bulk storage, termite treatment to avoid storage fumigation, warehouse ventilation, and calibration of weighing instruments.

LTG first implemented sustainable practices in rice production through the adoption of SRP standards with 150 farmers on 463 hectares (ha) of land in 2016, which was later scaled up to over 3,000 farmers on 11,520 ha in 2018. With these programs, LTG successfully rolled out sustainable agricultural standards and practices along its rice supply chain. The training approach was in person with high interaction, resulting in significant incremental productivity increases among the participating 3,494 rice farmers. Metal and pesticide residues (for example, aluminum, isoprothiolane, and tebuconazole) were either reduced or not detected in final products. The adaptation of SRP standards was high among the targeted farmers, which helped them to increase yields and fetch higher prices and ultimately led to increased net income. The improved post-harvest handling practices also contributed to significantly reduced losses during the drying, milling, and polishing stages. Further, the changes in warehousing practices enhanced rice product quality and helped to increase the level of compliance to international market requirements. In this regard, IFC coordinated with international buyers (VSR, Phoenix Commodities) for the uptake of LTG's rice produced under SRP standards.

Building on its initial SRP project with IFC and IRRI, LTG rolled out the SRP program to a larger number of farmers through a series of trainings on SRP standards for local hired extension workers, who further reached a larger number of rice farmers beyond LTG's supplier base. SRP implementation was replicated in surrounding areas and gained supports from local government, researchers, and other firms.

Source: IFC and World Bank personnel familiar with the project.

Climate-smart agriculture (CSA) is a set of practices that help farmers work sustainably; they include conservation agriculture practices. CSA is important because it helps farmers adapt and build resilience to climate change. It can increase agricultural productivity and farmers' incomes. Syngenta, for instance, has been training and supporting farmers to implement CSA practices that aid carbon sequestration. This is carried out through the Good Growth Plan under four themes: accelerate innovation for farmers and nature, strive for carbon neutral agriculture, help people stay safe and healthy, and partner for impact.[6]

On-farm carbon sequestration is an element of climate-smart agriculture tackled by Syngenta's Good Growth Plan. The Farm Carbon Toolkit provides practical tips for managing on-farm resources to increase sequestration potential via soils and via biomass.[7] Carbon sequestration can even result in direct cash benefits (Flesher 2021; Indigo 2023).

Regenerative agriculture is a conservation and rehabilitation approach to food and farming systems. It focuses on topsoil regeneration, increasing biodiversity, improving the water cycle, enhancing ecosystem services, supporting biosequestration, bringing degraded lands into production, increasing resilience to climate change, and strengthening the health and vitality of farm soil. The case study of Mercon's sustainable robusta coffee production in Nicaragua explains this in more detail (box 2.8).

BOX 2.8

Case Study: Mercon Coffee, Nicaragua—Sustainable Robusta Coffee Supply Chain, Aggregation through Collection Centers

In Nicaragua, coffee production represents 15–20 percent of total exports, where about 44,000 smallholder farmers in the country primarily produce Arabica coffee varieties. Since 2013, the government of Nicaragua has allowed the cultivation of robusta varieties in nontraditional coffee areas, including the Caribbean coast (CC). This region has significant agricultural production potential, but it is challenged by its remoteness, with lower road access than other areas and higher costs of service delivery. Mercon Coffee Group began intensifying the development of a robusta coffee supply chain with its own 1,000 hectare farm and by engaging surrounding smallholders.

Mercon's guiding principle has been to convert degraded lands into robusta production farms by avoiding expansion into forested lands. To achieve its goals, Mercon partnered with the

box continued

BOX 2.8

Case Study: Mercon Coffee, Nicaragua—Sustainable Robusta Coffee Supply Chain, Aggregation through Collection Centers *(Continued)*

International Finance Corporation (IFC) in joint advisory and investment services programs to access financing, technical support, and secured markets. The advisory services develop robusta cultivation in Nicaragua's CC region by leveraging collaboration opportunities with World Bank initiatives. Mercon also introduced its Leading Innovation and Farmers' Traceability (LIFT) program, which provides technical assistance to farmers in order to increase the supply, productivity, and quality of robusta coffee. Training materials are being digitized for both agronomists and farmer suppliers using Mercon's online platform and via mobile apps. Mercon also provides short- and long-term financing to farmers through IFC's Global Warehouse Finance Program by using the crops as collateral. Overall, the Mercon initiative is anticipated to promote greater sustainable production and inclusiveness to markets via tailored technical assistance, access to improved inputs, and the hands-on aggregation approach.

Source: IFC.

Financial

Cost of Inputs

The increased cost of using improved inputs is often the main barrier to closing the yield gap for farmers who are not linked to a formal supply chain or market or are too small (precommercial) to cover the transaction costs involved. A yield gap attributable to the lack of suitable, or affordable, inputs is thus most commonly found at the baseline of any development or commercial project involving smallholder farmers. This yield gap has attracted strong support from the public sector, with most countries focused on subsidizing or providing inputs in advance of the crop season to raise productivity and food security. In countries where inputs are imported, and therefore expensive, increasing input use to optimal levels for productivity may not be cost effective.

In addition, private-sector programs offer inputs or crop season loans in return for repayment at the time of harvest in the form of the crop or repayment in cash from off-takers who enter into the financing agreement as guarantor. Loan tenors are short, and the period to ROI is typically one cropping season, making these financing arrangements popular and relatively low risk.

Equipment Costs

Access to credit for irrigation and mechanization equipment is a persistent challenge because of the longer loan tenors and higher risk associated with the multiple seasons required for repayments and the correspondingly higher risk of climate-related crop failure.

Opportunity Costs

Yield optimization requires consistent attention to climate, crop growth, pests, diseases, and harvest timing. Farmers may perceive the need for alternative opportunities for income, which will reduce the time committed to farming. In that case, yield is of course affected. However, other income streams may allow a diversification of risk, which in turn could lead to greater stability of overall gross benefit.

One factor overlooked in the assessment of yield gaps is underreporting. This may occur for several reasons, including side selling of cash crops, which reduce reported sales to off-takers; consumption or storage of a part of the harvest by the household; carryover of seed to the next year; and measurement inaccuracies due to either poor weighting or incorrect land size as the denominator. While several of these reasons may be addressed quickly, others persist and typically affect overall reported yields.

Technical Capacity

Farming is as much a culture around a series of practices as a process of managing plants and natural resources. Traditional agricultural practices are closely bound with culture, and for many smallholders, seasonal climate patterns have entered a stage of rapid change that is happening faster than the adoption of new practices and technologies. The lag between the drivers of change and adoption of changes is often caused by a lack of training, which has an essential role in introducing, supporting, and reinforcing new technologies and practices. However, training alone is not a solution. Sustained, on-farm training in soil and water management and agronomy practices enable changes in farming practice, but they must be complemented with access to trained service providers who can deliver advanced after-market technical skills. The combination of on- and off-farm technology and practice requires a mixture of targeted training approaches. For example, sustainably raising yields through the use of irrigation systems requires design, installation, operation, and maintenance skillsets, which may include several stakeholders ranging from equipment suppliers to postsales service agents to

farmers themselves. Training to bring about yield increases can only be addressed though a holistic approach to equipment, inputs, practices, and demonstrations. Such demonstrations must be conducted with farmers, ideally in their fields, as proposed changes in behavior rarely work with smallholders if they are presented under the artificial conditions of model farms or limited to research stations.

OCP's West African Agribooster initiative is an example of a holistic approach to training (box 2.9).

External Factors

A range of additional factors may also affect the recording of yields after or before harvest. Several of these factors are nontechnical, such as those based on culture or human interactions. These may be more complex to evaluate: for example, the willingness to change practices around seed selection or the gradual escalation of fragility and breakdown of supply chains. More absolute and clearly quantifiable factors include the outbreaks of conflict, which often interfere with inputs and access to markets. In relation to these factors, a broader assessment or, where possible,

BOX 2.9

Case Study: IFC-Pilot Program for Climate Resilience, Bangladesh

Starting in 2014, the International Finance Corporation (IFC) worked with the Supreme Seed Company and mPower to train smallholder farmers in the southern part of Bangladesh on climate-resilient farming techniques. The training for the farmers included efficient irrigation and weeding techniques, the balanced use of pesticides, and the benefits of hybrid, climate-smart rice seeds. mPower provided training through a hybrid approach that maximized information transfer, practical capacity building, and availability of reference materials. This included a combination of technologies including SMS (short message service) text messages and phone calls, reinforced by lead farmers who would convey the training in person.

Yields increased by 0.68 metric tons per hectare, or 20 percent, for the treatment group of more than 23,000 farmers, with revenue increasing by 15 percent. In similar studies with just a few thousand farmers, the yields were even higher for potato crops (31 percent) and for mung bean, watermelon, and chili peppers (29 percent). Training provided through both mobile technology and field champions was critical to the success of the pilot.

Source: IFC.

baseline assessment of practices should be used to identify whether these will play a role.

Conflict and Fragility

The escalation of conflict, accelerating climate extremes due to global warming, and the outbreak of a global COVID-19 pandemic have all had a strong negative impact on agricultural yields in developing countries. The Saskawa Africa Association surveyed the effects of the global pandemic and identified factors with direct impact on yields that led to declines:

- Access to farms
- Extension services training
- Pre- and post-harvest handling services
- Access to raw materials by agroprocessors
- Post-harvest processing services (that is, rice milling)

Besides the global impact of the pandemic, which reached all countries, violent conflict remains a main cause of yield gaps. Conflicts increased from 2010 to 2020 in terms of number of locations, duration, and intensity (Delgado, Murugani, and Tschunkert 2021). The Russian invasion of Ukraine has resulted in heightened price volatility in the world's major food staples—maize, rice, soybeans, and wheat—which has negative consequences for food-import-dependent countries. These effects are exacerbated by high natural gas prices. As gas is a key input to fertilizer production, this has boosted fertilizer prices as well. The high fertilizer prices could depress future agricultural production, putting upward pressure on food prices.

While these factors are uncontrollable at the farm level, all contribute to significant yield reductions in the short term; they also create an opportunity for changes in the agricultural value chain and the introduction of measures to support improved efficiency during rebuilding. These exogenous shocks create an even more heightened awareness of the need to optimize yields and reduce gaps at a national level, providing opportunities but also creating the risk of global inequity.

Land Management Practices

The use of family labor and animal husbandry are strong parts of the culture for many smallholder farmers. In particular, the number of head of livestock owned confers significant social status, not (yet) fully replaced by an equivalent status from ownership of a tractor, despite the tractor's potential to increase the land area that can be

planted or to conduct activities that would require power in excess of family or animal power capacity. Sustainable land management practices increase soil fertility, which increases productivity and sequesters carbon.

Traditional Crop Practices

A number of key cropping practices inhibit yields, primarily the use of seeds carried over from one cropping season to the next. While this may allow locally adapted varieties to endure climatic conditions and shocks, the use of carried-over seeds does not optimize yields in the same way as the use of hybrid or genetically modified organism (GMO) seeds in the first cropping cycle. This is in part due to traditional methods of storage that may not adequately protect seed from pests, diseases, or climatic damage.

As ideas or methods are accepted within a society, they gradually come to be regarded as customary. Going back 150 years, land preparation in most of what is now Botswana was done with hoes. Farmers saw plows being used in what is now South Africa and introduced them to their own farms, with the result that an ox-drawn plow is now regarded as the normal equipment for land preparation and planting. More recently, in parts of Pakistan and Egypt, tractors are becoming part of the culture as they gradually replace draft animals as a source of power in farm operations.

New crops can also be introduced. Cocoa was unknown in Ghana until it was brought in from the United States. Ghanaian farmers began to cultivate it in the nineteenth century when traders were eager to export the cocoa beans to Europe. Farmers learned the necessary techniques for raising young trees, fermenting and drying the beans, and storage. Land-tenure rules changed as families moved to new areas to acquire land on which to start cocoa farms. Cocoa gradually became a central part of Ghana's economy, tradition, and culture.

Chapter Summary and Next Steps

Agricultural yield gaps have a myriad of definitions, ranging from the very theoretical to the very practical. This chapter has focused on practical definitions that can help stakeholders identify yield gaps within their domain of influence and make plans to reduce or eliminate those gaps. It has also presented several factors that influence yield gaps, some presented across a wide range of countries and contexts, some limited to just a few.

Stakeholders may benefit by using the following four-step checklist when identifying and planning activities to close yield gaps. The information obtained through the checklist should be specific, measurable, and actionable.

Checklist

Set appropriate yield baseline

- Compare observed yields in nearby provinces or countries, or in locations with similar agroclimatic conditions, to the observed yields in the location you are considering. The Food and Agriculture Organization (FAO) of the United Nations maintains an excellent free database, FAOSTAT, that provides food and agriculture data for over 245 countries and territories from 1961 onward. Another useful resource is the European Commission's World Atlas of Desertification.[8] ☐

Set suitable yield targets

- Consider how much a farming family needs to increase yields to address a variety of targets. Targets should be feasible given the context. ☐
  - *Target operational yield:* Increase yield to remain or become profitable given additional operational costs (that is, seeds, inputs, and seasonal costs). ☐
  - *Target investment yield:* Increase yields and profits to enable capital investment of a predetermined level on the farm (that is, pumps, equipment, and infrastructure). ☐
  - *Target commercialization yield:* This serves as a reliable producer for an off-taker (that is, yield above the level of household needs for food security). ☐

Identify key yield impact factors

- Identify which of the factors listed in this chapter—gender, technology, access to inputs, natural resource factors, climate, access to financial services, technical capacity, and external factors—have the most relevance and influence on yields in your location. Consider the extent to which each of the factors may affect yield and make an informed guess of the percentage to reduce your comparator from the first step. Use the resulting number to compare to the current observed yield to estimate the impacts of changes due to the proposed interventions. ☐

Determine the improvement pathway

- Compare the current yield and the yield target to determine the yield gap and key influencing factors that must be addressed. ☐

Annex 2A

Awareness of how yield measures differ is helpful to determine yield gaps. This chapter and several studies discuss different yield measures; below is a collection of measures that are used in this chapter or in some cases from other authors in the field for comparison.

Average Actual Yield (Ya)

Ya is defined as the average yield (for instance, the past 5 years for irrigated and 10 years for rainfed cropping systems) achieved by farmers in a given region under dominant management practices (sowing date, cultivar maturity, and plant density) and soil properties.

Partially Irrigated Yield Potential (Ypi)

For irrigated crops that do not receive sufficient water to fully satisfy their requirements, irrigation amount and timing need to be considered for simulating Ypi. This term is equivalent to "deficit irrigation" yield potential as used by others (for example, English 1990). Ypi is used as benchmark for estimating yield gaps in partially irrigated crops.

Potential Yield (Yp)

In irrigated systems, Yp (sometimes called yield potential) is the yield of a crop cultivar when it is grown with unlimited water and nutrients (according to its needs) and when biotic stress is effectively controlled (Evans 1993; van Ittersum and Rabbinge 1997). Therefore, crop growth is determined by solar radiation, temperature, atmospheric carbon dioxide (CO_2) concentration, and genetic characteristics. Yp is location specific because of the climate but, in theory, not dependent on soil characteristics. Yp is used as benchmark for estimating yield gaps only for fully irrigated crops. Yp is not framed in terms of rainfed crops, although Yp is used for estimating the *water-limited yield potential* (Yw; see definition below).

Technically Efficient Yield (YEY)

YEY is a farm's highest level of output given a set of inputs (De Koeijer et al. 2002). An assumption for YEY it that is economic yield (EY).

The total dry matter produced from a crop is known as biological yield, and the portion of this useful for humans as food, feed, forage, or fiber is known as economic yield.

Water-Limited Yield Potential (Yw)

For rainfed crops, Yw is the most relevant benchmark. Yw is defined similarly to Yp but takes into account that crop growth is limited by water supply and influenced by soil texture and field topography. Yw is used as benchmark for estimating yield gaps only for rainfed crops. Hence, Yw is not shown for irrigated crops.

Yield Gap (Yg)

Yg is the difference between Yp (irrigated crops), Yw (rainfed crops), or Ypi (partially irrigated crops) and actual yield (Ya). Yg is based on Yp, Yw, or Ypi simulated yield using optimal agronomic management as input (that is, cultivar maturity, sowing date, and planting density). In the research-based approach of global yield gap analysis, optimum sowing dates, plant density, and cultivar maturity are based on dominant practices currently used by farmers. In those cases, the optimum sowing date and cultivar maturity are determined within the time constraints of the dominant crop sequence (for example, areas where more than one crop is grown on the same field each year).

Yield Gap, Exploitable (Yg-E)

Yp and Yw are defined by crop species, cultivar, climate, soil texture (Yw, Ypi), and water supply (Yw, Ypi), and thus they are highly variable across and within regions. It is impossible for a large population of farmers to perfect crop and soil management in order to achieve Yp or Yw or Ypi, and it is not cost-effective to do so because yield response to applied inputs follow "diminishing returns" as average farm yields approach Yp or Yw or Ypi (Koning et al. 2008). Therefore, average farm yields often begin to plateau when they reach 75 to 85 percent of Yp or Yw or Ypi, and the exploitable yield gap (Yg-E) is defined as the difference between 80 percent of Yp or Yw or Ypi and current average farm yields (Cassman et al. 2003; Lobell, Cassman, and Field 2009).

Notes

1. The Green Revolution, also known as the Third Agricultural Revolution, was a period of technology transfer initiatives that saw greatly increased crop yields and agricultural production.

2. See "Hello Tractor Case Study," YouTube video, 2017, https://www.youtube.com/watch?v=tzIu6MYPuUM. See also the Hello Tractor website, https://hellotractor.com, and a pamphlet describing its services, https://static1.squarespace.com/static/5acdc066c258b4bd2d15050b/t/5fbe08bc1972c46e3c66466d/1606289607555/Better+Finance%2C+Better+Food+-+Case+study+catalogue+50.pdf. The company is based in Nairobi and has an office in Abuja, Nigeria.
3. For more information, visit SAI's website: SAI (Sustainable Agriculture Initiative) Platform, Geneva. https://saiplatform.org/.
4. For more information, visit SRP's website: SRP (Sustainable Rice Platform), Bangkok, http://www.sustainablerice.org/.
5. More about GLOBALG.A.P can be found on its website, https://www.globalgap.org/uk_en/who-we-are/about-us/.
6. Information about all of Syngenta's projects can be found on the company's website. See Syngenta Group, "Good Growth Plan," https://www.syngenta.com/en/sustainability/good-growth-plan; "Accelerate Innovation for Farmers and Nature," https://www.syngenta.com/en/sustainability/good-growth-plan/accelerate-innovation-farmers-and-nature; "Strive for Carbon Neutral Agriculture," https://www.syngenta.com/en/sustainability/good-growth-plan/strive-carbon-neutral-agriculture; "Help People Stay Safe and Healthy," https://www.syngenta.com/en/sustainability/good-growth-plan/help-people-stay-safe-and-healthy; "Partnering for Impact," https://www.syngenta.com/en/sustainability/good-growth-plan/partnering-impact; and "How Can Agriculture Play a Role in Addressing Climate Change?" https://www.syngenta.com/en/sustainability/climate-change/carbon-sequestration.
7. See more on these topics at the Farm Carbon Toolkit website. Farm Carbon Toolkit, "Carbon Sequestration," Blackbirds Perch, St Martin's, Isles of Scilly, UK, https://farmcarbontoolkit.org.uk/toolkit-page/carbon-sequestration/; and "Soils for Sequestration," https://www.farmcarbontoolkit.org.uk/toolkit/soils-sequestration.
8. FAOSTAT can be accessed at https://www.fao.org/faostat/en/#home. The European Commission's World Atlas of Desertification can be accessed at https://wad.jrc.ec.europa.eu/yieldsgaps.

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CHAPTER 3
AGGREGATION AND WORKING COST-EFFECTIVELY AT SCALE

Martin Albani

KEY MESSAGES

- Sourcing from smallholder farmers is often both necessary and desirable.
- Sourcing from smallholders necessitates aggregation of individuals into groups.
- To secure sustainable supply from these groups (farmer organizations), sourcing agreements that amount to contract farming should be finalized.
- Contract farming, under inclusive business modalities, is the mode of choice to integrate upstream production and sourcing into a controlled supply chain.
- Farmer organizations need capacity building to address skill and performance gaps, scale up needs and options, and develop opportunities for value addition.
- The pillars of capacity building are advising, training, coaching, and supporting investments done cost-effectively and executed with partners.

- Targeted capacity building is a tool to strengthen the buyer-supplier bond required to secure collaboration and commitment to contract compliance.
- This chapter explores the necessities, requirements, and opportunities of sourcing from smallholder farmers and doing so successfully.

The Rationale for Sourcing from Smallholders and for Aggregation

Sourcing from smallholders is necessary, given that globally the vast majority of farmers in agriculture, about 500 million, are smallholders who in some sectors provide as much as 70–90 percent of volume in relevant supply chains (Lowder, Sanchez, and Bertini 2021). To feed the world, sourcing from smallholders is imperative. In the same vein, access to farmland is crucial, and it is one of the comparative advantages of sourcing from smallholders. In most countries, agricultural land ownership is heavily regulated, and obtaining concessions of some kind is often not a viable option for off-takers. (It takes too long, is too costly, and/or is too restrictive.)

Sourcing from smallholders is desirable, and the advantages include, but are not limited to, capacity to ramp up or ramp down production without incurring fixed costs (contract farming); expand volumes while bolstering secured supply in volatile markets; reduce the risks of undersupply; hedge against localized soil health, pest, and disease problems; have access to donor assistance; provide opportunities for new business development; utilize new process- and production-optimizing technologies; meet corporate responsibilities; achieve sustainability and inclusiveness goals; gain community goodwill; and provide license to operate.

Aggregation is necessary, since it is unrealistic for firms to deal individually with the huge numbers of dispersed smallholder suppliers needed to meet their product sourcing requirements. In the following sections, we explore how to aggregate and we examine different aggregation models considering different crops and circumstances and including corporations' goals to operate inclusive and sustainable businesses. We then address how to deal with the challenges of contract farming and to realize contextual opportunities based on real-world experiences and on

best practices described in the literature. This discussion is complemented by business case studies.

Comparative Advantages

The potential advantages are numerous and attractive, but firms need to be proactive to seize and leverage them. Several investors found the following particularly valuable (CASA 2021):

Supply volume: Including smallholders in the supply chain helps to bolster the steadiness of supply and is an important way for expanding businesses to secure increased sourcing. This entails access to land, which would be difficult or too expensive for the agribusiness to obtain otherwise.

Processing economics: Agribusinesses engaged in primary processing with thin margins must ensure that their processing facilities operate at capacity to achieve and maintain economies of scale. To resolve supply issues directly and quickly, smallholders should be included in the supply chain.

Sourcing costs: Supply elasticity is greater for commercial farmers but at a cost and generally at a higher unit price for their buyers. Smallholders have lower production costs, particularly labor, and represent a more economical source of supply compared to alternatives, such as imports, where they exist. Furthermore, imports are exposed to foreign exchange risks.

Sales price: In some value chains, smallholder sourcing offers opportunities to agribusinesses to achieve higher sales prices, especially for a range of export-oriented products. Also, growing consumer consciousness has introduced price premiums for ethical, sustainable, fair-trade, and other product features associated with social responsibility. This is closely linked to perceptions of small-scale versus plantation farming. Some go so far as to say that smallholder sourcing is evolving from an added advantage to a requirement for competitiveness.

Social and political license to operate: Perhaps not obvious at first glance, reputation management and community buy-in can be critical factors in agribusiness success in low- and middle-income countries (LMICs).

Smallholder sourcing is seen as a valuable tool, but it should be truly mutually beneficial and inclusive to enhance the sustainability of agribusinesses. Alongside the social license to operate is the notion of political license to operate, which may be more salient in some LMICs. This entails building credibility and goodwill in the eyes of not just local communities, but also local and national governments. In certain contexts, smallholder sourcing was cited as a form of political business risk mitigation (CASA 2021).

Cost of capital: Agribusinesses sourcing from smallholders may find it easier to secure financing from impact or patient capital investors. They may benefit from more generous terms, including below-market interest rates, extended grace periods, or longer maturity and amortization schedules. Even among more commercially oriented private-equity firms, base-of-pyramid impact potential is often a component of pre-investment analysis. Agribusinesses also noted that the potential for reducing purchasing prices is particularly strong via direct sourcing. (See figure 3.1.)

Meanwhile, agribusinesses already sourcing from smallholders are moving toward upstream integration, away from intermediary models, and toward more direct sourcing from farmgate, cooperatives, and farmer groups. The elimination of middlemen can produce multiple benefits by lowering purchasing prices for the agribusinesses, while raising sales prices for smallholders.

FIGURE 3.1 Key Comparative Advantages of Sourcing from Smallholders as Seen by Investors

Source: Original figure for this book provided by IFC.

In addition, direct sourcing results in more contact and a better, more involved, managed, and controlled upstream integration of the buyer's supply chain. An important trend shows that corporations are placing more and more value on "intangibles" gained from operating inclusive business models with smallholders, which is being rewarded by their customers. Visible and credible demonstration of corporate social responsibility woven into a brand image that implies social and environmental consciousness, contribution to sustainability, responsible sourcing, and so forth, can achieve these rewards.

Opportunities and Challenges

Advantages = opportunities that have been seized. This may sound like a trivial conclusion, but embracing it has important consequences, as, among other things, it can be useful when designing a systematic approach that does not overlook an opportunity that is not obvious. The same logical approach applies to risk. To reduce the likelihood of risk, it is important to anticipate the most common ones and those with the worst consequences.

Positive opportunities in working with smallholders are described as follows:

Margins: Potentially, better margins can be achieved via lower unit procurement costs (eliminating intermediaries) and possibly higher selling prices for "original" produce and premium quality.

Security of supply: Security is bolstered by access to land, especially considering supply issues in volatile markets, and spreading one's portfolio geographically, thus reducing risk of undersupply. This benefit also includes the opportunity to hedge risks associated with localized pest and disease problems.

Business development and economics: Sourcing from smallholders holds potential for developing new business, finding clients for other products and services, and reaching the base of the pyramid. New technologies can be accessed, such as efficient, low-scale processing equipment, information technologies for coordination, and lower-cost traceability systems. Contract farming may enable the capacity to ramp up or ramp down production without incurring fixed costs to the agribusiness. Developing inclusive business with smallholders opens the door to donor assistance.

Intangibles: Along with tangible benefits are those that include documentable corporate social responsibilities, which strengthen the brand image. Gaining community goodwill improves the environment for an inclusive business model.

Achieving the advantages is not without challenges, but the opportunities outweigh the risks, and they are manageable. The question should not be whether to include smallholders in the supply chain, but how to do so effectively for mutual economic and other benefits.

Side selling: When farmers sell produce to buyers outside those with whom they have contractual arrangements, it is probably the primary inherent risk of sourcing from smallholders. In fact, side selling is an indicator that all efforts of collaboration were not enough and failed. So, if side selling is a symptom, let us focus on what support interventions are needed to establish a close and resilient relationship between smallholders and off-takers. Relationship and trust building through targeted support of various kinds, and close and frequent communication, can prevent the most worrisome risks from materializing. In that sense, the weaknesses of the smallholders present an *opportunity* for the off-taker to build and cement relationships with the smallholders and farmer organizations, to integrate the upstream chain elements, and to add value for impact and a mutually beneficial inclusive business. The types of support needed and how to implement them will be explored later in the chapter.

In conclusion, the positives of smallholder sourcing outweigh its risks, considering the safeguards, benefits, and opportunities relative to alternatives, whether the latter is imports, intermediaries, or single-supplier sourcing from large-scale plantations.

Costs of Sourcing from Smallholders

There are no uniform cost numbers for cost-benefit considerations when sourcing from dispersed and various types of producer bases, across different arrays of crops, in different geographies (each with particular physical, political, and socioeconomic parameters), and in varied stages of development. The complex nature of costs and benefits, however, makes them well worth exploring for planning purposes.

Costs comprise expenses and investments. There are fixed costs such as overhead and start-up investments. Typically, training modules need to be adapted and customized to local requirements and translated into

local languages to be useful for smallholders. Additional staff cost should be accounted for proportionately. Managerial efforts may be more difficult to measure in currency units. Accumulated variable costs will depend on the number of interventions and duration of capacity-building activities.

The benefits and impacts in the inclusive business model are wide ranging and materialize at different times. They affect the actors, the sector, and the environment. The impact goes beyond short-term economics: into more competitive profit margins, for example. Some may first appear as intangibles that translate into tangible wins later. Intangibles may have invaluable impact and primarily serve to protect the sustainability of the business per se, representing more than monetary value.

By experience and as shown in the case study in box 3.1, neither the off-taker nor the farmer organization needs to take on the costs and efforts alone. Aggregation and working cost-effectively at scale is best achieved by collaborating and partnering with other direct and indirect actors within and across value chains. The most cost-effective partners will be those who share the off-takers' business development goals: for instance, development organizations, research institutions, departments of agriculture, agri-input and equipment traders, agripreneurs, sustainability platforms, certification bodies, consultants, financial institutions, agricultural technology (agtech) providers, nongovernmental organizations (NGOs), and their donors.

BOX 3.1

Case Study: Cargill, Côte d'Ivoire—Sustainable and Traceable Sourcing through Farmer Organizations

Cargill is one of the world's leading cocoa and chocolate producers committed to a more sustainable and traceable cocoa production. At the heart of its operation is a partnership with more than 100 farmer organizations in Côte d'Ivoire representing more than 125,000 smallholders. Côte d'Ivoire is a globally leading producer of cocoa beans, producing 40 percent of the world's cocoa and engaging about 1 million smallholders, who in turn support the livelihoods of 8 million people. But most of the cocoa farmers live on US$0.97 a day—below the world's extreme poverty line. Recognizing this, Cargill launched the Cargill Cocoa Promise in 2012, a program dedicated to creating sustainable livelihoods for cocoa farmers and their families.

box continued

BOX 3.1

Case Study: Cargill, Côte d'Ivoire—Sustainable and Traceable Sourcing through Farmer Organizations *(Continued)*

Cargill is committed to sourcing from cooperatives. However, the company faces challenges in this regard. The lack of professionalism in cooperative management impacts farmer loyalty towards off-takers as well as the ability of the cooperatives to have viable, profitable growth and to respond to Cargill's growing sourcing needs. As aggregators, cooperatives often failed to secure supply and be profitable. Cooperatives also faced logistical problems, as they were operating with old, worn-out trucks that were expensive to maintain, and financial institutions were not willing to lend to cocoa cooperatives because of historical default rates in that sector. A seminal study conducted by the International Finance Corporation (IFC) with over 1,000 farmers in 2014 also showed that there is over US$2 billion in the cocoa value chain circulating outside the formal financial system, with all the risks and inefficiencies that that cash flow brings.

In this context, in 2014 Cargill partnered with IFC on investment and advisory services. The first phase of the advisory project was implemented from 2014 to 2018 with the objective of developing the local cocoa supply chain. It supported the professionalization of 80 farmer organizations and focused on improving their logistics and finance capabilities in order to secure a more sustainable and traceable cocoa supply. The advisory component was accompanied by financing facilitation for the purchase of new trucks for the cooperatives as well as the creation of multiparty partnerships with banks and telecom companies to register close to 15,000 farmers to digital payment channels.

IFC and Cargill also teamed with the Sustainable Trade Initiative (IDH), TechnoServe, and the Institut National Polytechnique Félix Houphouët-Boigny (INP-HB) to launch the first-of-its-kind Coop Academy to professionalize cocoa cooperatives by providing their leaders with the management skills to improve daily operations of their organizations. A customized capacity-building program was designed with 28 days of training and 12 months of personalized coaching, comprising SCOPEinsight for benchmarking and IFC's Agribusiness Leadership Program (ALP) for training and coaching. In parallel, a risk-sharing facility of up to US$6 million was set up to finance the purchase of new trucks for Cargill's partner cooperatives.

The results of the intervention in phase one were highly beneficial for cooperatives and for individual farmers. Of the supported 80 cooperatives, 74 percent improved their business performance; 62 cooperatives accessed over US$8 million in the form of lease financing for new trucks with a zero-default rate; 27 cooperatives processed digital payments to member farmers; individual farmer incomes increased on average by 125 percent from the baseline; and the cooperatives collectively reinvested over US$1 million from their premium payments into their communities.

A second phase (2019–23) works with 140 farmer organizations on professionalization as well as helping expand the use of digital payment channels to farmers and cooperatives to

box continued

BOX 3.1

Case Study: Cargill, Côte d'Ivoire—Sustainable and Traceable Sourcing through Farmer Organizations *(Continued)*

enhance their inclusion in the formal financial system. One hundred twenty cooperatives are already using digital payment channels in partnership with financial technology (such as OnPoint or Wave) or mobile network operators (such as MTN), enrolling over 25,000 farmers to digital channels, with a volume of more than US$1.5 million premium payments done digitally. Cargill and IFC are also in the last stages of launching a digital platform in partnership with Eclectics that will allow digital payments for purchases of cocoa from cooperatives in partnership with a few financial institutions, and 50 cooperatives had accessed more than US$4.6 million in loans for 175 trucks as of December 2021. In addition, 2,000 women in the women's groups are being trained on basic entrepreneurship skills to promote women's economic empowerment.

Overall, the more professional cooperatives are supplying increased volumes to Cargill, managing their farmers better, ensuring quality of the supply, managing certifications, and investing in farmers and their communities. With this intervention, the experience of Cargill demonstrates that aggregation and working cost-effectively is best achieved through collaboration and partnership with other key stakeholders in the sector. The capacity-building methodology in this project (assessing, training, coaching, and reassessing) also became a model for the development of the ALP, which has since been used in over 30 projects and 20 countries, reaching more than 500,000 farmers globally.

Aggregation Fundamentals when Sourcing from Smallholders

Relationships, agreements, transparency, comprehension, mutual benefits, perceptions, and trust are fundamental when sourcing from smallholders. It cannot be emphasized enough that successful and sustainable sourcing from smallholders and their aggregates (farmer organizations) must be based on establishing and maintaining good relationships with true mutual understanding and agreements based on underlying trust.

The term *contract farming*, with an emphasis on *contract*, seems to be reserved for only one particular option of aggregation and sourcing from smallholders. This may be legalistically correct, but the emphasis on contract is not right from an operational point of view. Upstream integration requires building a tight supply chain with controlled and responsible sourcing under firm agreements.

It is important to understand, however, that while contracting is important, reliance on a formal contract without the foundation of relationship, true understanding, mutual agreement, and trust would be a recipe for failure. Furthermore, contracting per se is not the only means of aggregation and especially not the first step. All aggregation follows a series of discussions and agreements, and only after the necessary steps have been taken should formal contracts follow.

With that interpretation, all aggregation of smallholder farmers is in fact a kind of contract farming, namely, sourcing based on various agreements that cover promises and expectations. For instance, the *lead farmer* of an informal farmer group (IFG) suggests to the members several practical and economic benefits deriving from working together. If accepted, the shared idea becomes an agreement, a form of contract.

The *aggregator* (off-taker or intermediary) suggests to smallholders and their farmer organizations to join in an agreement whereby the suppliers promise to produce and deliver crops as specified, under the condition that the aggregator provides certain kinds and amounts of support as specified and promised or committed to in a contract.

Verbal agreements and written contracts should be treated as having the same validity. The differences between the seemingly informal agreement and the written, witnessed, and signed contract are mainly legalistic in nature but also emotive, with different pros and cons. On the one hand, the verbal version leaves more room for arguing and disputing how something was meant and understood. On the other hand, there may be cultural and social norms that cause profound discomfort and aversion against the "shackling" sensation of very formal contracts.

Perceptions do count and matter!

The Key Actors: Farmers, Aggregators/Off-Takers, and Facilitators

Farmers

The main actors are the farmers and the aggregators themselves. "Farmers" in this context are smallholder farmers aggregated in groups, that is, farmer organizations.

Smallholders are generally defined as family-run farms with 2 hectares or less of land (although some expand that size definition). They are

vulnerable in many ways and unable as individuals to securely sustain their business. Their strength is having land and the fundamental skills to cultivate it. Their weakness is multiple dependencies with diminished access to finance—typically identified as the main obstacle.

Assessing the situation of smallholders is critically important for off-takers in their effort to aggregate and integrate them through groups (farmer organizations) in a controlled supply chain. The shortcomings of smallholder farmer organizations and their needs represent challenges to the off-taker but also opportunities to provide targeted support to establish and secure sustainable business.

Mutual trust and the shared belief that the off-taker and producer are pursuing common interests for mutual benefit are keys to success. In fact, they should convey that mutual understanding to each other, and each should realize that the success of one depends on the success of the other.

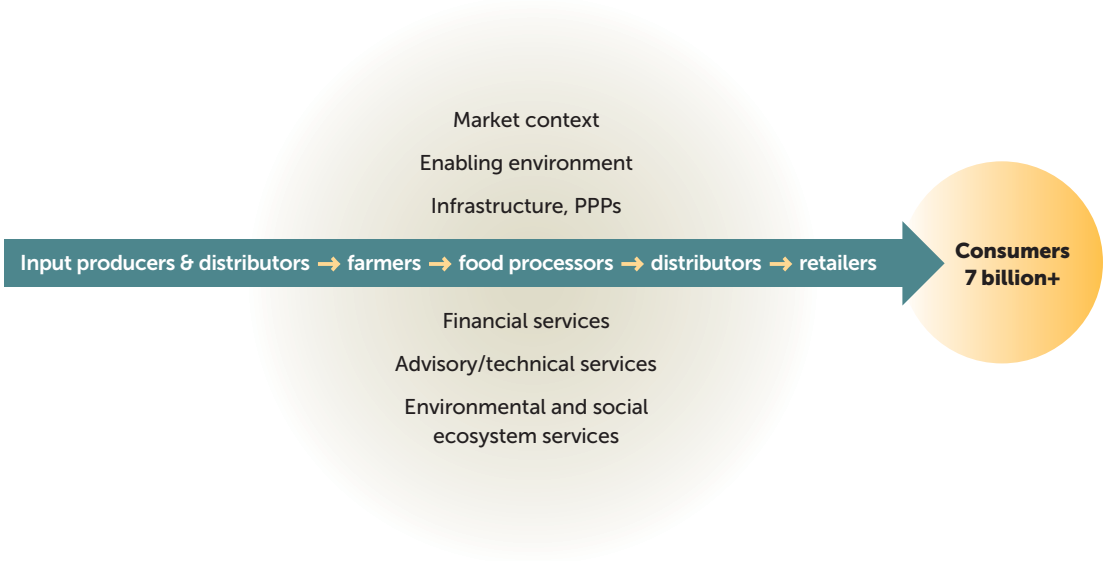
Note that smallholders do not make up a uniform category. As such, it will be necessary for managerial and economic reasons as well as for success to group together from the outset smallholders that meet similar assessment criteria.[1]

Figure 3.2 illustrates actors along the supply chain and those across it delivering business support services and contributing to the enabling environment.

Aggregators/Off-Takers

At first glance, an *aggregator* is an *off-taker* or an intermediary who buys agricultural produce from smallholder farmers and sells it to other supply chain actors. That off-taker initiates and supports aggregation, grouping smallholders into farmer organizations; has the means and the need to purchase large quantities; and has the knowledge of qualitative and quantitative market demand, preferences, trends, and prices. Aggregation can also be started by a lead farmer who forms a group to pool resources and collectively gain better market access. Definitely not to be overlooked are associated aggregators such as *input suppliers,* typically for seeds, fertilizers, and agrochemicals, and *service providers,* who contribute to capacity building of farmer organizations and provide farming extension services to smallholders. They all have a need to aggregate smallholders because smallholders represent their market. They are also prime candidates to be potential and high-value implementation partners in contract farming.

FIGURE 3.2 Supply Chain Actors Contributing to the Enabling Environment



Source: World Bank 2018, 13.
Note: PPP = public-private partnership.

Facilitators

NGOs, development organizations, and government agencies can play important facilitating and supporting roles—from start-up of farmer organizations through their capacity-building stages—until they become self-sustainable. They typically provide essential cross-cutting support to create an enabling environment, and they may enter private-public partnerships. The case study in box 3.2 demonstrates this well, using the experiences of Heineken and Soufflet in Ethiopia. From the outset, however, NGOs and governments should plan only for initiating and supporting activities and have an exit strategy to encourage sustainability as soon as possible or when critical capacities have been built.

Staple food value chains, such as for rice, cassava, and maize, are complex, made up of mainly informal or semiformal business arrangements between smallholder farmers and a range of traders and processors in highly fragmented and mostly loose supply chains.

BOX 3.2

Case Study: Heineken Breweries Share Company (HBSC), Ethiopia—Local Malt Barley Sourcing through Farmer Organizations and Model Farmers

Heineken International (Heineken N.V.) is a Dutch brewing company founded in 1864 that owns over 160 breweries in more than 70 countries. In Ethiopia, Heineken started operations in 2011 by procuring two breweries from the Ethiopian government and inaugurated its third brewery, now Ethiopia's biggest, in 2015.

Heineken launched the first local malt barley supply chain development project in Ethiopia in partnership with the Dutch government from 2013 to 2017. The project successfully introduced new high-yielding seed varieties in collaboration with government research institutes. This was followed by a second phase (2018–19), jointly implemented by the International Finance Corporation (IFC) and Heineken, with more emphasis on aggregation and business skills development for aggregators.

Despite Ethiopia's great potential for malt barley production and the government's eagerness to boost production, malt barley yield was too low—2.4 metric tons per hectare (t/ha)—to meet national demand prior to this project. Aggregation of available produce was not effective enough to serve the needs of large buyers, and domestic prices for malt barley were not competitive with imports. Consequently, all breweries were importing most of the malt they needed. In this context, the project was designed to increase Heineken's local sourcing of malt barley by increasing the productivity of farmers, enhancing the business skills of aggregators, and facilitating input and output financing.

Heineken and IFC partnered with the European Cooperative for Rural Development (EUCORD), a local consulting firm (PRECISE), Cordaid, and three local microfinance institutions (MFIs) to implement phase two of the project. Farmers were provided with agronomy training and access to improved inputs, while aggregators (cooperatives, unions, and model farmers) received the package of SCOPEinsight assessments and IFC's Agribusiness Leadership Program (ALP) training. The project worked with model farmers as aggregators for the first time in Ethiopia and pioneered the implementation of ALP in the country. Both the agronomy and business skills interventions leveraged and worked in line with the country's public extension system.

A total of 80 aggregators (39 cooperatives, 16 unions, and 25 model farmers) benefited from business skills capacity building using ALP, and the final SCOPEinsight reassessments demonstrated that slightly more than three-quarters of the aggregators scored higher than 3.5 (out of 5.0), registering 11 percent improvements in their scores from baseline. Under these aggregators, 40,152 farmers (including 20,000 from the preceding phase one project) benefited from agronomy training, improved inputs, and access to market. There were also spillover effects, where an additional 50,000 farmers adopted the improved farming practices and inputs. Also, US$1.8 million was mobilized through local MFIs and facilitated for 29,235 farmers in short-term financing for the purchase

box continued

BOX 3.2

Case Study: Heineken Breweries Share Company (HBSC), Ethiopia—Local Malt Barley Sourcing through Farmer Organizations and Model Farmers *(Continued)*

of inputs (seeds, fertilizers, and agrochemicals). Yield doubled among targeted smallholders from 2.4 t/ha to 4.5 t/ha and led to an estimated US$59 million incremental increase in farmers' sales revenues (with sales to Heineken and other off-takers). With strengthened aggregators, Heineken significantly increased its local sourcing from 5,000 t in 2017–18 (baseline), to 19,000 t in 2018–19, and 15,000 t in 2019–20. More importantly, the project played a key role in proving the case for commercial malt barley production in Ethiopia, which led to the investments by international malting companies Soufflet and Boortmalt.

Building on the success of the phase two project, the same approach is currently being replicated at scale with Soufflet Malt Ethiopia. Soufflet plans to source 100 percent of its malt barley locally, with 80 percent of the sourcing from smallholder farmers. During its implementation period of 2020–23, 100 aggregators (cooperatives, unions, and model farmers) are receiving business skills capacity-building support, and 50,853 (3,404 female) farmers are receiving agronomy training and access to improved inputs. So far, through the aggregators, farmers generated US$17.6 million from sales revenue, and 31,500 t of malt barley has been supplied to Soufflet.

Cash crop value chains, such as those for cotton, coffee, cocoa, and fresh bunches of palm oil, are more formal, with shorter and tighter chains and few key actors.

High-value food crop value chains, such as for fruit and vegetables, typically operate in well-coordinated markets with a clear value chain driver such as an exporter, supermarket, or large processor.

Animal husbandry and related produce value chains, such as those for animal meat and dairy products, typically require highly regulated food-safe and biosecure supply chains in well-coordinated markets, similar to those for the high-value food crops.

Tight versus loose value chains: In all categories, the supply chains need to be tight or tightened as a prerequisite for quality-controlled production and traceable sourcing, which can be achieved through contract farming. Tight chains are imperative to gain access to finance and to ensure traceability, food safety, and, where necessary, biosecurity (Mattern and Ramirez 2017).

Sourcing and Aggregation Models

Ways to Source from Smallholder Aggregates

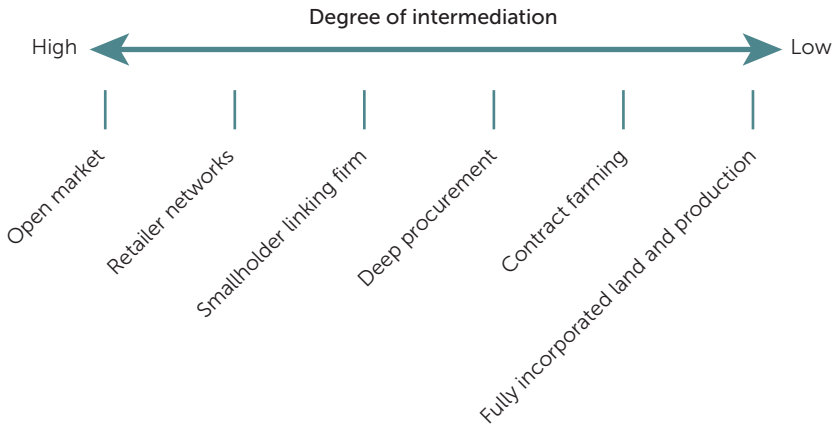
Distinguishing up to six separate alternative sourcing models for the relationship between the farmer or farmer organization and agribusinesses is useful, but keep in mind that in practice these distinctions often blur. An off-taker may merge different sourcing modes or pursue them in parallel.

In the *open market model*, an itinerant trader purchases directly from the farmgate, possibly brings the crop to a collection point, and sells to another middleman or intermediary. The product might pass through several traders before reaching the company. In *intermediary models*, the agribusinesses either source from independent third-party aggregators or they work more closely through arrangements or contracts with specific intermediaries or aggregators such as collectors, preprocessors, or trained agents who link and coordinate transactions with smallholders or their farmer organizations. *Direct sourcing* from smallholders or their farmer organizations includes *deep procurement* (purchase agreement just before season) or—and even better—via actual *contract farming* of specified crops under mutually agreed conditions. In the *nucleus-estate model*, agribusinesses maintain a central plantation and supplement production through informal or contracted agreements with nearby smallholders.[2] However, the term *nucleus estate* may also be used for a lead-farmer-owned, well-developed farm operation, which, acting as a champion, supports and collaborates with other smallholders as a *farmer group*. These models of sourcing are depicted in figure 3.3.

Direct Sourcing versus Sourcing through Intermediaries

Direct sourcing clearly implies that the off-taker operates under direct agreement or contract with the supplier, directly provides upstream services of support, demands produce as per specifications, and has oversight. The farmer produces and supplies, and the off-taker pays directly. By contrast, in an indirect sourcing model through intermediaries, the agribusiness is not necessarily free from the same obligations and controls, but these are simply less direct. In other words, the off-taker or agribusiness may delegate but must not give up its decisive influence and control and consequently lose the benefits of the upstream integration. The agribusiness should work with the intermediary, ensure that support to the farmer organizations is being

FIGURE 3.3 Models of Sourcing at Decreasing Levels of Intermediation



Source: Adapted from Gradl et al. 2012, figure 14.
Note: Neither the open market nor the fully incorporated model meets inclusive business criteria. Aggregation of smallholders' produce suits both large-scale sourcing of crops and selling of farming inputs. Companies sourcing from smallholders, particularly in the context of upstream integration through contract farming, will have to provide inputs and support services. Companies selling inputs may also add contract farming to their business model to promote and influence the proper use of their products—a valued strategy in combination with promoting sustainable agriculture.

provided, build capacities, and maintain control. To make that important oversight and contribution point stronger, let's ask the question: "Is indirect sourcing without provision of support really an option?" The answer must be "no"—not for integration in a tight supply chain and a sustainable and inclusive business model. Excluding itinerant traders or mere brokers, a chosen intermediary must link and provide services to off-takers and suppliers. That intermediary procures directly, possibly through contract farming.

The burden of providing support and exerting due diligence and control may be shared only among actors. Passing on responsibilities does not eliminate associated efforts and costs without jeopardizing the business model and the outcome. Fundamental and advanced criteria for successful contract farming apply to all forms of responsible sourcing, whether direct or indirect.

Since final responsibility for product quality and safety rests with the brand owner or seller, the off-taker or agribusiness must exercise due diligence to ensure the supplying smallholder or farmer

organization receives the upstream support to deliver products as expected and agreed upon.

In conclusion, anyone, direct buyer or intermediary, will have to source through contract farming to achieve true upstream integration as part of an inclusive business model.

Aggregation Models

Smallholder aggregation models can be categorized by their drivers, structures, motivations, sizes, and degree of organization and professionalism.

Drivers and Motivation

Aggregation into informal groups or more elaborate farmer organizations may be initiated by a lead farmer or by an off-taker, intermediary, or independent trader (table 3.1). Group formation or aggregation may also be driven by a government or an NGO to improve the agriculture sector's performance. These aggregation models are designed to work with multiple smallholders at the same time, thereby decreasing transaction costs.

Lead farmers are advanced and innovative farmers in a certain locality, acting as aggregation points for neighbor smallholders. They may conduct training and facilitate access to markets. As successful farmers, they enjoy trust and respect from their peers. Hence, information provided by or through them is more readily adopted than from other sources.

Nucleus farms are well-developed commercial farms with processing capacities and strong market links. Under contract farming models, they are used, developed, or even created by agribusinesses to organize collaboration with smallholders, support them in many ways, and serve as a collection point for products.

Farmer organizations and *formal farmer organizations (FFOs)* are smallholder member-based groups that pool resources for common goals. Their forms include informal and formal groups, cooperatives, trade associations, and farmer-owned sourcing and trading companies. Farmer organizations are commercial, provide business services to their members, and represent them collectively. Even if initiated or facilitated by external actors, they are owned and controlled by the smallholders themselves. They pursue common procurement and sales interests. They may

TABLE 3.1 Aggregation Models, Structure, and Motivations

Model	Structure	Driver/motivation
Informal farmer group (IFG, a first aggregate and entry point to establish or develop sustainable supply)	Typically built around lead farmers with basic capacities: share information, jointly participate in training, shared collection point	Producer driven: members keep independence while pursuing common interests to increase bargaining power, access inputs and technical assistance, secure market access, and improve access to scarce resources such as water
Nucleus farm	Advanced "champion" farm, setting example, attracting collaboration	Producer- or lead-farmer-driven: can collaborate with or aggregate smallholders to leverage own connections with buyers or markets.
Formal farmer organization (collective output still too small but valuable self-managed entity as part of a larger aggregate)	Formally registered as a cooperative; manages and acts as small enterprise; manages group support and input needs as well as shared resources	Buyer driven[a] to secure or enlarge supply base: includes traders, processors, wholesalers, retailers, exporters; also involves input suppliers (seeds, chemicals, and services) who also can take the role of aggregators and serve above buyers; involves specialized intermediaries (agripreneurs) supported to improve management of finances and quality/quantities of outputs Driven by (or better, only initiated) NGO/government intermediaries to build capacity and become sustainable
Corporate farmer enterprise (sometimes referred to as a second-tier organization)	Registered company, built on an aggregate of smaller farmer organizations, often via shareholding: acts as an aggregator by itself and manages input supplies and services as or better than FFO; does trading Referred to by various names including depots, fora, and apex cooperatives	Driven by market opportunities and motivated by economies of scale, maximizing bargaining power: run as a commercial company with profit goals and dividends paid to shareholders May be an accredited supplier to government and institutional buyers, hence qualified to bid in tenders An advantage for the buyer is the least involvement in aggregation and related efforts, as well as shared legal due-diligence responsibility Increased time and resources needed to build strong apex cooperatives, as size can reduce trust between members

Source: Original table for this book provided by IFC.
Note: FFO = formal farmer organization; NGOs = nongovernmental organizations.
a. For strategic reasons, to achieve early success, the first target of aggregation should be FFOs with similar, but not too diverse, capacities and development needs and prospects.

purchase equipment to be used jointly and produce, store, and process collectively. They aim to secure access to finance for their members.

Off-takers should support the development and professionalization of farmer organizations. Economical ways of doing so are discussed in detail later in this chapter, supported with case studies.

How to Implement

Aggregation, trust, gap analysis, the contract, farmer organization support, resources, solutions, and partners are the key elements in implementing smallholder sourcing. The overall process of implementation entails the following tasks: identify and select the smallholders and their farmer organizations, draw up contracts that are perceived as win-win, follow through and deliver on the mutually agreed-upon elements of the contract, and develop the business.

Aggregation

For strategic reasons and to achieve early success, the first target of aggregation should be the type of FFO to engage with: one whose members have similar, not too diverse, capacities and development needs and prospects. With this in mind, economies of scale can be achieved for the kind of supports that contribute to the commercial viability of the business case and growing profitability. These will range from inputs, extension services, and specific training to the prospects of value addition and scaling up (quality and quantity). In the process of aggregation, this approach may also create FFO champions that can serve as models to motivate IFGs and individual smallholders to join the development, expanding the supplier base for the agribusiness over time. This widens the spectrum of inclusiveness and development impact.

A Five-Step Guide to Aggregate Smallholders

Step 1: Determine the basic goals of the agribusiness. These could include type of crops, varietals to source and specifications, the volumes required per season or per year, and how much control to exercise and support to provide. The latter determines depth of procurement, integration, and control needed to achieve the agribusiness's goals.

Step 2: Conduct desk and field research, networking, and partnering in the supply chain. Desk and field research should be done simultaneously to study contextual parameters, analyze the value chain (including current production data, source channels, business support infrastructure), and determine environmental factors. From experience, this process will entail a back and forth between desk and field research to evaluate information and findings.

There are farms and farmer organizations that are ready, or have the will and capacity to get ready, to become part of an aggregate of suppliers.

It is advisable to start with FFOs with similar capacities and support their needs, which will increase the effectiveness of training and support, economies of scale, and the business's commercial viability.

Choosing farms or farmer organizations would be done either directly by one's own team or in collaboration with partners (professionals, firms, and institutions) that are working with farmers cultivating the crops required in the target area. In either case, prepare a checklist with the selection criteria for suitable farms or farmer organizations. These suitability criteria will include, among other specific or individual requirements, the expected varietals, quality, and quantity of the crop; farm sizes; locations and logistics; performance indicators; compliance with sustainable agriculture standards; and, importantly, a gap analysis to estimate the required level of effort for building and enhancing the capacity of the prospective supplier. SCOPEinsight provides the tools for that.[3]

Conduct a first round of visits to the field of smallholders, FFOs, other professionals, traders, and other intermediaries in the supply chain. These visits are invaluable to add information and validate what was obtained from secondary sources. Then start sketching the upstream part of the supply chain.

See the list of recommended sources of information and prospective collaboration partners, including prospective partners to manage the aggregation process and to later collaborate with in the provision of upstream support. Prospective strategic partners have shared business interests in the same supply chains and are eager to collaborate for mutual benefits, likely without added costs to the agribusiness. This is further elaborated in box 3.3.

Step 3: Meet targeted smallholders or farmer organizations for assessment and to establish a baseline. Analyze the capacity gaps (access to resources, information, know-how, and managerial capability) of the prospective farmer organization. Comprehensive assessment tools are provided by several institutions and initiatives such as SCOPEinsight and IFC's Agribusiness Leadership Program (ALP).[4] Pay particular attention to gaps and exclusion criteria in regard to sustainable farming (due diligence). Although that process is very formal, the aggregator should create an atmosphere of open conversation with the farmer organization, discuss its needs and wants, and negotiate on what can be agreed on.

Step 4: Determine strategic alliance partners for organizing and managing the aggregation of and the sourcing from smallholders. Many of them may

BOX 3.3

Preferred Strategic Partners in Aggregation

- Industry and traders' associations working in the same range of crops and agricultural products
- Crop, traders, or industry associations, chambers of commerce
- Rural departments of agriculture (may have supportive strategies in place, have information on development activities in the area, and have leads to identify prospective partners locally)
- Departments of investment (if any)
- Suppliers of certified seeds and of other quality, probably certified, inputs (They obviously serve the same, that is, the right segment of farmers or farmer organizations, already advanced or willing to invest in performance.)
- Extension service providers and their employers or organization
- Agricultural universities and/or vocational training institutions
- Nongovernmental organizations working in the target area in value chain development
- Certification bodies with current and prospective client information, certainly eager to cooperate
- Platforms such as the Sustainable Agriculture Initiative (SAI) and the Sustainable Rice Platform (SRP) (to provide sustainability assessment tools, standards and performance indicators, and access to networks)
- Financial institutions, especially those offering microfinance support
- Agtech or information and communication technology for agriculture (ICT4Ag) solutions providers
- Farm equipment sellers and leasing firms
- Logistic firms or harvest service providers
- Agripreneurs and current intermediaries in the supply chain (The agripreneur has dual potential value, first at this phase of aggregating, and then, as a low- or no-cost trainer or extension of the aggregator; currently competing traders or brokers should also be explored for suitability and readiness to become a contract aggregation partner.)
- Lead farmers and nucleus-estate operators as focal candidates for aggregation themselves and also as excellent sources of information on aggregation options in the locality (and adjacent areas) and on development needs and opportunities

deliver later, jointly, the agreed-upon support to smallholders for contract farming (upstream integration). The selection process is best done through discussing and using a memorandum of understanding. Once all parties are comfortable with that, make firm and formal contracts with the selected collaboration partners and with intermediaries.

Step 5: Meet the selected smallholders or farmer organizations to finalize the formulation of agreements—the contract. When meeting with the finalists, appear to be the decision-maker and be prepared to explain and commit on the spot to the support you can provide.

Conclude a fair and transparent contract, ensure that it is truly understood and agreed upon, and have it witnessed and signed by a respected and mutually trusted person of influence (see upcoming section "The Contract").

This process should be followed up with preparing and agreeing on a schedule for the provision of goods, services, and information with the FFO. Ensure that this will result in two-way communication: namely, exchanges of information such as progress reports, monitoring data gathering and recording, and ad hoc observations.

Trust and Communication

For good reason, trust and personal relationships must be emphasized repeatedly, especially regarding agribusinesses headquartered and with operating experience mainly in countries with a "contract culture," a reliance on formal documents, written contracts, and their legal enforcement. In most agribased emerging markets, the culture is very different, and contract enforcement by legal means is perceived differently—as a communication defeat and reputational loss. Even the upfront request to sign a very legalistic contract can be regarded as an expression of mistrust on which business can hardly be based successfully.

Trust is a function of many elements, but good communication—frequent, formal and informal, and of varying types—is a key ingredient.

In that sense, the bedrock of successful aggregation and contract farming is trust, and contract farming is the backbone of upstream integration. Drafting the actual contract requires knowing each party's understandable interests, a common perception of mutual benefits, transparency, clear agreements on "what if" situations, namely, foreseeable variations with reward and discount schemes, and a signed and witnessed contract, followed by frequent communication throughout.

The farmer wants to trust the off-taker and expects procurement and payment as agreed, timely support and to the full extent agreed, fairness, and empathy for the farmer, who is perceived to be in a weaker position.[5]

The off-taker wants to trust the farmer and expects supply of the crop varietal as per specifications in quality and volume as agreed, and excellent communication throughout, with updates and early heads-ups informing of or anticipating any changes that may occur.

All the emphasis on trust is not an invitation to trust blindly. Good communication is key, and the saying "trust is good, but control is better" may sound harsh but holds true in business. To achieve that, and in the absence of already long-standing relationships, a solution is to team up with others and form strategic alliances. Instead of deploying an army of one's own field staff (intermediaries in the best sense), the off-taker can build on shared interests and seek collaboration with their preferred suppliers of products (seeds, chemicals, and other farming inputs) and services (training or extension, finance, and logistics). Often this requires training of suppliers' personnel and improving or even organizing their reporting and communication systems, but it will be worth the effort.

Gap Analysis

Prior to concluding an agreement and before formulating a contract, the off-taker should conduct a thorough gap analysis of the supplying farmer organization. This forms the basis for decision-making, discussions, and planning of support and capacity building, and potential investments to be made. Comprehensive gap analysis tools are, for instance, provided by SCOPEinsight, and specific tools for self- and third-party assessment are available for sustainable agriculture (Farm Sustainability Assessment)[6] by the Sustainable Agriculture Initiative and sustainable rice cultivation by the Sustainable Rice Platform (SRP),[7] respectively.

In the chapter's earlier section "Opportunities and Challenges," several risks or typical challenges, as they are often encountered in contract farming, have been highlighted. It is useful to revisit them before drawing up the contract and to anticipate how to mitigate risks and deal with sensitive issues. Table 3.2 explores high-level considerations of challenges and potential solutions, while the details of these are presented in the sections "Implementing the Contract" and "Contract Farming Resources, Solutions, and Partners."

The Contract

To recap: A contract is a comprehensive, detailed, fair, negotiated agreement on mutually agreed obligations. The contract is very important as a reference tool in communication with the smallholder farmer organization, but reliance on that formal document without a solid relationship foundation, true understanding, mutual agreement, and trust would be a recipe for failure. Based on experience, the following are the key considerations and specific elements upon which the contract should be built.

TABLE 3.2 Overview of Challenges and Potential Solutions

Challenges to secure	Solutions working directly with farmers or with networking partners
Quantity, quality, consistency, uniformity	Advisory, training, and coaching in sustainable agriculture—Sustainable Agriculture Initiative (SAI) and the Sustainable Rice Platform (SRP)—from use of quality inputs, seeding, and farming techniques to quality management, leveraging extension services
Safety, traceability	Advisory on food safety, part of sustainable agriculture standards (for example, GlobalG.A.P.); application of agtech (for example, FarmForce, Bluenumber)
Compliance with rising standards	Off-taker/aggregator to anticipate trends and provide or facilitate advisory and capacity building
Packaging logistics	Provision of material and/or outsourcing of activity, partnering with relevant service providers
Loyalty and fulfillment of commitments by farmers (side selling)	Agreements on what support to manage and which gaps and needs of the smallholder farmer organization to address—clearly and specifically addressed in the contract; promote such with the members to gain trust, buy-in, loyalty
Capacity-building efforts and costs	Efforts with partners = investment, not a cost, paid for by the gain in yields, quality, loyalty, and contract fulfillments
Political opposition to commercialization of smallholders	Advocacy, promoting the contributions to socioeconomic development and political stability brought about by the inclusiveness, support to, and sustainability of the business model introduced by the off-taker

Source: Original table for this book provided by IFC.
Note: agtech = agricultural technology.

Winning principles begin with the contract introducing and maintaining transparency and ensuring clear understanding. To that end, the off-taker should stay in close and frequent buyer-seller contact throughout the duration of the agreement, which will also discourage interference by freelancing traders. In case of extensive agreements involving standards and specific practices, companies must build and monitor smallholders' capacities. In that case, trusted partners and specialized intermediaries are of great value, not only to accomplish the technical advisory, but also to keep up close contact and the flow of communication.

Managing expectations is a great way to minimize disappointment. The off-taker needs to insist on a discussion of reciprocal fairness and contract flexibility, which will increase cooperative attitudes and compliance. One must also accept reality and should therefore define reciprocal provisions for "side selling" and "side buying." Agree on mutually acceptable final price adjustments based on actual yields, quality, and prevalent market price levels. Clearly define the required quality standards and consequences of under- or overachievements.

Offer rewards for the achievement of agreed-upon goals in compliance with guidelines, but by the same token, include a discount scheme for product deficiencies.

Partnering and forming strategic alliances begin with forming partnerships with farmer groups that facilitate communication, provision of services, secure sourcing of agreed-upon volumes, and product quality. The off-taker should explore recruiting some independent intermediaries to become corporate purchasers and field consultants. Relatively easy and most useful is to partner with selected service providers in the areas of logistics, for example, harvesting support. Forming strategic alliances with seed suppliers who have shared interests begins at the aggregation stage and leverages their long-standing relationships with their customers and their distributors' customers. More detailed suggestions are provided in the section "Contract Farming Resources, Solutions, and Partners," followed by examples of resources, networks, programs, platforms, and initiatives to call upon or partner with. Finally, bear in mind that intermediaries and partners must be trained and equipped to ensure farm-level compliance with sustainability and inclusiveness criteria.

Strengthening supplier-buyer relations, thus triggering loyalty, is the bedrock, and it must be focused on exploring and then responding to social and infrastructural needs of the farmers' businesses, especially those that may not be cash based (which seems to be generally underutilized). This relates to the farmers' or farmer organizations' socioeconomic needs in the areas of health care, nursing, education (scholarships), advocacy, visibility, social activities, and training. Indirect financing is also attractive and economical, including, for example, favorable financing at lower-than-market rates or a nominal cash prize if a child attends university. Most practical and most in demand is the provision of, or facilitated access to, certified seeds. Together with the provision of training to obtain better quality and yields, this is a highly attractive element in contract farming. A final, proven tool to increase compliance is to have the contract witnessed by a respected community leader (accepting the patronage culture).

Excelling in communication is a goal to be achieved by securing the flow and exchange of information along the supply chain with a focus on critical elements (including updates and alerts) and crucial actors. The off-taker should explore collaborative use of databases and the knowledge of key input suppliers and service providers. Ensure close communication by all available means, such as personal direct contacts, phone calls, digital or social media chats, networking partners and alliances, and service providers. If possible, convert some intermediaries into purchasing agents or

agripreneurs, by collaborating rather than competing. Beyond the need to assure the success of contract farming, continual and frequent contact with the suppliers is meant to prevent the interference of middlemen.

Some examples of valued social contribution include the off-taker committing to providing social benefits or contributions to farmer organization–managed benefits, for example, health (visiting nurse), student transportation (leased minivan), and childcare. The off-taker may initiate a foundation for community causes and contribute a nominal amount per metric ton of crop. Similarly, a scholarship can be created and funded; the community can then be empowered to select candidates annually.

Implementing the Contract

The agribusiness should take a holistic approach to both needs and opportunities to add value. The most cost-effective way to strengthen smallholder farmer organizations, to scale up outputs and impact, and to achieve optimal use of resources is through collaboration. There are three key levels for this:

First, cooperating with smallholders is the foundation of any inclusive agribusiness. Smallholders need to be aggregated to make business relationships with hundreds or thousands of small and often remote farmers. The off-taker's management must ensure that the procurement staff is fully informed of their roles and trained to execute the agreements (contracts) the company has entered into with the smallholder farmer organizations and any intermediaries.

Second, leveraging synergies and complementarities can be achieved through partner organizations or entities to complement the company's own strengths in order to pursue shared interests with smallholders. The relationship with other organizations can range from being purely transactional to very close partnerships: for example, in the form of joint ventures.

Third, improving the broader business environment through collective action with nonprofit organizations and policy dialogue with governments can be effective. For that, special platforms exist in the domain of agribusinesses to facilitate collective action and policy dialogue for a better enabling environment.

In a tight, well-interlinked value chain, *holistic development* will ensure that the strengthening of one element has synergistic push-pull effects on the others: downstream from better inputs and production to better markets and from better markets to upstream improvements along the chain.

Table 3.3 provides an overview of the development needs of farmer organizations, whereby the common most dominant needs such as access to finance and to markets straddle across the whole supply chain. Segmenting the chain into three components makes it easier to identify specific needs and plan for targeted interventions. Conversely, the segmentation can be used as a tool to make interrelationships more visible and create scenarios of interventions in one segment that have impact on the other two. By taking this kind of holistic view in planning, the cost/benefits of interventions can be optimized.

Contract Farming Resources, Solutions, and Partners

For the three components of the supply chain—production, processing, and marketing—there are resources that can be used to respond to development needs and to add value. Finding these resources and proposed solutions will always be a work in progress due to the continual developments of the technologies supporting production; processing; communication with markets; and digital interactions with the environment, among actors, and with communities in the business world.

Many of the resources presented in this section come with web-based references that will have their own dynamic updates. Readers are encouraged to use the URLs provided in the chapter reference list and the endnotes or the keywords for their own internet searches.

TABLE 3.3 Smallholder Farmer Organization Support at All Levels That Meets Needs and Strengthens and Develops Sustainable Business

Support to production	Support to processing	Support to marketing
Provision of information/ advisory support	Provision of information/ advisory support	Provision of information/ advisory support on regulatory requirements, market demand, consumption trends, consumer preferences
Digital farming support: Global Environmental Monitoring System (GEMS)	Post-harvest advisory support, equipment, and logistic services: for example, Tun Yat,[a] Twiga smart crates (Silafrica 2020)	Collecting and grouping of products by categories
Information exchange: chatbot platforms	Digital applications—traceability: for example, Bluenumber,[b] FarmForce[c]	Market prospecting services: finding new markets for crops and diversified products

table continued

TABLE 3.3 Smallholder Farmer Organization Support at All Levels That Meets Needs and Strengthens and Develops Sustainable Business *(Continued)*

Support to production	Support to processing	Support to marketing
Access to quality inputs	Applications/techniques to reduce spoilage/extend product shelf-life: for example, Apeel[d]	Facilitation of participation in trade fairs, online trading e-commerce: for example, Pinduoduo[e]
Access to productive equipment	Advisory support on value addition and preprocessing opportunities	Connecting to trade associations
Agricultural extension services to agripreneur	Processing of by-products for additional value creation	Support to understanding buyers and export potentials
Sustainable agriculture—Sustainable Agriculture Initiative (SAI) and the Sustainable Rice Platform (SRP)	Access to processing equipment	Farm Sustainability Assessment (FSA) tool (SAI)[f] SRP-verified label SRP Brand Manual[g]
Resilient, regenerative climate-smart agriculture (CSA)	Access to packaging facilities	Narratives for marketing and promotion: www.sustainablemarkets.org
On-farm carbon sequestration	Advisory support/training on food safety	Narratives for marketing and participation in carbon markets.[h, i]
Advisory on precision agriculture—agtech	Labeling and certifications	n.a.
Provision of information and advisory support on add-on business from crop rotation, off-season alternate crops, waste management to biomass uses	Advisory support on grading, quality control, logistics	n.a.

Source: Original table for this book provided by IFC.
Note: n.a. = not applicable.
a. Tunyat website, https://www.tunyat.com/.
b. Bluenumber website, https://www.linkedin.com/company/bluenumber/.
c. FarmForce website, https://farmforce.com/.
d. Apeel website, https://www.apeel.com/.
e. Pinduoduo website, https://en.pinduoduo.com/.
f. SAI Platform website, https://www.saiplatform.org.
g. SRP website, https://www.sustainablerice.org.
h. https://ag.purdue.edu/commercialag/home/resource/2021/06/opportunities-and-challenges-associated-with-carbon-farming-for-u-s-row-crop-producers/.
i. https://www.ucsusa.org/resources/agricultural-soil-carbon-and-carbon-markets.

There are many services, networks, initiatives, and prospective partners to support production and to professionalize farmer organizations. These can help smallholders improve productivity through rehabilitation of farms and material, better access to inputs, improved mechanization, and environmentally sustainable farming techniques,

passed on through advisory services, and ideally all introduced, provided, and/or facilitated by the off-taker. The following provides an entry point for the off-taker to navigate through the seemingly endless options.

Professionalizing the Farmer Organization

The *International Organization for Standardization/IWA 29:2019 Professional Farmer Organization—Guidelines* (ISO 2019) is a standard that establishes common guidelines for professional farmer organizations to improve their business performance.

The Agribusiness Market Ecosystem Alliance (AMEA)[8] is a global network in the agricultural sector for accelerating the professionalization of farmer organizations, currently reaching millions of smallholder farmers in more than 80 countries.

The IFC Agribusiness Leadership Program (ALP)[9] prepares farmer organizations to become more professional and more productive so that they then can attract finance and customers, sell more, and do more for their members and for farming communities. The ALP integrates SCOPEinsight assessments[10] for capacity and creditworthiness. Training and coaching are designed to measurably improve the management skills and professionalism of farmer organizations.

A novel digital solution is also offered by ALP Metrics. It is a mobile-phone-based assessment survey for producer organizations, model farmers, and last-mile retailers. ALP Blended Learning integrates e-learning and live virtual training with traditional face-to-face approaches. Both innovations present the opportunity to implement projects more effectively with greater development impact at lower cost.

Low- Or No-Cost Extension Services Solutions

The Last Mile Retailer[11] provides retailers an often overlooked link between agribusinesses and smallholders. Frequently, agri-input retailers are farmers' first stop for advice and knowledge. IFC and partners, including SCOPEinsight, Cultivating New Frontiers in Agriculture,[12] Bayer,[13] and Syngenta,[14] created Last Mile Retailer. It aims to improve the professionalism, knowledge base, and business performance of agri-input retailers.

The *Agricultural Entrepreneur—Agripreneur*, a concept from the Syngenta Foundation,[15] is an entrepreneur-centric approach to address bottom-line problems of the marginal agrarian community. Every

agripreneur works with 150–200 farmers in a cluster of two to three villages and acts as a one-stop resource provider for the agricultural needs of smallholders. Kuza One[16] is an agtech digital platform that leverages last-mile rural agents to improve farmers' productivity, resilience, and income. They provide advisory or extension services to the smallholders and facilitate transactions for procuring, servicing, quality inputs, mechanization, credit, market, and allied services. Kuza establishes and trains agripreneurs who generate their own income via commissions from the transactions the farmers make in the marketplace. Agripreneurs can be a low-cost extension arm, consulting smallholders for an off-taker instead of the firm employing its own large extension field force. The practical experience with the agripreneur model is presented in box 3.4, a case study of Bayer in India.

BOX 3.4

Case Study: Bayer Better Life Farming Alliance, India, Agri-Entrepreneurs—"Agripreneurs"—Approach for Aggregation and Holistic Development of Supply Chains

A global partnership among Bayer Crop Science, Netafim, Swiss Re, and the International Finance Corporation (IFC) was launched in 2018, aiming to enable 3 million smallholders to unlock their farming potential and improve their livelihoods.

The initiative works to achieve its objective by promoting the adoption of modern and climate-smart farming practices and technologies, facilitating access to quality farm inputs, and offering access to markets. Accordingly, Bayer introduced the Better Life Farming Alliance (BLFA) approach, which entails working with a network of rural agri-entrepreneurs—agripreneurs—to provide holistic extension and aggregation services. Through BLFA, Bayer works with 5,000 agripreneurs who offer extension and aggregation services together with the mainstream extension team working in farmer engagement.

The Bayer initiative provides smallholders with a complete package of farm inputs (plant protection, balanced fertilizers, seeds, micro-irrigation) together with training and farm demonstrations using the BLFA approach (agripreneurs) to help sustainably increase farm yields and create markets for the produce. The agripreneurs work as the last-mile channel in underserved geographies, providing access to both agricultural inputs and markets. The initiative supports agripreneurs with the tailored business skills training program, Last Mile Retailer, and comprehensive capacity building is also provided to professionalize their aggregation role using IFC's Agribusiness Leadership Program.

box continued

BOX 3.4

Case Study: Bayer Better Life Farming Alliance, India, Agri-Entrepreneurs—"Agripreneurs"—Approach for Aggregation and Holistic Development of Supply Chains *(Continued)*

In India, the Bayer initiative aims to reach 25,000 smallholders, of which 50 percent are women. The program also aims to support 300 agripreneurs, including 150 women. In this initiative, IFC works with the BLFA partners to build the capacity of the agripreneurs for supporting smallholders with improved agronomy practices and technologies to increase farm yields. The agripreneurs are also empowered in their aggregation roles to meaningfully integrate smallholders into the commercial agribusiness supply chains. The alliance of BLFA partners, including input suppliers, capacity builders, financiers, off-takers, and other service providers ensures the delivery of complex and all-inclusive support to the agripreneurs and smallholder farmers to achieve holistic development of the supply chains. In this regard, the initiative substantially increases the inclusion of smallholders from underserved areas and improves their business acumen and farm productivity. This process, in turn, enlarges the supplier base for off-takers and grows the market for input and service providers.

The results from such an initiative are a win for all stakeholders. Bayer's market share increases in underserved geographies, its brand value is enhanced, and its supplier base is increased. The agripreneurs' income is increased through alternative livelihood options, and their business professionalism is improved. Smallholder farmers double their farm yields, increase their income, and boost sustainability through climate-smart agriculture practices. Given these results, the BLFA approach is set for replication, for an ultimate global reach of 100 million smallholders.

Bayer is currently scaling the BLFA approach through its growth plans and expansion efforts in Bangladesh and Indonesia. Similar plans are also underway for Kenya, the Philippines, and Vietnam. Bayer's commitment to the BLFA, its targets, training, and other capacity-building activities are further being institutionalized under the Better Life Farming (BLF) Academy (a work in progress). The BLF Academy seeks to standardize the ALP and Last Mile Retailer programs as it expands beyond India. The BLFA initiative in India is a pilot and steppingstone to the larger goals of Bayer and its alliance members by increasing market shares, brand value, and reach in underserved geographies.

Support Production and Facilitate Market Access of Off-Season Crops

Off-takers and partners can support value addition at the production level for their mutual benefit in other ways: for instance, by encouraging crop rotation and helping the farmer gain market access for the alternate crop (typical example: beans or pulses as an alternate off-season crop to rice).

Support Add-on Business

An example of collaborative business creation is the use of post-harvest waste. The use of crop post-harvest waste as biomass for energy generation, biological fertilizer, and so forth is quite common and represents a resource for many business spin-offs. Material such as rice straw (or just the stubs) presents multiple add-on business opportunities (see IRRI 2018).

A recent project by a corporate social responsibility–conscious entrepreneur (Urmatt) collects rice stubble from smallholders, who would ordinarily burn the stubble. The entrepreneur processes the straw into paper pulp to produce biodegradable, food-safe packing material that replaces single-use plastics, thus preventing post-harvest pollution (greenhouse gas emissions from burning).[17]

Access to Financial Resources

Limited access to finance is the smallholder's most quoted business impediment, and there is no single solution; a multipronged approach is needed for short- and long-term solutions to this multitiered problem. An immediate activity for longer-term and longer-lasting impact is financial literacy training that includes preparation of business plans, as financial institutions expect these plans for loan applications. This training is part of the packages that aim to professionalize smallholder farmer organizations (for example, the ALP). Shorter-term interventions depend on options that vary by location, infrastructure, and regulatory environment.

The off-taker may collaborate with microfinance and microinsurance institutions. For instance, an advance payment mechanism to support smallholders' access to inputs was put into place to prefinance farmer organization members' inputs before production and sales in Burkina Faso and Mali (IFAD 2016). Based on volume estimates of produce that will be sold through the farmer organization, advance payments are made in two tranches: one during the first week of the farming season and the other when the produce is delivered to the farmer organization. Digital solutions are included in the subsection "Digital Solutions."

The warehouse receipt system is a good solution where the infrastructure exists. Farmers or farmer organizations store their produce in a warehouse in exchange for a voucher. The voucher can then be used as collateral to obtain funding from a rural finance institution. The system

depends on the availability of adequate storage facilities and funding agencies willing to engage.

Information Services

Lack of information is mentioned as the second biggest smallholder farmer organization deficit (after access to finance). In fact, the amount of information accessible today is overwhelming, but it must be searched for in a targeted manner and then processed. The off-takers are in a great position to prove their support value, provide information, and benefit from it as well. The sources of information are too numerous to list but include the networks, platforms, and initiatives already highlighted in the first three subsections under "Contract Farming Resources, Solutions, and Partners." The channels to provide information services are direct ones, through intermediaries and one's network of partners. To counter occasionally voiced concerns, transparent sharing of market and marketing information does not diminish the off-takers' power of knowledge if applied in proactive fashion but rather helps achieve the buy-in, willingness to upgrade, compliance, and loyalty from the smallholder farmer organization; again, this provides mutual benefits.

Digital Solutions

Digital solutions serve at all levels, along and across supply chains. They either strengthen or make support and monitoring activities possible at all through farm and data management, production and processing monitoring, traceability, agent development, farmer information and extension services, training and coaching, supply chain benchmarking, and precision agriculture to help smallholders improve performance and make the inclusive business model successful.

Digital solutions are covered in more detail in chapter 4.

Notes

1. See Agribusiness Market Ecosystem Alliance (AMEA) and Agribusiness Leadership Program (ALP) Tools at the ALP website, http://www.ameaglobal.org/.
2. A central plantation is a company-owned nucleus-estate model that would have to be assessed as to whether it delivers on the comparative advantages of smallholders (risk mitigation, diversity, and inclusion) to fit into one of the supplier categories.

3. See the SCOPEinsight web page, "Assessments," for the tools and approach useful for this endeavor, https://scopeinsight.com/how-we-do-it/assessments/.
4. See the SCOPEinsight website, https://scopeinsight.com, and IFC: International Finance Corporation/World Bank, Agribusiness Leadership Program web page, https://www.ifc.org/wps/wcm/connect/Industry_EXT_Content/IFC_External_Corporate_Site/Agribusiness/Advisory/Agribusiness+Leadership+Program/.
5. The farmer's expectation toward the off-taker's willingness to compromise can be challenging.
6. See the full range of Farm Sustainability Assessment (FSA) resources at SAI (Sustainable Agriculture Initiative) "Platform Resource Centre," https://saiplatform.org/resource-centre/fsa/.
7. See the SRP (Sustainable Rice Platform) web page, "Resources," http://www.sustainablerice.org/Resources/.
8. See the AMEA (Agribusiness Market Ecosystem Alliance) website, https://amea-global.com/.
9. See the IFC Agribusiness Leadership Program website, https://www.ifc.org/wps/wcm/connect/industry_ext_content/ifc_external_corporate_site/agribusiness/advisory/agribusiness+leadership+program.
10. See the SCOPEinsight web page, "Assessments," https://scopeinsight.com/how-we-do-it/assessments/.
11. See the IFC Last Mile Retailer: Improving Outcomes in Agribusiness website, https://www.ifc.org/wps/wcm/connect/Industry_EXT_Content/IFC_External_Corporate_Site/Agribusiness/Advisory/Last+Mile+Retailer/.
12. See CNFA, "Cultivating New Frontiers in Agriculture," website, https://www.cnfa.org/.
13. See Bayer, "Our Targets to Be Met by 2030," website, updated February 24, 2022, https://www.bayer.com/en/agriculture.aspx.
14. See Syngenta Group, "Innovating Sustainable Agriculture Solutions," website, https://www.syngenta.com/innovation-agriculture.
15. See Syngenta Foundation for Sustainable Agriculture, "India," web page, https://www.syngentafoundation.org/agriservices/wherewework/india.
16. Kuza Biashara Limited, "Revolutionizing Rural Businesses," website, http://www.kuza.one/.
17. Personal communication with Urmatt project staff. More information about Urmatt may be found on its website, https://www.urmatt.com/.

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CHAPTER 4
AGRICULTURAL TECHNOLOGY

Ashley Elliot

KEY MESSAGES

- Thanks to improved infrastructure connectivity and diverse technology ecosystems in many emerging markets, the digital technologies that strengthen smallholder supply chains are expanding every year.
- Emerging solutions encompass how farmers receive payment, obtain finance, protect against risk, access markets, optimize production, and manage data and supply chains.
- These technologies focus not just on boosting incomes and yields but also on supply-chain traceability and certification—a response to growing consumer demand.
- However, the agriculture technology (agtech) "revolution" remains in the early test-and-learn phase. The landscape is both fragmented—due to low interoperability and accessibility—and overcrowded, due to a lack of consolidation among subscale start-ups.
- Agtech winners with products that are multiuse and scalable will gradually emerge, boosted by the falling costs of mobile data, handset, and cloud storage, but as with the earlier "fintech revolution," it is hard to predict ahead of time which models will succeed. (*Fintech* is shorthand for financial technology and for the companies using it.)

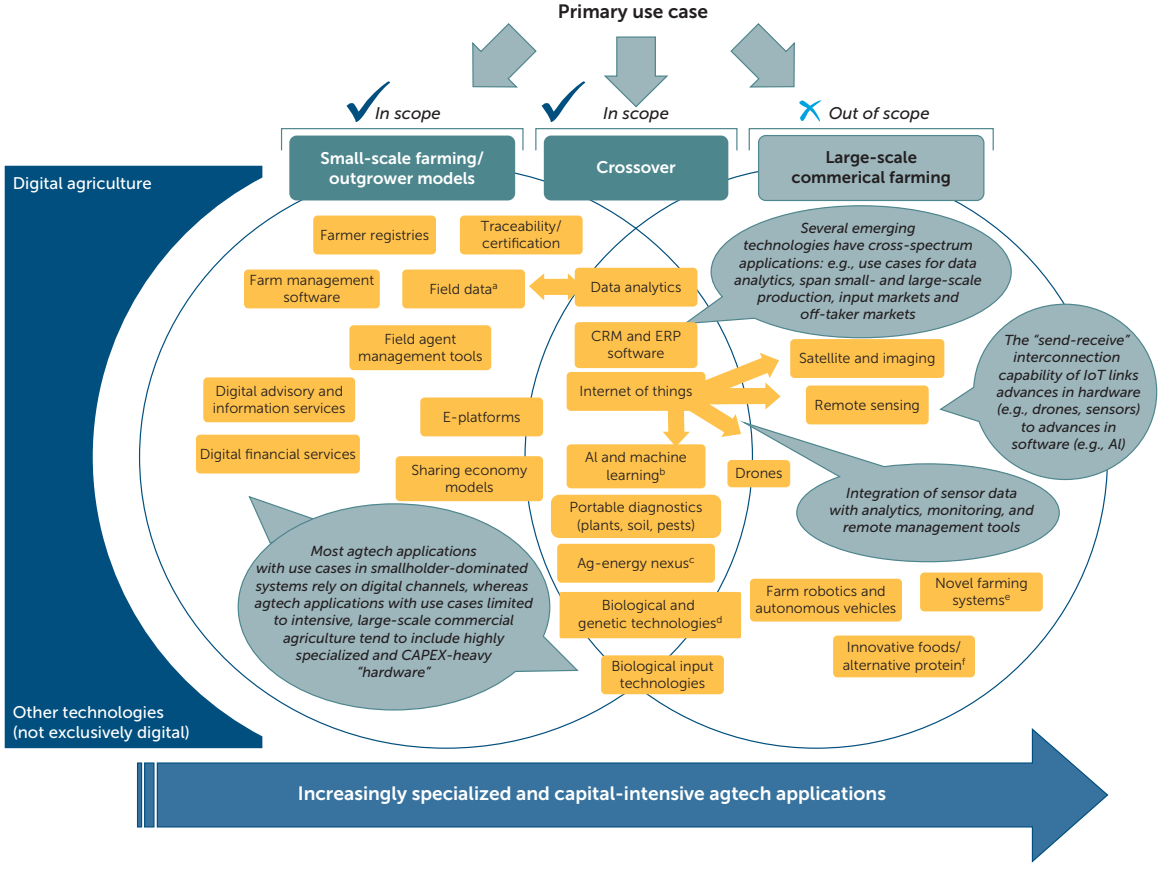
- Above all, cost and complexity will determine scale and engagement: unless agtech tools are compatible with low-resource or low-digital-literacy contexts and address critical farmer needs at ultralow cost, adoption will be low. Overengineering is a key risk: agtech solutions should focus only on the key pain points—keeping user interfaces simple, minimizing external dependencies, and ensuring financial viability at a realistic targeted threshold.
- Agribusinesses should review their operating model regularly to identify whether new digital solutions can add value to their specific business needs. For operational managers applying digital solutions to their smallholder supply base, key areas include agronomic advice, field data collection, agent field-force management, and software that enhances traceability, certification, and procurement.
- This chapter concludes with a practical checklist to help guide operational managers through key decisions and issues to monitor across the life cycle of an agtech investment, from inception through rollout.

Introduction

Before assessing the agtech opportunities available to smallholder-focused organizations, a practical definition is required. While some industry players confine agtech to digital tools, others include hardware not exclusively linked to digitalization, such as novel farming systems, innovative foods and cellular agriculture, farm robotics, and biotechnology. For this handbook, we do not limit our definition of agtech to digital activities. Rather, our focus is on the full suite of technologies that have applications in the smallholder agricultural systems that predominate in emerging market (EM) contexts, as outlined in figure 4.1.

The "sweet spot" for scalability in an EM context lies primarily in farm-level digital advisory services, digital financial services (DFS), digital marketplaces (e-platforms), digitized supply-chain management, and animal health technologies, as shown in figure 4.1.[1] These subsectors map onto the most prevalent issues facing smallholder production and off-taker markets, while also lowering barriers to entry for local tech entrepreneurs. See box 4.1 for more information.

FIGURE 4.1 Types of Agricultural Technologies (Agtechs) in Emerging Markets



Source: International Finance Corporation.
Note: AI = artificial intelligence; CAPEX = capital expenditure; CRM = customer relationship management; ERP = enterprise resource planning; IoT = internet of things.
a. Examples include transaction data, agronomy data, weather data, soil data, and crop and flock surveillance.
b. Category labels are not mutually exclusive: e.g., digitally-enabled "data analytics" has crossover with AI and machine learning, as AI can be leveraged to deliver information and decision-making tools to farmers or to extension agents, agro-dealers, agribusinesses, banks, and regulators.
c. Examples include modular cold chain storage and solar irrigation systems.
d. Transformational developments in genomics and gene-editing are being applied to plant biology, microbiology, and biochemistry. A key example is development of seeds optimized for specific environments. Increased research in microbes, pheromones, and specialized coatings is also leading to biological solutions that boost yields and reduce pest damage and post-harvest waste. One example is CRISPR, a non-genetically modified organism (GMO) gene-editing technology that may improve trait selection in plants and other organisms.
e. Primarily referring to emergent forms of controlled environment agriculture such as vertical or indoor "closed loop" farming.
f. For example, cellular agriculture (including plant-based "meat" products).

BOX 4.1

Variations in Agtech Market Developments across Emerging Markets

- Africa has seen the world's fastest growth of digital advisory services and digital financial services (DFS) in agriculture, albeit from a low baseline, with growth especially high in East African markets such as Kenya, Rwanda, Tanzania, and Uganda, which have well-developed mobile and mobile-money infrastructures.
- In Latin America and the Caribbean, agricultural e-commerce has seen the fastest growth in recent years, with digital advisory services and DFS lagging behind.
- In South Asia, an agricultural, value-added, service model–led mobile network operator (MNO) predominates, often backed by ambitious government programs. This model works alongside an agricultural e-commerce ecosystem that benefits from well-established local corporations, the demand from large urban centers, and a substantial banked rural population in Bangladesh, India, and Pakistan.
- As a global leader in software development, India's agtech market stands at the vanguard of innovation across most agtech subsectors, including nascent low-cost solutions based on the "internet of things" (IoT).
- In Southeast Asian markets such as Indonesia, the Philippines, and Vietnam, agtech solutions benefit from relatively well-structured value chains, especially in export-focused commodities. As a result, numerous digital procurement and supply-chain solutions, as well as a limited number of IoT-based "smart farming" solutions, have emerged. However, the lack of mobile-money solutions in the region has curtailed DFS innovation in agriculture.
- China has emerged as the global leader in rural e-commerce "super-platforms," thanks to the country's robust transportation, energy, and connectivity infrastructure, and supportive e-commerce policies. In 2019, China built the world's largest optical fiber and mobile network, with an optical fiber and 4G coverage rate of more than 98 percent for its administrative villages. The country has 1 billion internet users and 4.2 million kilometers of rural roads. Today, China accounts for more than 42 percent of all global e-commerce transactions (US$262 billion annually, as of 2019).[a]

a. See Phatty-Jobe 2020. For China-specific data, see FAO and ZJU 2021.

In contrast, more capital-intensive and complex technologies that revolve around high-intensity farming are more applicable to developed markets, where the price point for end products would be high enough to offset the sizable up-front investment and per-unit costs. (These technologies include vertical and indoor farming, automated production systems, and substitute food innovations such as alternative proteins.) The same issue applies to internet of things (IoT)–based solutions that rely on

expensive sensor equipment and to blockchain applications for agriculture[2]—although a gradually increasing number of exceptions exist in the more mature EMs for agribusiness.[3]

Use Cases

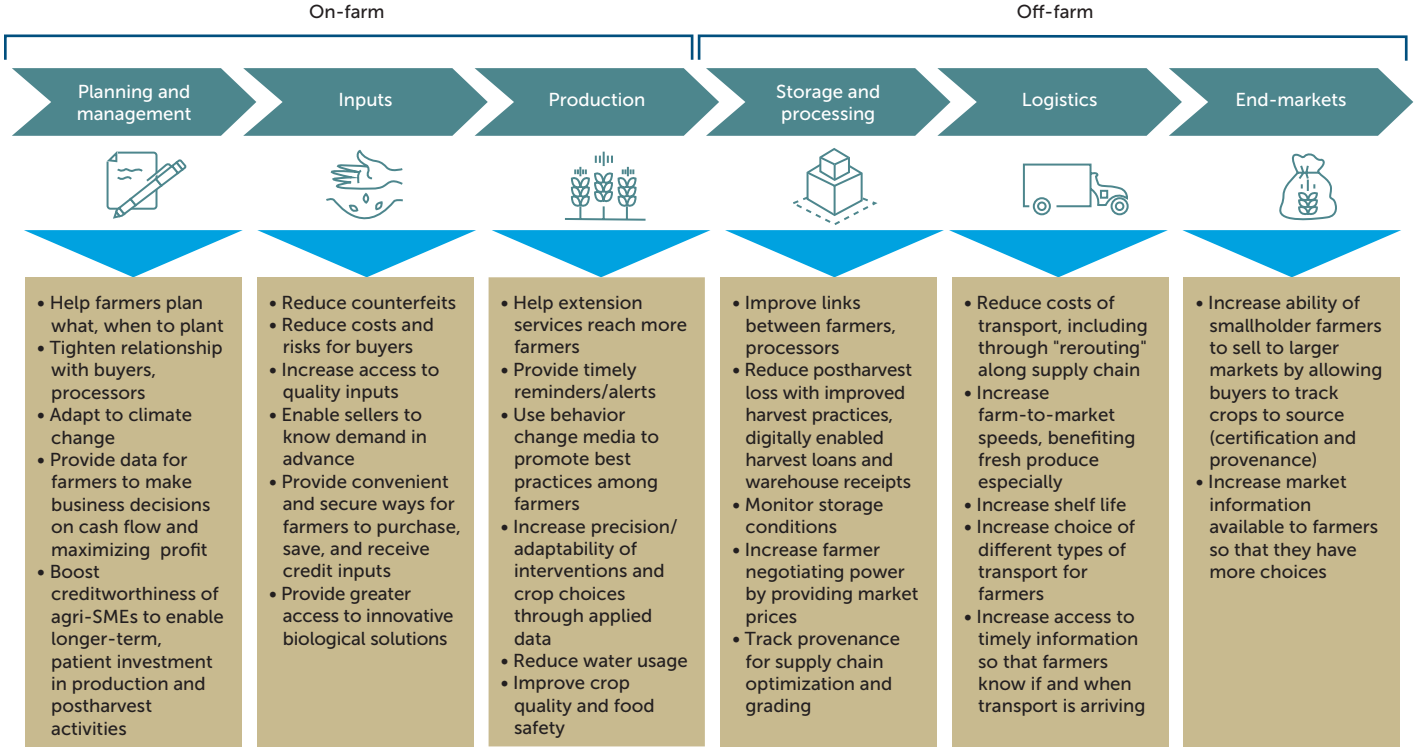
From a smallholder perspective, the beneficial impacts of agtech solutions include the following (see also figure 4.2):

- Enhanced productivity and reduced crop losses achieved through real-time agronomic or market data, associated analytics, and digitized advice
- Greater access to appropriate financial products via the digitalization of investment readiness, credit screening, and loan decision-making processes (for example, by building a digital record from farmer mobile payment and farm location data)
- Reduced bottlenecks around collateralization thanks to digital and satellite-based farm mapping that enhances security of land title
- Strengthened links to high-quality input markets (seeds, fertilizers, and pesticides) and structured off-taker markets, thanks to participation on e-platforms
- Better nutritional outcomes, because the crops produced and consumed benefit from agtech solutions that deliver more nutritious food, including through more precise crop nutrition and protection (Valverde 2020; Tsan et al. 2019)

Meanwhile, for large-scale input suppliers and off-takers engaging with smallholder farmers, the benefits of agtech solutions include the following (see also figure 4.2):

- Greater capacity to incorporate smallholders into commercial supply chains due to reduced field agent costs, increased aggregation capability, and improved operational efficiencies
- Improved market links leading to increased demand for input products, reduced crop losses, higher production volumes, and higher overall profitability
- Less volatile supply volumes because of real-time tracking and predictive analytics

FIGURE 4.2 Impact of Agtech Solutions across the Smallholder Value Chain



Source: Adapted and expanded from USAID 2018.
Note: SMEs = small and medium enterprises.

- Augmented visibility across the value chain, enabling off-takers to understand farmer needs and incentives in detail—and tailor products and services to them
- More efficient use of energy and resources, boosting environmental sustainability
- Improved safety and brand integrity, thanks to improved traceability and standards compliance, and reduced counterfeiting—which in turn can unlock higher-value end markets, for example, organically certified foods (Valverde 2020; Tsan et al. 2019)

However, it is not enough to simply match farming challenges to tech solutions. To understand why certain agtech solutions are not viable in low-resource settings, it is essential to view the cost-benefit calculations driving technology adoption through the lens of smallholder incentives.

Is new hardware or software "nice to have" for smallholders (for example, providing improved training or insights into crop performance) or is it a "must have," with an immediate impact on incomes (for example, providing first-time access to high-value sustainable food markets)? If climate adaptation is a high priority for development institutions working with smallholders, does it necessarily follow that farmers wish to prioritize it in the immediate term? These distinctions matter because agtech solutions will be widely used only if they directly address farmers' highest priorities. The benefits of agtech for smallholders may also reduce the household expenses and improve cash-flow, as it would be faster and less costly to do the activities already listed as benefits.

This point is underscored by the gap between the number of unique (but unengaged) users on agtech platforms and the number of people actually making use of the service. Across Africa in 2019, there were 26 million users registered on more than 400 agtech applications, of which only around 40 percent (11 million) could be classified as engaged. The issue, therefore, is less about reaching users and more around incentivizing active and sustained engagement.[4]

Market Infrastructure

Understanding the level of market development is also key to determining the appropriateness of new technologies. For every agtech application, there is a minimum necessary level of infrastructure and supportive regulation for scale to become feasible. Market development can be unpacked into four building blocks:

1. *Structural fundamentals of the agricultural system*, including average farm size; quality of transport links; formalization of input and off-taker markets; quality and openness of agricultural policies, programs, and research and development (R&D) systems; prevalence of informal agricultural trade; and human capital, including agronomist and extension officer training
2. *Maturity of digital connectivity infrastructure*, including mobile network reach; voice and data costs; digital payment network penetration; digital ID frameworks; and the software or hardware that enables data acquisition, storage, and analytics
3. *Readiness of physical marketing and logistics infrastructure*, which is needed to "back up" the digital activities
4. *Conduciveness of the regulatory environment*—especially modernized digital, mobile-money, e-commerce, sound data privacy policies, and a market-oriented investment climate

Two requirements stand out as game changers: first, the scale of the digital payments ecosystem, without which many agtech solutions become nonviable,[5] and second, the quality of agriculture data systems (for example, farmer registries that generate a farmer ID and log information on individual farms, location-specific data on input and crop prices, national soil maps that identify location-specific nutrient deficiencies, land title registry data, weather and agronomic data, and financial data from agricommodity transactions).[6]

Market Segmentation

While the level of agtech market development varies within every jurisdiction and subregion, the building blocks framework can broadly categorize EM countries from nascent to advanced (figure 4.3).

Applying this segmentation on a qualitative basis, roughly two-thirds of all countries in sub-Saharan Africa fall into the nascent category primarily due to critical shortfalls in connectivity infrastructure. Similarly, fragile states in Asia and other regions are nascent. For now, most agtech investments in these regions are not likely to be sustainable.

At the other end of the scale, several larger EM economies can be categorized as advanced, with agtech sectors that have more in common with world-class agtech hubs such as Israel, the Netherlands, or the United States than with countries in the nascent or basic categories. Examples include Argentina, Brazil, Chile, Colombia, and Türkiye.

FIGURE 4.3 Level of Agtech Development across Emerging Market Countries

	Nascent	Basic	Intermediate	Advanced
Tech ecosystem	Limited tech entrepreneurship Severe lack of digital services Prohibitively high SMS and mobile data costs	Emerging tech ecosystem Small but identifiable pool of tech start-ups "First mover" angel investors and venture capital present	Increasingly competitive and broad technology market Sophisticated technology services, including in agriculture	▪ Mature market with established regional tech players, funded by a sizable VC/PE ecosystem, including sector-specialist funds
Digital infra-structure	Weak telecoms infrastructure and low mobile and internet penetration Most smallholders do not use m-money	Basic digital infrastructure present in urban areas but rural connectivity limited Relatively high mobile and data costs dampen uptake	▪ Well-developed digital infrastructure, though rural connectivity is variable and complementary infrastructure is less developed	▪ Well-developed digital infrastructure providing nationwide affordable mobile and internet services, including in rural areas
Agricultural system	▪ Agri-sector dominated by SHFs; mean farm size <1 ha ▪ Low income country; agri-sector receives minimal investment flows	▪ Agri-sector remains SHF dominated, despite a cluster of commercial farms; mean farm size ~1 ha; low-income country	▪ Large numbers of SHFs balanced by cohort of locally owned medium-sized farms and large commercial agriculture; lower-middle-income country	▪ High number of mid- to large-scale farms; mean farm size of 40 ha+; agriculture holds relatively small share of GDP; upper-middle-income country
Enabling environment	▪ Digitalization policies are poorly defined and lack enforcement; agri-sector regulations are not market oriented	Agribusiness and tech policies are outdated or poorly defined, but policy environment is broadly market oriented	▪ Policies are broadly well defined and generally enforced, with clear sector regulatory frameworks for tech and agriculture	Relatively high levels of compliance with well-defined policies, developed with industry input, with sustained enforcement

TYPICAL CHARACTERISTICS

ILLUSTRATIVE EXAMPLES:

Source: Original figure for this book provided by IFC.
Note: GDP = gross domestic product; ha = hectare; m-money = mobile money; PE = private equity; SHF = smallholder farmer; SMS = short message service (i.e., text); VC = venture capital.

Between these nascent and advanced groups are two categories: basic and intermediate. Taking Africa as our example, the number of regions in these middle categories runs into double figures and includes Côte d'Ivoire, the Arab Republic of Egypt, Ghana, Kenya, Morocco, Senegal, Tanzania, Tunisia, Uganda, and Zambia. It is in these markets, we believe, that agtech investments can make the most decisive impact in addressing the global food challenge.

Deep Dives: High-Potential Agtech for Smallholder Value Chains

Digital Advisory and Information Services

Advisory-first solutions led the first wave of innovation in EM-focused agtech, providing information and decision-making support to farmers in a wide range of areas, including the following:

- Input usage
- Farm management (for example, more precise, data-driven crop management decisions)
- Market pricing and market access channels
- Agronomic techniques
- Pest and disease surveillance
- Weather and climate risk management
- Data analytics (providing country, regional, and crop-specific insights)
- Extension system tools
- Out-grower management support for off-takers

While relatively few agtech companies achieve commercial viability solely by providing digital advisory services, such services are commonly offered at zero or near-zero cost as a way to build deep farmer or customer relationships that unlock additional business lines. (See box 4.2 for an overview and box 4.3 for a case study on the agtech company CropIn.) As such, there is significant overlap between this category and the other categories described in this chapter.

BOX 4.2

Smallholder-Focused Digital Advisory Services around the World

The marketplace for advisory-first solutions is constantly evolving as start-ups test and modify new offerings, pivot into new services or partnerships, or fail. Over time, any survey of existing players becomes outmoded. Yet it remains useful to spotlight models from different emerging market regions in order to convey the breadth of value propositions that entrepreneurs are bringing to market. We highlight five examples:[a]

1. From its base in Nigeria, KITOVU[b] is using data to eliminate supply-chain inefficiencies in African agriculture, enabling farmers to make more money through increased yields and market access.
2. In India and other markets, the participatory and peer-to-peer advisory services provider Digital Green[c] delivers locally relevant training videos in 50 languages, in addition to collecting and analyzing data through Connect Online Connect Offline (CoCo), a dashboard that allows users to visualize insights on any device regardless of connectivity, and providing farmers with access to information about soil health, input availability, weather forecasts, and pest risks through its FarmStak product, together with scientifically vetted, localized, timely advisories.
3. Also in South Asia, the artificial intelligence (AI)-based agronomy app BharatAgri[d] provides weather-based dynamic advisory through its own app to help farmers address climate risks, along with advice on crop management and technology adoption.
4. In Kenya, Farmingtech[e] develops mobile technologies that increase productivity and profitability through data-driven decisions, including (1) DigiCow, an app that keeps digital records, analyzes reports, and allows timely alerts to farmers on important gestation dates, and (2) the Digital Vet System, a service based on unstructured supplementary service data (USSD) that allows farmers to request veterinary services.
5. Netherlands-based AgroCares[f] delivers precision farming advice based on real-time nutrient intelligence to a global client base. Products include SoilCares, which monitors and analyzes soil fertility in real time; FeedCares, which measures the quality of nutrients in silages and raw materials; LeafCares, which enables fast, affordable testing of nutrients in leaf tissue to support harvesting decisions; and InsectCares, a software solution which locates harmful insects to guide crop protection decisions.

a. Examples are selected to demonstrate variety in terms of geography and business model and do not imply a recommendation or preference on the part of the International Finance Corporation versus other agtech companies in the market segment(s). This applies to all chapter case studies.
b. Kitovu website, https://kitovu.com.ng/.
c. Digital Green website, https://www.digitalgreen.org/.
d. BharatAgri website, https://www.bharatagri.com/.
e. Farmingtech website, https://digicow.co.ke/.
f. AgroCares website, https://www.agrocares.com/.

BOX 4.3

Case Study: CropIn

Snapshot: CropIn Technology Solutions has developed a flexible, software-as-a-service (SaaS)–based farm management solution that enables digitization of farms; data-driven decision-making; and full visibility of people, processes, and performance. As an early adopter of optical satellite imagery and artificial intelligence for farm management, CropIn's flagship products—SmartFarm, SmartRisk, SmartWare, and RootTrace—deliver its solutions by leveraging big data analytics, machine learning, satellite monitoring, and weather analysis. Initially focused on India's Bihar and Madhya Pradesh states, CropIn's solutions have been applied to a range of geographies. The full product suite includes:

- Climate-smart advisory services (including season-wise crop configurations)
- Weather-based advisory services in the local language, including seven-day hyperlocal forecasts based on best available weather observation systems and forecast models
- Web- and mobile-based advisory dashboards to deliver rapid agronomic insights for timely pest and crop health management
- Technical inputs in real time from agriculture experts (for example, via public research institutions)
- Digitization of all records associated with agricultural production
- Monitoring of production costs and financials, including key performance indicators (KPIs)
- Traceability function and real-time inventory reporting to ensure quality standards and adherence to compliance and certification requirements

Challenge: CropIn addresses the need for enhanced smallholder resilience in the context of increasing weather shocks and climate change. By using technology to advise farmers on ways to achieve optimal harvests depending on weather conditions, soil, and other indicators, the company empowers farmers to adopt climate-resilient practices and adapt to climatic uncertainty.

Opportunity: CropIn has developed climate smart, data-driven products that guide farmers on sustainable agriculture practices through the application of predictive and curative measures. This real-time data is downscaled to the farm-plot level to help farmers make effective decisions for their specific crops. The conversion of sophisticated tech and complex data into tailored and user-friendly advice creates a farm-level transformation opportunity for farmers.

Impact: CropIn's products concentrate on three areas: (1) increased efficiency, through app-based data gathering, which provides real-time visibility for field agents; (2) increased productivity, through timely and actionable insights that enable farm managers to make business decisions that boost yield quality and quantity; and (3) increased sustainability, through actionable insights that empower farmers and supply-chain managers. Moreover, with a flexible per-acre or per-user pricing model, and with solutions that are not specific to crop or location, CropIn's solutions can easily be scaled up. The company is also well-placed to develop partnerships—for example, with agricultural equipment and processing machinery providers—where CropIn provides the software edge, helping farmers improve the quality of the inputs that go into their machines.

E-platforms

Overview

Digitized marketplace business models that create links across the agribusiness value chain have risen to prominence over the past five years. Since many of the initial cohort of advisory-first solutions had encountered challenges with monetization and user engagement, many agtech innovators then pivoted to a business case that focuses on value-chain integration—models that typically deliver more compelling value for users by unlocking access to finance and larger markets.

The Consultative Group to Assist the Poor (CGAP) identifies six strategic choices that determine the specific model for an e-platform in the food and agriculture space (see figure 4.4).

From these decision points, four main categories of e-platform arise:

1. Integrated market linkage platforms that connect farmers directly with wholesalers, retailers, or consumers, enabling farmers to retain higher revenue share (These platforms may also undertake investments in missing-link physical infrastructure—see the section "From Market Linkages to Super-Platforms.")
2. Business-to-consumer (B2C) models for agro-inputs and/or online input marketplaces
3. Digitized agricommodity exchanges
4. Sharing economy platforms for farming equipment and other nonfood assets

FIGURE 4.4 CGAP Strategic Choices for E-platform Models

1. *Model*
   What type of model will the platform employ? Open, mediated, or contract?
2. *Crops*
   What crops/value chains will the platform focus on, particularly at the onset?
3. *Buyers*
   Who will be the platform's target buyers?
4. *Transport and Logistics*
   How will the platform manage its transportation and logistics?
5. *Farmer engagement*
   How will the platform engage farmers and facilitate the movement of goods to buyers?
6. *Financial services and payments*
   What financial services and payment solutions can and should the platform provide?

Source: Shrader, Morawczynski, and Karlyn 2018.
Note: CGAP = Consultative Group to Assist the Poor.

Whatever the category, virtually all e-platforms use mobile and mobile-money systems to reach large numbers of smallholders disbursed across rural landscapes, aggregating and formalizing previously fragmented supply and demand. Participation in digital marketplaces reduces the costs and risks to farmers of locating and transacting with suppliers or buyers, ultimately improving their incomes through a virtuous circle in which more structured market access encourages higher investment by farmers in quality inputs, equipment, and other assets. These benefits are partly the result of increased certainty: e-platforms enable farmers to understand and trust market requirements (around standards, volumes, and timing) while simultaneously providing the financial and technical support to enable them to capture market opportunities.

From Market Linkages to Super-Platforms

The initial wave of e-platform solutions is paving the way for end-to-end super-platforms to emerge that combine agricultural market links to a broader ecosystem of integrated products and services—from market-pricing data, agronomic advice, and farm and supply-chain management tools to mobile credit and insurance, distributed energy solutions, household consumables, and other nonagricultural services (for example, m-health or medical advice delivered via phone). This model is complex and involves a daunting level of up-front investment—including the need to hire large networks of field agents—but its advantages are manifold.

> Convenience, more attractive prices (i.e., improved bargaining power vis-à-vis input sellers), and strongly aligned incentives on input quality, since the super platform also partakes in the upside of higher farmer productivity and incomes. [In addition,] financial services are likely to be far more affordable than alternatives due to the super platform's privileged access to the farmer's data and, most importantly, its ability to monitor input purchases or off-take transactions. (Tsan et al. 2019)

For the platform owner, service bundling presents an answer to the thorniest question in smallholder-focused agtech: how to monetize user activity when individual farmer willingness to pay is negligible? By bundling a spectrum of value-adding services, platforms can create instant value that farmers are willing to pay for, in contrast to the longer-term results associated with yield-improving advisory-only solutions. Meanwhile, for the platform owner, arbitrage opportunities and secondary revenue streams are created. By creating attractive economies of scale for intermediaries and platform partners, the platform owner can

take a share of the value created for each customer segment, for example, through business-to-business (B2B) advertising revenues or platform access fees, rather than relying on farmer subscriptions or farmer data monetization.

Blending Online and Offline Assets

To succeed in rural areas, e-platforms must deploy hybrid semidigital networks that combine digital channels, human touch points, and physical infrastructure to overcome the bottlenecks created by weak rural connectivity, digital literacy gaps, and low user trust. This requires parallel investments in the following:

- *Human touch points* at the village level, including field forces made up of digitally skilled extension officers, company agents, or networks of lead farmers: for the largest platforms, this in-person network can be substantial. Alibaba's Rural Taobao platform, for example, has engaged 60,000 agents in China as of 2019, with plans to increase to 300,000.
- *Missing-link physical assets* that are strategically positioned to fill key gaps in existing infrastructure linking rural/informal and urban/formal markets: For example, investments in modernized processing or warehousing and storage facilities, quality management facilities, cold chain packaging, and local-level logistics depots.

Investment in offline capability provides a higher level of control over the digitized aspects of an e-commerce platform. As one recent study observed, "The most successful agri e-commerce businesses invest in more than a platform; they provide additional functions, such as farmer and buyer engagement, payments and logistics, quality control and warehousing" (Phatty-Job 2020, 5).

However, these offline investments also increase the capital expenditure (CAPEX) and operating expenditure (OPEX) requirements to a much higher level than those faced by nonagricultural e-platforms or financial technologies for example. Examples of agriculture-focused e-platforms that have undertaken major capital investments to develop offline infrastructure and in-person services, alongside a digital offering, include Indonesia's TaniHub, which manages cold chain and storage functions, and China's Pinduoduo platform.

Outlook

To a significant extent, the future of smallholder-focused agtech belongs to the new generation of super-platforms. As with the leading e-commerce

platforms worldwide, from Amazon to Alibaba, building commercially viable farmer-focused platforms at scale (that is, several million active users) is a long-term journey. As this journey unfolds, cost control and consolidation will be the path to take. Most platforms will operate at a loss for several years before reaching targeted scale. Consequently, this part of the agtech landscape is set to emerge throughout the 2020s, both as the segment with the fewest number of "winners" and as the model with the most transformational impact on smallholder value chains. Indeed, by 2030, investments in agricultural connectivity have the potential to unlock more than $500 billion in gross domestic product (GDP) globally (Goedde et al. 2020). (See box 4.4; box 4.5 provides a case study of Pinduoduo in China.)

BOX 4.4

Smallholder-Focused E-platforms around the World

As noted in this chapter, agtech is relatively young and fast evolving: Many business models will improve or fail over the medium term. Any survey of existing players will be superseded in time. Nevertheless, it is helpful to highlight the current models emerging from different regions to illustrate the variety of value propositions already in play. We selected six examples:

1. UK- and Kenya-based WeFarm[a] provides an on- and offline peer-to-peer platform for smallholders in multiple markets to transact with retailers via a free-to-use platform.
2. Also in Kenya, DigFarm[b] provides 1.3 million registered Kenyan farmers with advisory services, market links, inputs, input credits, and crop insurance aiming to become a one-stop shop—all backed by the infrastructure and agent network of market-leading mobile network operator, Safaricom.
3. From its base in India, blockchain-enabled e-marketplace and data analytics firm agri10x[c] provides real-time synchronization of supply and demand by leveraging artificial intelligence, blockchain, and the internet of things. The company identifies and resolves issues around soil health, moisture levels, pests, and diseases to ensure healthy crops and better pricing, and it predicts and advises on harvest timing and commodity pricing.
4. Another South Asia–focused company, Agrim,[d] has created an agri-inputs business-to-business (B2B) marketplace, empowering small agri-input retailers via technology to provide wide product selection, the best procurement prices, shop delivery, and flexible payments.

box continued

BOX 4.4

Smallholder-Focused E-platforms around the World *(Continued)*

5. In the same geography, DeHaat[e] provides a one-stop shop for agricultural services. Farmers get access to quality inputs, coordinated sale of produce to institutional buyers, and tailored science-based farming advice. Last-mile access is provided through a chain of DeHaat centers.
6. Finally, India-based B2B agricultural commodity platform Bijack[f] digitizes and organizes the agroprocurement market by connecting buyers and sellers through a single platform. The company boosts accountability and transparency through a buyer-seller rating system.

a. WeFarm website, https://wefarm.info/.
b. DigFarm website, https://digifarm.com/,
c. Agri10x website, https://www.linkedin.com/company/agri10x/?originalSubdomain=in.
d. Agrim website, https://agrim.app/.
e. DeHaat website, https://agrevolution.in/.
f. Bijack website, https://www.bijak.in/.

BOX 4.5

Case Study: Pinduoduo—a Digital E-commerce Platform in China

China has the world's highest e-commerce penetration, but e-commerce penetration for agricultural products is in the low-single digits, and many farmers are still living below the poverty line. Pinduoduo (PDD) is a mobile-only marketplace that connects millions of agricultural producers with consumers across China. It aims to bring more businesses and people into the digital economy so that local communities can benefit from increased productivity and convenience through new market opportunities. The platform enables demand aggregation and creation (introducing products to markets) through recommendations, and provides insights on consumer preferences and market pricing to farmers.

As of the end of 2019, PDD's total transactions were worth US$150 billion; 600 million buyers were connected with 5.1 million merchants, and there were 54 million orders per day (19.7 billion annually). Agricultural products comprise 13 percent of these transactions, with a value of US$21.3 billion benefiting 12 million farmers nationally. The merchants are individual farmers, cooperatives, young entrepreneurs, and distributers.

PDD uses a team purchase business model that offers a lower price than buying individually (prices are determined by the merchants on the platform). Two buyers can form a team, and buyers

box continued

BOX 4.5

Case Study: Pinduoduo—a Digital E-commerce Platform in China *(Continued)*

can invite friends to buy with them as well as join existing teams. Despite the option to buy individually, 99 percent of the buyers use the team purchase model. The team purchase approach facilitates demand aggregation by avoiding fragmented purchasing, enhancing supply chain efficiency, enabling fresh produce delivery, lowering consumer price, and providing consumer insight for farmers.

Customers provide reviews on the quality of the agricultural produce, and merchants face penalties for ruined products while customers are compensated with free coupons. PDD supports farmers' cooperatives to create brands for agricultural produce that will allow premium qualities to get rewarded.

Despite the high demand, there are structural problems limiting farmers' capabilities to respond adequately, chiefly, that there are 500 million farmers in the country to feed a population of 1.4 billion. Recognizing this, PDD has partnered with provincial governments through its Duo Duo Farms initiative to develop pilot farms that adopt financial, agronomic, and technological innovations to improve farm productivity and raise farmer incomes. The company's goal is to develop sustainable models that can be replicated on more impoverished counties across China.

Factors for PDD's success include (1) high connectivity penetration and expanded social media use, (2) online payment system used in everyday life in China, (3) expanded access to e-wallet, and (4) high logistics penetration and well-developed physical infrastructure to enable delivery.

To deepen PDD's digital inclusion efforts in agriculture, the company is allocating all profits as of the second quarter of 2021 to the 10 Billion Agriculture Initiative (US$1.4 billion). This new initiative facilitates the advancement of agtech, promotes digital inclusion, and provides agtech talents and workers with greater motivation.

PDD's business model has the potential to be replicated and scaled up in developing countries with high population sizes and large numbers of smallholder farmers, in which supply chains are fragmented and multiple layers of intermediaries raise consumer prices. However, in these contexts, the less-developed infrastructure and political uncertainties may limit the scale and level of success for the business. Nonetheless, the low margin e-commerce trading with large numbers and high-volume transactions engaging millions of farmers, merchants, and consumers, makes it viable in such countries.

Source: Pinduoduo website, particularly "Our Company" video, PDD Holdings, Shanghai, https://en.pinduoduo.com/.

Digital Supply Chains

While e-platforms are taking center stage, there remains a need for more niche agtech models to address specific bottlenecks—especially in supply-chain management. Opportunities abound for software- and data-driven solutions that enhance companies' ability to digitally track and manage smallholder supply chains—for example, from sourcing to cold chain storage, from processing and delivery to markets. Broadly, this category breaks down into three segments:

1. Software-as-a-service (SaaS) and digitized procurement to improve efficiency and standards across the supply chain
2. Whole-of-supply-chain traceability solutions
3. Sustainability certification solutions (including organic product certification tracking)

These functions often overlap under a multicategory solution, as the underlying use case is the same: to lower costs, unlock access to quality-sensitive markets, and simplify and strengthen smallholder engagement (see box 4.6).

BOX 4.6

Digital Supply-Chain Solutions around the World

To illustrate the wide range of value propositions in agtech, we describe a diverse selection of examples from different emerging market regions:

- A Norway-based provider of supply-chain enterprise resource planning and traceability software, FarmForce[a] offers digital solutions for sustainable agrisourcing globally, with sales in Latin America, Africa, Asia, and other regions. The company works with off-takers to learn where and how products are grown and to connect with global markets via a "bush-proof web and mobile platform" (Farmforce n.d.).
- A traceability and supply-chain software-as-a-service provider, SourceTrace[b] operates in 32 countries with a software platform that enables full visibility into the agrifood value chain, with touchpoints from farm to retail.
- A Ghana-based traceability and anticounterfeiting company, mPedigree[c] deploys mobile and web technologies to secure products against faking, counterfeiting, and diversion.

box continued

BOX 4.6

Digital Supply-Chain Solutions around the World *(Continued)*

- From its base in India, AgNext[d] provides rapid food-quality assessment through its full-stack Qualix platform, delivered via a mix of artificial intelligence, machine learning, the internet of things, and advanced data analysis. The company builds trust and speed by delivering real-time accuracy, and it incorporates physical and chemical analysis solutions applicable across commodities (grains, spices, tea, milk, and animal feed).
- A coffee supply-chain verification and certification specialist, Enveritas[e] enhances smallholder participation in global coffee supply chains by reducing high verification costs and leveraging geospatial data and statistics to cut costs.

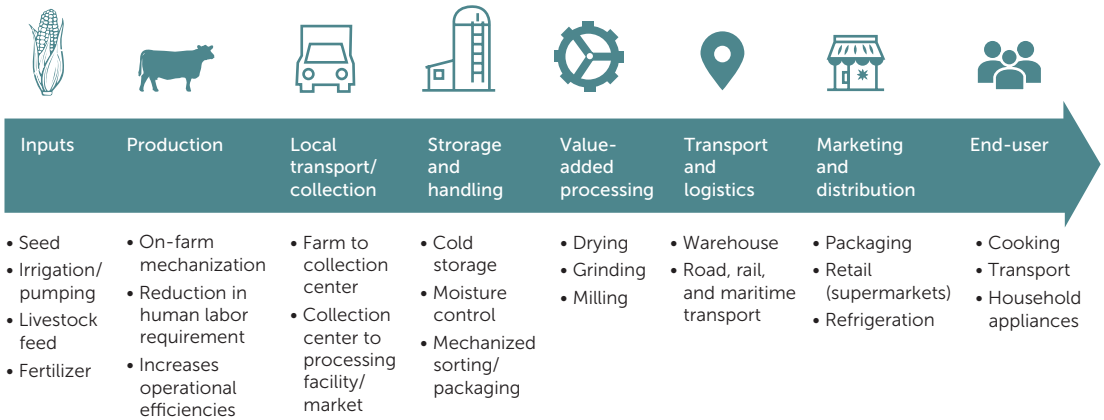
a. Farmforce website, https://farmforce.com/.
b. SourceTrace website, https://www.sourcetrace.com/.
c. mPedigree website, https://mpedigree.com/.
d. AgNext website, https://agnext.com/.
e. Enveritas website, https://www.enveritas.org/.

The Agricultural-Energy Nexus

The agricultural-energy (ag-energy) nexus is a nascent but important dimension to the smallholder-focused agtech ecosystem; innovative energy solutions have the potential to power farm-level productivity and post-harvest activities. This section focuses on the application of distributed (that is, modular, off-grid) energy solutions to small-scale agriculture, ranging from solar irrigation and water tech to modular cold storage, minigrid powered crop drying centers, and biogas-based dairy farming appliances (figure 4.5).

Despite the broad spectrum of demand for agriculture-focused energy-as-a-service solutions in rural (largely off-grid) environments, few commercially viable business models have emerged in the ag-energy space. This is often due to the need for significant up-front investment, which is often beyond the reach of smallholders with limited access to finance. To date, several overlapping constraints have held back this sector—as identified in a landmark report produced by Factor[e] Ventures,[7] which we summarize in table 4.1.

FIGURE 4.5 Energy Needs through the Agribusiness Value Chain



Source: Factor[e] Ventures 2020.

TABLE 4.1 Constraints to Agricultural-Energy Sector Growth

Subsector	Distributed energy use case	Traditional constraints
Irrigation	Only 4 percent of agricultural land in Africa is irrigated. The figures for Asia and Latin America—where 37 percent and 44 percent of cropland is irrigated, respectively—are higher but remain low in absolute terms.	Environmental and market data are limited, which curtails efforts to concentrate on the core market for irrigation services. Business model innovation is required to incorporate market mapping, financing, farmer education, and behavior change, as well as improving market access for high-value products. Effective policy and public subsidies are also needed to enable innovative partnerships and business models.
Cold chain	The developed world has 200 cubic meters (m^3) of refrigerated storage capacity per 1,000 people. In the developing world it is 19 m^3, and in Kenya and Nigeria it is less than 3 m^3. India and China together host 255 million m^3 of refrigerated warehouse space, but other emerging markets (EMs) lag far behind.	Technology adaptation to enable refrigeration in the absence of uninterrupted power is needed. The cost of controlling the temperature of agriproducts must also be more closely matched with the value that refrigeration creates at each point in the value chain. Currently, the economics rarely work. Innovation in business models is needed to make financing refrigeration products feasible with risks shared more evenly by stakeholders.

table continued

TABLE 4.1 Constraints to Agricultural-Energy Sector Growth *(Continued)*

Subsector	Distributed energy use case	Traditional constraints
Agricultural processing	Farmers can lose up to 30 percent of grain due to mycotoxins and bacteria from poor storage and drying. Even a decade ago, the estimated economic value of post-harvest losses in India alone was US$15 billion. Agroprocessing is predicted to be the fastest growing subsector in the next decade: a US$122 billion revenue increase.	Technology adaptation is needed for market and business models that can deliver processing capabilities in more distributed and remote areas. There is a lack of farmer-aligned agribusinesses operating in remote areas to partner with and source from smallholder farmers, add value, and link their products to markets.
Agricultural waste-energy applications	Less than 0.5 percent of Africa's available biomass waste residues are used for energy. Globally, utilization of biomass for energy amounts to ~10 percent of energy production, arising primarily from cooking and heating in EMs. At the same time, fuel for generators alone accounts for 24 percent of total spending by African consumers on electricity, while providing only 7 percent of electricity service.	Technology development and adaptation are needed to deliver the benefits of waste-to-energy solutions to smaller and more remote farming operations. Mechanisms to aggregate agricultural waste and the behavior change to recognize its value will be required to harness this resource.
On-farm productivity	Engines supply only 10 percent of farm power in Africa, where cereal yields are 70 percent lower than the rest of the developing world. In India, at least 240 million people have no access to electricity, of which more than 90 percent are in rural areas. Globally, 1.1 billion people live off-grid in rural villages without modern energy access, forcing farmers to rely on human or animal energy for tilling, cultivating, and harvesting.	Distribution systems and a lack of farmer financing are the primary barriers to boosting productivity. Public and private (and partnered) means of providing farmers with physical and financial access to inputs, mechanization, and machinery must be developed and scaled. Technology innovation is a limitation, particularly for mechanisms that deliver and scale sustainable means for boosting on-farm productivity.

Source: Adapted and synthesized from Factor[e] Ventures 2020. Additional data from the World Bank; Food and Agriculture Organization of the United Nations; Salin 2018; Safdar and Heap 2016.

Precision Farming

As noted in the chapter's introduction, capital-intensive and complex technologies that revolve around high-intensity farming are less applicable in smallholder value chains. However, this does not rule out every solution under the "precision-farming" umbrella, given that the costs for some applications are manageable (especially at lower-tech

specifications) and are falling every year. While smart farming remains the newest agtech use case to take hold in EMs, companies developing relatively affordable solutions that leverage mobile IoT functionality have a growing presence, often paired with digital agronomy solutions—in particular in South and Southeast Asian markets. Currently, most business models focus on one or more of the following:

- Autonomous farm equipment monitoring
- Smart shared assets[8]
- Satellite imagery–enabled smart crop monitoring
- Smart livestock monitoring

Other use cases such as self-operated robotics for automated pesticide and herbicide spraying and "drone farming" are less prevalent—although some do exist. For now, unlicensed IoT networks remain the primary source of connectivity for precision-farming solutions, which creates a bottleneck, as these networks have minimal capacity for scale and frequently suffer from poor reliability. As such, we anticipate a significant breakthrough in scale for IoT-based applications in smallholder agriculture in the coming half decade. Capitalized mobile network operators (MNOs) increasingly commit to business models for agri-IoT solutions that leverage their own deep connectivity infrastructures (for more, see GSMA n.d.). This represents an exciting, near-term tipping point.

IoT-based solutions will attain scale fastest in markets with a higher proportion of medium-sized farms, as these have greater ability and incentives to digitize. The up-front costs of developing IoT solutions are compensated more easily by efficiency gains on larger farm areas and in more intensive or high-volume value chains such as cereals, grains, fruits, and vegetables (Goedde et al. 2020).

Agtech as a Tool for Strengthening Smallholder Engagement

Agtech is only a tool—not a silver bullet. To maximize impact, solutions must be designed and operationalized with their limitations and risks in mind, and with sensitivity to the constraints of uneven connectivity infrastructure, weak market links, or low digital skills. In this section, we outline the key vulnerabilities before concluding with a checklist to guide user-centric and context-sensitive design and execution.

Risk Factors

Some emerging agtech solutions will not stand the test of time. We remain in the test-and-learn phase, during which many new models lack a clear line of sight to commercial viability without grant funding and perpetual soft financing. Against this backdrop, solutions with the best prospects of success will be those designed with mitigation strategies for known risk factors (figure 4.6), such as the following:

- The inability of digital solutions to substitute for physical infrastructure investments that enable agricultural trade (for example, roads, energy, irrigation, processing, and storage)
- The risk that digitalization of agricultural systems may trigger a decline in the number of jobs due to consolidation, even as the number of quality jobs increases

FIGURE 4.6 Key Risk Factors of Digital Solutions

a. Demand side: farmers

Inequality of access (digital infrastructure and connectivity)

- Lack of connectivity and poor quality of connectivity of broadband infrastructure leads to unequal access, especially in rural areas.
- If the technology requires substantial investment, then segments like SHFs, women, and youth will often be excluded.

Technology readiness and data privacy

- Agtech adoption issues remain especially for SHFs; other issues include limited technology readiness and training.
- Digital technology raises questions about the ownership and use of data acquired by these technologies.
- Predominance of SHFs in EMDEs limits viability of traditional business models and technology companies.

b. Supply side: technology companies

Digital ecosystem

- Agtech solutions are built onto existing data (e.g., weather indices, agricultural ministry databases, supply chains, market price data, surveys, and farm sensors). Absence of such core data increases challenges.
- There is low availability of DFS and limited availability of e-commerce/e-logistics specializing in agribusiness.

VC and unproven business models

- There is a higher perceived risk with untested business models, which limits investment, thereby leading to more focus on better-developed markets like Brazil and South Africa.
- Untested business models could lead to higher failure rates, requiring higher risk appetite.
- There are not enough incubators and accelerators to help create a steady pipeline of agtech companies.

Appropriate physical marketing and logistics infrastructure is needed to "back up" the digital activities.

Source: Original figure provided by IFC.
Note: DFS = digital financial services; EMDE = emerging markets and developing economies; SHFs = smallholder farmers; VC = venture capital.

- The data privacy and information security risks that accompany digitalization
- Lack of interoperability with other digital platforms and bank or telecoms systems in a poorly coordinated and highly fragmented agtech ecosystem
- The danger that the complexity of agtech solutions runs ahead of the short-term ability and willingness of governments and smallholders to adopt them
- Disintermediation risk—that is, the risk that platform users become reliant for their market access upon digital solutions that may abruptly fail: One example is when an app is discontinued by a network operator seeking to launch its own in-house version; another is when digital platforms become obsolete due to infrastructure upgrades or downgrades. While this risk factor has precedents in the financial technology sector, it is often overlooked in agtech.

A single data point brings the agtech ecosystem's immaturity into focus: In 2018, the annual total stock of grant funding to agtech (US$197 million) actually *exceeded* the earned revenues from agtech solutions (US$143 million) in Africa. The situation in EMs outside of Africa is more encouraging, but even in large markets such as India and China, proof points supporting commercial viability for agtech solutions are currently the exception and not yet the rule.

Alongside the lack of metrics on financial performance, data are also weak on the social and environmental returns delivered by agtech.

> Robust evaluations and trustworthy impact metrics are hard to find across the [digital agriculture] space. The sector requires significant investment in capturing impact data if we are to better understand successes and failures. (Tsan et al. 2019)

This paucity of performance data provides a helpful reality check, but not a cause for pessimism. It reflects, above all, how incipient the agtech sector remains in developing economies. Taking a multidecade view, we are still on the starting line in a market with virtually untapped potential. Today, the share of the addressable market for agtech solutions in Africa reached by market incumbents stands at just 4–8 percent (Tsan et al. 2019), with comparable percentages applying to low- and lower-middle-income Asian markets. By 2030, however, current growth trajectories indicate that about 200 million smallholders will be participating in

agtech platforms in Africa. In India, most of the country's 120 million smallholders will access agtech solutions by the end of this decade (EY 2020).

In summary, the sector is growing rapidly off a low base and at a rate across Africa—currently 44 percent per annum—that speaks to its infancy and exuberance (Tsan et al. 2019). What lies ahead, as we enter a phase in which multiple uses are bundled together, is the hard work of sector consolidation and scaling of the select few business models that prove enduring.

Strengthening Smallholder Supply Chains through Agtech: A Checklist for Decision-Making

How can operational managers who are responsible for integrating smallholder farmers into supply chains make informed, risk-adjusted decisions about whether—and how—to invest in agtech (figure 4.7)? In this section, we flag the key decisions and issues throughout the lifecycle of an agtech investment decision and rollout where the solution is focused on a company's own supply chain. The range of tools includes, but is not limited to the following:

- Field data collection tools that shift from paper systems to enable greater integration and automation of data, providing more accurate information on a dispersed smallholder base: for example, parameter mapping and digitized surveying functions that collect biometric farmer data such as farm geographic information system (GIS) coordinates
- Agent field-force management
- Farmer training and provision of farming advice directly to smallholders
- Streamlining of payment processing to smallholder suppliers
- Data analytics
- Weather data
- Market information

FIGURE 4.7 Challenges and Benefits of Digital Agribusiness-Farmer Engagement

a. Challenges

Sample pain points across agribusiness farmer engagement

	Last-mile sourcing				
Agribusiness-farmer engagement	**Farmer recruitment**	**Capacity building**	**Program management**	**Crop purchasing**	**Payment**
Sample value-chain activities	• Farm and farmer profiling • Farmer onboarding • Input provision	• Agricultural extension support • Farm development plans	• Sustainability • Certification • Traceability • Outgrower schemes	• Crop collection • Crop transportation • Quality control • Warehousing	• Crop payment • Receipt issuing
Sample pain points	• Manual profiling is time consuming and disorganized (hinders crop forecasting for the next season). • Manual record keeping makes reconciling input loans a challenging and tedious process.	• Information dissemination is costly. • Farmers are often busy and unable to attend. • Not all farmers are reached with extension support, which negatively affects crop yields and quality.	• Manual data collection impedes real-time tracking of progress. • Certification bodies may oppose manual records, which can be prone to errors and easier to forge or change.	• Farmers unware of the collection schedule end up selling to other buyers or waiting a long time for collectors to arrive. • Crop collection vehicles are not used effciently (e.g., not economical to collect small volumes).	• Cash payments are risky and costly. • Manual reconciliation of payments is time consuming and prone to errors. • Paper receipts are prone to tampering and falsification (obstruct traceability programs).
	Opportunities to digitize the last mile				

b. Benefits

Opportunities to digitize the last mile across agribusiness-farmer engagement

Opportunities to digitize the last mile	Digital procurement tools enable targeted data collection in a variety of formats and complete, accurate recording of data.	Mobile technology allows crop buyers to send notifications and disseminate information to farmers in a timely and cost-effective way.	Digital survey tools support personalized questionnaires and collection schedules and track progress in real time.	Farmer notifies buyer of intent to sell using mobile technology. Collection schedule optimizes routes and is shared with farmers.	Mobile money enables the transition from cash to digital payments and creates transparent transactions. Digital notifications replace paper receipts.

Source: Adapted from Phatty-Jobe 2020.

- Full tracking, traceability, and certification software that reduces waste or improves standards
- Supply-chain management tools and operations software (for example, procurement management)

No two agribusiness models are the same, but the following checklist brings together the recurring themes observed across a range of regions—collating diverse lessons and insights for supply-chain and procurement managers, sustainability managers, and field managers. Our focus is on identifying and managing (1) context-specific issues around smallholder adoption in a marketplace where the economics around agtech remain challenging and (2) the critical factors for successful operational execution.

The checklist is not comprehensive and is generalized rather than value-chain-specific. Nevertheless, we hope it provides one useful reference point among others for those commencing an agtech investment decision-making and design process, as well as for governmental or non-governmental agricultural development programs leveraging technology in their engagement with smallholders.

Not all questions in the list will apply to every investment or design process. However, six guiding principles stand out as being universally applicable:

1. Focus only on solving for the most critical pain points.
2. Prioritize multiuse over single-use solutions as this will increase adoption.
3. Keep user interfaces simple and avoid customizations.
4. Minimize dependencies on external tech firms and consultancies and on pending regulatory changes; instead, retain in-house control over the technology.
5. Avoid reliance on subsidies—ensure the solution can be financially viable at a realistic targeted scale threshold.
6. Design to ensure "operational gearing," that is, the ability to increase revenues or impact as user numbers grow, without increases in costs or complexity.[9]

Checklist

Part 1: Objective Setting

Identify Pain Points.

- Which known operational challenges will the proposed agtech solution address? ☐
  - Examples: reducing reliance on physical cash in the supply chain and improving visibility and quality of produce supply ☐
- Can the opportunity cost of leaving these challenges unaddressed be quantified to determine the size of existing pain points with accuracy? ☐
- If there are several identified bottlenecks, can these be ranked (highest to lowest priority) using a risk likelihood or impact methodology to identify the most critical challenge(s)? ☐

Fix and Align Priorities.

- Which partners will be engaged beyond farmers (for example, agro dealers, transporters, aggregators, retailers)? ☐
  - What is the value proposition for them? ☐
  - How will they collaborate with each other? ☐
- What is the level and make-up of demand for agtech among smallholders in the supply chain? ☐
  - In-person, one-to-one interviews or perception surveys required? ☐
- If the proposed agtech solution is deemed "must have" by the company, to what extent is it also high priority for smallholders in the supply chain? ☐
  - Example: If the solution enhances productivity, will this translate into enhanced profitability for farmers? Has this been understood by farmers? ☐
- Is the objective of the agtech solution clear and binary (for example, obtaining organic certification through digitized field data collection) or incremental (for example, delivering marginal cost savings)? ☐
  - Design key performance indicators on a traffic light system or sliding scale, accordingly. ☐
- Is there a documented and phased implementation plan for all parties? What is the proof of concept? What assurance exists that the model will work and be cost-effective? ☐

Measuring Impact

- What measurable commercial and social or environmental impact is being targeted? ☐
  - How will this be measured? ☐

- What would success look like at a defined time interval (for example, end of year one)? ☐
- Can we focus in on the top three easily trackable metrics? ☐
  - Simplicity is the key to avoiding overburdening participants with reporting requirements. ☐

Inclusion versus Exclusion

- Is there a risk that the solution could exclude some smallholders in the supply chain (due to variable digital literacy or the inability of some farmers to switch farming techniques)? ☐
  - If so, can the solution be modified to ensure a net positive outcome for all farmers? (Allow for early versus late adopters and a sliding scale on willingness to pay or use [GSMA 2022].) ☐

Part 2: Resource Mobilization and Budgeting

Fundraising and Funding Costs

- Can the solution be funded in-house? (In-house is the preferred option because projects funded from the company's own balance sheet generate higher levels of ownership and are more agile in response to evolving needs.) ☐
  - If not, can partners be identified that bring both funding and technical expertise? ☐
  - If initial funding will be grant based, is this locked in? Is there a risk of disbursement delays? ☐
- If there are multiple funders, are their objectives aligned, or could they conflict during rollout? ☐
  - Example: Some funders target financial returns, while others prioritize social impact. ☐
- Can local currency financing be secured, rather than relying on US dollar funding (which may create a foreign exchange risk if future revenues are in a local currency whose value depreciates)? ☐

Budgeting

- Has a realistic budgeting process been undertaken and stress-tested, allowing for potential delays? ☐
- Can a low-budget test-and-learn pilot be conducted to remove financial risk from the project? ☐
- If a request for proposal process is being conducted to select a technology partner, what insights can be gained from bid submissions regarding opportunities to reduce costs? ☐

  - Example: Minimize cross-border travel and consultant expenses. ☐
- What in-house skill gaps need to be filled to form a team capable of project design and rollout? ☐
  - Examples: marketing, app content development, user experience design, product management, data analytics ☐

Part 3: Market Sizing

User Base

- What is the target user base or total addressable market size? ☐

Closed-Loop Solutions

- For closed-loop projects targeting a known number of smallholder farmers already participating in a company's supply chain, an accurate number may be deduced based on current sourcing operations (typically ranging from the low hundreds to tens of thousands). ☐

Scalable Solutions

- For scalable agtech solutions being marketed to smallholders within and outside of a company's existing supply chain, market sizing will be less accurate. Estimates can be based on an assessment of the total population of reachable users who have the hypothetical ability and willingness to use the solution (determined by access to the devices, connectivity infrastructure, and disposable income required, plus survey-based data on levels of demand). Note that the population cohort for advisory solutions is limited to the number of farmers within a given region (this would be the case for a digitally enabled market off-taker arrangement, for example), whereas for bundled products offered via e-platforms (such as mobile credit and insurance), the number of households can be a more useful metric. In either case, forecasted user numbers can be multiplied by the estimated median average revenue per user (ARPU), but should then be discounted heavily (we would advise by around two-thirds) to reflect the average ratio of user engagement versus nonengagement historically experienced by agtech platforms, absent a robust participation incentive or enforcement mechanism. (The reality is that adoption rates are overestimated in the vast majority of cases.) ☐

Part 4: Farmer-Centered Product Design

In-House versus Third-Party

- What is the business case for developing the capability in house (higher complexity but generates valuable proprietary data and ensures control over technology) versus a joint venture with a technology partner, a build-operate-transfer model, or full outsourcing? ☐

- Does the desired solution already exist, either in-country or in other EMs? (If so, seek to partner with the provider and adapt the model—it always makes sense to work off proven off-the-shelf technology if it meets core requirements.) ☐
- If the solution is initially built by a third party, who will own the user data? ☐
- Is there a credible plan to build in-house capability in the future to own and execute customizations (as opposed to indefinite reliance on fly-in/fly-out consultants)? ☐

Single Use versus Multiuse

- If the solution is the single-use case, is its problem-solving capability compelling enough to ensure adoption? Can this be tested prepilot? ☐
  - Is it single crop or multicrop in scope (GSMA 2022)? ☐
  - If the solution focuses on data collection or advisory services, can these be linked to more tangible farmer benefits such input access, market access (for example, building relationships with distributors or end buyers), or soft credit (for example, by creating a digital record that supports financing applications)? ☐
- How can the current or future needs for customizations be kept to a minimum? ☐
- Can the solution run on basic feature phones and operate via short message service texts, or does it require an internet connection? ☐
- Is the solution focused only on individual smallholders (for example, farmer advice), or can it be applied to small and medium enterprises agribusiness owners (for example, enterprise resource planning)? ☐

Building Trust

- Has the solution been designed to be participatory and to ensure that information flows in both directions, between the company's representatives or partners and smallholder suppliers? ☐
- How will trust be built with target users? ☐
  - Examples: local language compatibility, in-person demonstrations, and education centers identifying "user champions," or partnering with trusted local brands or nongovernmental organizations (NGOs)[10] ☐
- Is the user interface simple and sensitive to differences in language, literacy, and digital skills? ☐

Lowest Possible Cost

- What is the minimum necessary cost to deliver the core use case for farmers? What ancillary capabilities can be stripped out to keep costs low? ☐

Highest Possible Replicability

- How can the solution's replicability be enhanced, even if this means losing a degree of precision? ☐
- Are there opportunities to capture integration opportunities with local banking systems, telecommunications company systems, or government agricultural programs? ☐
- If the model is initially focused on a company's own supply chain, can it be designed to enable franchising or SaaS opportunities further down the line? ☐

COVID-19 Impact

- How is COVID-19's impact affecting farmer behavior, and what are the implications for project design? Is there an accelerated adoption opportunity (for example, public health advantages of contactless payments)? ☐

Critical Dependencies

- What are the key dependencies in terms of (1) the supporting infrastructure required for the solution to function (for example, availability of farmer registries, digital agronomy data, soil maps, and so on) and (2) regulations required to enable the solution, such as data laws that give access to government-held agricultural data? (Note that time frames for the passage of draft technology regulation are often slower than expected.) ☐
- How can such dependencies be reduced? If they can't, does the business case still hold? ☐

Part 5: Delivery and Revenue Model

Evidence-Based Forecasting

- What is the revenue model (if applicable), and how will this evolve from pilot to scale-up? Are ARPU estimates based on relevant real-world examples, rather than macrolevel forecasts? Likewise, are scale-up targets grounded in real-world evidence? ☐
- Is the pricing model flexible and reflective of different affordability profiles for different user segments? Are there options to defray or defer up-front user costs to boost adoption? ☐
- Does the path to profitability rely on a specific scale threshold? If so, has this minimum user base been preidentified? ☐
- Or, if the solution will be free to use, how will return on investment be tracked? What savings will the solution deliver when compared to the current operating model (for example, reduced need for in-person training of widely dispersed farmers, or reduced need for field agents due to more efficient aggregation)? ☐

Monetization

- If the intention is to monetize data, has in-country legal counsel been consulted to ensure compliance with data regulations? Do the data need to be housed onshore? What will this cost? ☐
- Has willingness to pay been tested among customers of aggregated data? (Past experience shows it is very challenging to monetize agricultural data). ☐
- Has the option of monetizing a share of the value created for intermediaries been explored, as a more feasible revenue model than user fees or data monetization (for example, through B2B advertising revenues or platform access fees)? ☐

Part 6: Stakeholder and Partner Engagement

Stakeholder Mapping

- Which local stakeholders have influence over the agtech solution and the farmers who will use it (for example, government representatives, community leaders, shop owners, aggregators, agrodealers, NGOs, MNOs, microfinance institutions, or local banks)? What is their likely level of support? ☐
- Has a written memorandum of understanding been drafted confirming the roles and responsibilities of all key stakeholders, as well as a grievance mechanism? ☐

Owning the Engagement Process

- If project sensitization has previously been led by a third party (for example, an NGO), has the messaging been clear and consistent, or is there a risk of inheriting inflated expectations (especially if the project is delayed or suspended)? ☐
- Is there a user feedback mechanism in place to identify and address issues early? ☐

Partner Due Diligence

- If a tech partner is involved, what is its technical track record and reputation? Does it have experience in this specific value chain and cultural context? ☐
- What is the partner's view on timelines—is there a risk that it is overpromising to win the contract? What is its source of funding, and is it reliable? ☐
- Is the balance of execution risk and financial commitment shared fairly with the partner(s)? ☐
- Above all, does the partner share your values? ☐
- Can a single strategic partner be identified, rather than engaging with multiple partners? ☐

Part 7: Course Correction in the Run Phase

Decision Gates

- What pilot phase checkpoints and milestones will trigger a decision on whether to scale up?[11] There are many examples of scratch-card certification of input quality, but what is their record of success and cost-effectiveness? ☐
- What role will marketing or sales agents and field agents have in ongoing training efforts: that is, engaging farmers to build trust in and understanding of the product? ☐
- How will internal resource requirements shift from design phase to pilot phase to scale-up (for example, shifting from a model led by a content development team to a model led by a marketing or field agent team)? ☐

Notes

1. This includes genetic technology that produces more nutrient-dense food and that prevents disease without reliance on antibiotics.
2. The record-keeping capability offered by blockchain is not useful until underlying data quality is sufficiently high. Therefore, in an EM agribusiness context, the need to solve basic data collection issues comes first. See Patel (2020).
3. In countries such as China, Colombia, India, Indonesia, and South Africa.
4. See the presentation by Dalberg Advisors, "Dalberg on AgTech: Delivering on the Potential of Digital Agriculture Platforms for Smallholder Agriculture in the Age of COVID-19 and Beyond," World Bank Webinar Series, June 2020, https://olc.worldbank.org/content/digital-ag-series-dalberg-agtech-potential-digital-agriculture-platforms-smallholder (log in required). A lower estimate of 30 percent is provided by McKinsey & Co. in Goedde et al. (2021).
5. Where mobile data are ubiquitous and relatively affordable—and where smartphone ownership is common and 3G, 4G, or even 5G networks are present—agtech solutions that depend on connected field sensors; advisory services delivered via video; or apps for field diagnostics of pests, diseases, and soils all become viable. By contrast, where connectivity infrastructure is weak or expensive, agtech models must revert to unstructured supplementary service data (USSD), SMS, and text alert delivery channels based on interactive voice response (IVR) systems, reducing their usefulness.
6. Adapted from Tsan et al. 2019.
7. An impact venture builder that supports early-stage tech companies in energy and agriculture, primarily in East Africa.
8. Smart-shared asset solutions facilitate access to capital-intensive agricultural assets by sharing costs among large groups of farmers on a "sharing economy" basis.
9. Several of these principles are aligned with recommendations provided in the excellent AgDevCo presentation, "Navigating the Agri-Tech Landscape" (Capelli, Valverde, and Roberts 2021) as well as in Valverde (2020). A further pathfinding report by the GSMA (2022) informed the development of these principles.

10. As noted in the AgDevCo presentation, "Navigating the Agri-Tech Landscape" (Capelli, Valverde, and Roberts 2021). The same webinar presentation also included several insightful real-world case studies.
11. Parts of Part 6 draw on Valverde (2020) and presentations on this topic by the African agriculture-focused impact investor, AgDevCo, including Capelli, Valverde, and Roberts 2021.

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PICOTA
3,95
MANGO
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CHAPTER 5
FINANCING NEEDS AND SOLUTIONS FOR AN AGRIBUSINESS SUPPLY CHAIN

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KEY MESSAGES

- Agriculture finance has numerous benefits. It enables agribusinesses to achieve their business objectives in terms of buying commodities or selling goods and services and it empowers poor farmers to increase their wealth and facilitates the development of food value chains required for feeding 9 billion people by 2050.
- The financial needs of smallholder farmers (SHFs), rural micro-, small, and medium enterprises (MSMEs), and agribusinesses are diverse, ranging from payments to savings and loans as well as risk mitigation instruments.
- Agribusiness anchors can provide financing to SHFs directly or via aggregators such as farmer organizations. However, most agribusinesses do not have the administrative capacity or commercial appetite to prefinance more than a relatively small proportion of the total SHF base.
- Agrifinance has been around for centuries. But in most markets agricultural lending rarely exceeds 3–5 percent of bank assets, which will not be sufficient to finance the growing needs of the industry that must increase food production by 70 percent by 2050 (World Resources Institute 2019).

- Financial institutions have traditionally been reluctant to engage in agrifinance due to a lack of understanding, high risk perceptions, and the high cost to serve.
- Agribusinesses can help improve direct bankability of SHFs by financial institutions by expanding the range of SHF borrower information available to the financier, supporting the SHF to meet financiers' eligibility requirements, and working with financiers to help mitigate key lending risks.
- Technology is a game changer and can significantly increase access to finance. Toward this end, leveraging value chain relationships and building partnerships is critical, as access to data can significantly de-risk agricultural lending.
- Additional instruments to de-risk agrifinance include index-based insurance and climate-risk scoring, all enabled by technological innovations.
- The proliferation of agricultural technology (agtech) and financial technology solutions is driving more robust SHF lending methodologies, with techniques that better leverage borrower information and incentivize repayment to mitigate credit risk, which in turn encourages increased direct SHF lending by financiers.

Introduction

Smallholder farmers and agribusinesses have diverse financing needs, ranging from payments through savings to loans and risk mitigation instruments.

The overall financial needs of small-scale producers in developing countries are estimated at about US$240 billion annually (Dalberg Advisors/KfW 2018), providing an indication of the magnitude of the investments required in small-scale agriculture. Out of this amount, the world's 270 million smallholders require US$188 billion to cover agricultural inputs or investments in mechanization and US$50 billion to cover nonagricultural household-related expenses, including health care, school fees, home improvements, and life events. (ISF Advisors and Mastercard Foundation 2019). Importantly, these estimates may not take into account the climate-specific capital required, which is currently estimated at US$70 billion a year (IFAD 2020).

Additionally, estimates suggest that at least US$80 billion in annual investments will be required to meet growing global food demand.

Most of this needs to come from the private sector due to limited public resources. Investments are needed for farmers and agriculture MSMEs to increase their productivity while reducing environmental impact and taking into account climate risks. These would include investments for input, trade finance, equipment, and technology. Access to finance helps an agribusiness manage cash flow and grow sufficient volumes of crops, produced sustainably, at the right quality, and in a timely fashion. Financing should ultimately help an agribusiness increase its revenues.

Banks, microfinance institutions, and institutional investors have traditionally provided very limited resources for the sector. Agriculture loans and investment portfolios currently are disproportionately low compared to the agriculture sector's share of gross domestic product (GDP). While agriculture contributes 15–50 percent of a country's GDP, lending by banks to the agricultural sector ranges between 3 and 15 percent. Important challenges for the financial institutions include (1) management of unique risks in agriculture, (2) high transaction costs in dealing with large numbers of small farmers as well as MSMEs along the agriculture value chains, (3) limited effective demand for finance, and (4) lack of expertise in managing agricultural loan portfolios. Financial systems are even less prepared to finance the shift to sustainable agriculture and agrifood industries. Challenges faced by financial institutions, such as lack of expertise in assessing lending risks or managing agricultural loan portfolios, can be addressed through capacity building.

There are several tools that help financial service providers de-risk agricultural lending. For example, the past two decades have seen the emergence of risk mitigants such as index-based crop insurance and agroclimatic risk assessment tools. Leveraging relationships within value chains can also de-risk agricultural finance.

In addition, technology innovations and ever-increasing computing power have a game-changing impact on agrifinance. Increased computing power allows real time analysis of vast amounts of data from a variety of sources, such as payments within value chains, in real time. This data can in turn be used to enhance customer profiles, providing additional insights into their financial behavior and financial strength. The use of mobile payment and agent infrastructure can significantly reduce the cost to serve, while digitalization of payment streams can form the basis for data analytics as invisible transactions become visible.

Within the past 10 or more years, a relatively small but growing stream of investments has led to a proliferation of digital financial

services (DFS) and related information services aimed at the agriculture sector. These have been launched by incumbents from the finance and payments sectors as well as new entrants, such as mobile network operators (MNOs) and digital technology companies. These offerings exhibit a diverse range of financial and operating models, and they all rely on digital solutions for many, if not all, of their business operations. Offerings can range in financial complexity from layaway payments for SHFs to buy inputs without a loan to index-based weather insurance for global reinsurers. In terms of digital complexity, these offerings exhibit a similarly wide range: from no requirement on the part of a SHF to own or have access to a mobile device to the use of smartphones and quick response (QR) codes by SHFs and cloud-based management information systems (MISs) by other enterprises or corporate actors in an agrivalue chain.

At the same time technology gives rise to new business models, agtech platforms can help organize smaller producers into a better optimized ecosystem and improve their resource allocation, as well as performance, while strengthening value chains. These platforms are able to link producers with consumers (business-to-consumer, or B2C) but also producers with agribusinesses (business-to-business, or B2B) that are off-takers of agricultural commodities (for example, trade, local processing, and so forth). Technology can also be used to help bundle financing and insurance more efficiently and at a lower cost per farmer. Financing farmers through such platforms can reduce investment risks by increasing diversification and enhancing transparency.

Data analytics is a critical factor to de-risking agrifinance. The development of strategic partnerships enables access to a variety of data sets from input providers, MNOs, off-takers, and so forth. Partnerships with technology companies can provide agroclimatic risk analysis and mitigation strategies and other information that can further increase financiers' ability to understand and mitigate risks. Embedding finance in specific value chains, where payments are digitized, can further reduce risks—as participants and flows become transparent.

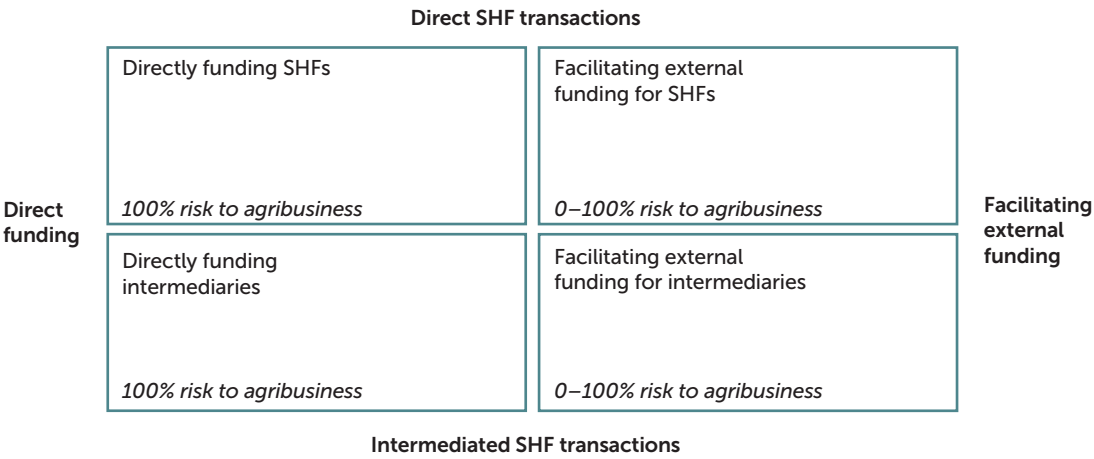
The most prevalent model for SHFs and rural MSMEs to access finance is through larger agribusiness (anchors) who directly or indirectly finance SHFs, leveraging their supply and/or distribution chain relationships to do so. Such financing can be provided from the agribusiness's own balance-sheet, the agribusinesses may borrow from banks to on-lend to farmers, or they partner with banks and microfinance institutions (MFIs) for the latter to do the lending to SHFs based upon a

guarantee from the larger agribusiness. There are pros and cons with each of these arrangements. Also, the options are not mutually exclusive, as they can be combined: for a certain set of farmers the agribusiness could do the finance directly, while for another set of farmers, financial institutions can do the lending. The options for an agribusiness to finance its suppliers and distributors are summarized in figure 5.1.

Larger agribusinesses have access to capital markets and may raise funds at lower rates than local banks. Their knowledge of the SHFs, along with the focus on using finance to secure volumes of business, could lead to competitive credit costs for SHFs. Small and medium enterprises (SMEs) agribusinesses may not be able to secure lower-cost funding. Their funding through local commercial banks could be limited by their balance sheet and assets, and thus credit could be more expensive.

Bringing in banks and MFIs to lend to farmers could be advantageous to an agribusiness because the agribusiness would not need to use its own balance sheet to raise funding to on-lend, while it would still be able to facilitate funding to its suppliers. SHFs can also find additional financial products beyond those for crop production. However, banks and MFIs may be more risk averse than the agribusinesses, and farmers may not have the risk profile these financial institutions seek. Therefore, the availability of credit to SHFs may be limited compared to direct lending from the agribusiness, and fewer farmers would be able to access credit,

FIGURE 5.1 Matrix: Smallholder Farmer (SHF) Funding Choices



Source: Original figure for this book by the International Finance Corporation.
Note: SHFs = smallholder farmers.

given the loan application requirements of banks and MFIs, which are more structured compared to production credit from agribusinesses.

Financing by agribusinesses could rely on off-taker contracts or purchase orders to their suppliers (farmers), resulting in contract-farming arrangements. However, financing can also take place in a less formal environment, wherein agribusinesses could provide inputs on credit to SHFs, which in turn would be expected to pay back the loan in kind through crop delivery, supplying at least a percentage of the crop to satisfy the cost of inputs provided. The case study in box 5.1 provides an example of such a system.

BOX 5.1

Case Study: Jiva Platform in Indonesia

Jiva Ag Pte Ltd—established in 2019—is a wholly owned subsidiary of Olam Group Ltd. Since early 2021, Jiva has been operating a digital platform in Indonesia that provides inputs to maize farmers and procures the crop after harvest to deliver to feed mills. Inputs are provided on credit, with Jiva earning a spread from buying and selling inputs. This approach embeds the cost of finance in the crop price, and there is no interest rate. Farmers can pay the input credit in cash or by delivering part of their crop. However, the focus is to link input credit to purchasing the crop. After harvest, Jiva advances funds to its buyers to pay cash, aggregate the crop, and deliver it to feed mills with whom it has contracts. Jiva's business model focuses on margins for input and crop trade, while the company facilitates input supply and crop purchases by providing credit. Through this platform, Jiva builds a transaction history of farmers, offers customized agronomic advice, and provides access to input and output markets, thereby enhancing farmers' income and welfare. Jiva uses a combination of digital technologies and on-ground presence to facilitate financing. The company employs the services of microcollectors (MCs) that serve as commission-based agents and Jiva's primary point of contact with farmers. The MCs have four main functions: (1) register new farmers with their "know your customer" data; (2) help farmers apply for credit (in-kind inputs) and place input orders through the MC app; (3) receive and distribute inputs to farmers; and (4) use the procurement advances provided to purchase the crop from the farmers and pay them immediately. Jiva uses activation coordinators (ACs) who are full-time employees to hire, train, and manage the MCs. By the end of 2022, Jiva reached more than 12,000 transacting farmers and 1,000 MCs with 50,000 tons of corn in total transacted volume. The International Finance Corporation (IFC) is contributing financial resources and expertise to further develop, strengthen, and expand this business model.

box continued

BOX 5.1

Case Study: Jiva Platform in Indonesia *(Continued)*

IFC's participation allows Jiva to scale its lending program to MCs and farmers and will help build a track record of repayment behavior for commercial lending (risk sharing) from IFC and other financial institutions. IFC also offers its expertise to enhance Jiva's credit-related processes and improve the environmental and social sustainability of its operations.

Source: Original box for this book by the International Finance Corporation.

A key risk is side selling, in which the SHF would sell to someone else to avoid repaying the loan. The extent of side selling depends on the structure of the value chain and the relationships between the farmers and agribusinesses. Crops that require centralized collection and processing (for example, sugar, cotton, and rubber) and have a well-structured value chain around an anchor buyer are better at controlling side selling. Beyond these, the creation of loyalty incentives, provision of nonfinancial services, field monitoring, use of digital technologies, and the like can lower the risk and incidence of side selling.

Agribusinesses can provide data and information on their SHF suppliers to financial institutions (banks and MFIs) to enable these institutions to assess financial needs, design financial products, and assess credit and other risks. Beyond data and information, agribusinesses could share some of the credit risks (for example, first-loss credit risk sharing) or provide some guarantees to banks and MFIs. The repayment of such loans is often based on delivery of the crop to the agribusiness, although farmers could also be given the option of selling somewhere else if they repaid the loan to the bank or MFI. However, in such scenarios, the agribusinesses are not likely to be willing to share any of the risks.

Financing through Agribusiness Anchors

Smallholder farmers most often require smaller amounts of credit for working capital, which makes it impractical to ask for collateral. Therefore, agrifinancing for SHFs places emphasis on lending models that mitigate risk through a better understanding of borrower cashflows and how to capture them for loan repayment. The following subsection

briefly addresses agricultural value chain finance (AVCF), a common form of SHF prefinancing within a contracting relationship.[1] The second subsection looks in greater length at agrifinance products and techniques to strengthen AVCF arrangements in the face of high side-selling risks. The third subsection considers SHF agrifinance opportunities that do not require a prefinancing commitment by the anchor agribusiness.

Agricultural Value Chain Finance (AVCF) through Agribusiness Anchors

AVCF involves prefinancing of goods or services, typically agri-inputs, to the producer during the production cycle in return for delivery of outputs to a designated off-taker after harvest. A contract establishes a financing relationship in which provision of preharvest credit (cash or in kind) is repaid using proceeds from the smallholder's crop sales postharvest, payable by the off-taker directly to the financier (when the financier is a party other than the off-taker). Table 5.1 shows common AVCF arrangements.

TABLE 5.1 Typology of Common AVCF Arrangements

AVCF type	Funding source / risk allocation	Description	Typical motivations
Off-taker prefinancing	Off-taker	Off-taker prefinances smallholder farmer (SHF) inputs, expecting delivery after harvest to repay input credit.	• Supply security • Quality assurance • Traceability • Corporate social responsibility
Input-supplier prefinancing	Input supplier	Input-supplier prefinances SHF inputs and expects delivery after harvest to repay input credit.	• Product marketing • Demand stability • Up-and cross-selling
Tripartite arrangement	Off-taker, input supplier, or both, with risks allocated among them	Input supplier and/or off-taker prefinances SHF inputs and expects delivery to off-taker after harvest to repay input credit.	• Mix of the above
Financier-led arrangement	Financier, which may take full risk or share risk with off-taker or input supplier	Financier prefinances SHF inputs and expects delivery to designated off-taker after harvest to repay input credit.	• Relationship building • New business opportunities • Portfolio diversification • Impact investment

Source: Original table for this book by the International Finance Corporation.
Note: AVCF = agricultural value chain finance.

AVCF schemes may be established by off-takers linked to a contract-farming or an out-grower scheme, and by input suppliers (or, much less commonly, equipment vendors) as part of a product marketing strategy. In the latter case, the input supplier may itself off-take and then on-sell the produce to buyers, or it may partner with one or more off-takers, which directly off-take from the contracted producers and then provide the repayment for the input credit. The agribusiness's contractual relationship under AVCF may be directly with the producer or via an intermediary—for example, a producer organization (PO), a retailer/distributor, or a trader/aggregator—which would be given full or partial responsibility for provision of inputs and aggregation of outputs.

POs have often been engaged by agribusiness anchors as a useful means to reduce risk when lending to multiple SHFs. The involvement of the PO can help reduce transaction costs through facilitation of last-mile logistics and distribution. The PO also takes on the repayment risk by an individual SHF member and is usually better positioned than an agribusiness or financier to mitigate that risk: preemptively by virtue of the close relationship with the member SHF, at time of default through offsetting the repayment obligations of the defaulter with produce provided by other members, and post facto through increased likelihood of recovery based on social and community-based financial and legal interactions. The resulting debt can then be remedied within the PO rather than through foreclosure proceedings, which may impact the future borrowing capacity of the individual SHF or of the PO.

The financier relies on the off-taker to make loan repayments out of the SHF's sales proceeds rather than relying on the SHF making payments directly to the financier, the latter translating into increased transaction costs and risks for the financier. However, AVCF based on off-taker or input-supplier prefinancing has inherent limitations in application for both commercial and structural reasons:

Commercial: Most agribusinesses do not have the administrative capacity or commercial appetite to prefinance more than a relatively small proportion of the total SHF base. To engage the large number of SHFs in its catchment area, an agribusiness may explore sources of external funding. When an external financier prefinances the SHFs, the agribusiness may consider supporting the prefinancing by (1) providing pertinent information to assist the financier in appraising the SHF's creditworthiness; (2) committing to off-take so the financier is assured that prefinanced SHFs can find a market for their produce and a mechanism for facilitating repayment in the case of an off-taker; (3) sharing to a defined extent in the repayment risk; and (4) providing

full or partial guarantees. These themes are explored further in the sections titled "How Can an Agribusiness Help Smallholder Farmers Become Bankable for Financial Institutions?" and "Sources of Finance in AVCF."

Structural: AVCF tends to work best in "tight" value chains. Such value chains have one or more constriction points along the chain, usually but not always at the level of agroprocessing. These constriction points provide limited choice of route for goods to market, thus reducing the possibilities for side selling (that is, when a producer sells its produce to someone other than the designated off-taker, circumventing the repayment mechanism stipulated in the financing agreement).[2] It is particularly difficult to avoid side selling with food crops because they are sold and consumed everywhere. To prefinance SHFs in value chains not ordinarily supportive of AVCF, an agribusiness may consider products and techniques that can strengthen AVCF against side-selling risk, potentially pushing the boundary of AVCF beyond the traditional tight value chains, or to look at alternative approaches for financing SHFs aside from prefinancing.

Strengthening AVCF against Side-Selling Risk

Four broad agrifinance techniques strengthen AVCF against side-selling risks:

1. Providing positive incentives for the SHF to fulfill delivery obligations
2. Broadening financing from a transactional to a relationship-based framework
3. Reducing side-selling opportunities
4. Increasing the financier's recourse against SHFs

Incentives for SHFs

A study of Africa's large-scale out-grower schemes conducted by TechnoServe (2014) suggests that "carrots" may be more effective than "sticks" in addressing side-selling risks. The most basic carrot for good performance may be the SHF's retention within the prefinancing arrangement—that is, to continue benefiting from the scheme in the next season, the SHF must fulfill its delivery obligations this season.

Other important carrots include (1) fair pricing for inputs and outputs, (2) awareness raising and extension services to promote transparent understanding by the SHF and effective capacity to benefit from the prefinanced inputs, (3) prompt payment upon delivery of outputs, and (4) the affordability of the SHF's delivery commitment.[3] Experience suggests that ongoing high-touch interaction with the SHF by the agribusiness or its designated representatives is a key aspect of attractive scheme design: during the production cycle for monitoring and problem solving, and as harvest approaches, in order to purchase quickly before alternative potential buyers step in. Distributing packaging material, such as grain sacks, is another effective incentive. Other, more sophisticated incentives may include performance-based rewards, profit-sharing mechanisms, and loyalty schemes that incentivize farmers to achieve production and delivery targets. Rewards noted in the TechnoServe study include incremental expansion of prefinanced input packages and access to subsidized goods and services (for example, small equipment and insurance).

Broadening the Financing

Side selling can be driven by factors unrelated to the inputs-for-outputs AVCF transaction but may be rooted in the wider socioeconomic situation of the SHF, which brings high exposure and low resilience to shock and structural volatilities. Therefore, by broadening the financing arrangement beyond the transaction to address the broader needs of the household, inclusive of savings and insurance products to boost resilience, some of the causal factors that drive side selling may be mitigated. This technique is likely to be applicable only when social lenders are involved as an external source of financing, addressed in the section "Sources of Finance in ACVF."

Reducing Side-Selling Opportunities

There are two broad ways in which value chains can be tightened: (1) restricting access by unauthorized buyers to the SHF's output and (2) expanding the set of acceptable off-takers participating in the AVCF arrangement. In addition, agribusiness, through a network of field agents, can monitor farmers whom they have financed and ensure that at harvest these farmers will deliver at least enough quantity to fulfill repaying the in-cash or in-kind (inputs) prefinancing they received.

Unauthorized buyers may be restricted altogether or may otherwise be closely monitored at inspection points or by using relevant traffic-surveillance and vehicle-tracking technologies. However, such arrangements, while possible, are not common.

A more common approach is through licensing or zoning measures. Some licensing or zoning rules are exclusionary, others quota-based, and others structured around requiring buyers to meet eligibility criteria. These arrangements are often enforced by a public agency. However, they may also be overseen by an industry association acting on a self-regulatory basis. For regulation to be worthwhile, it should be structured so that the benefits clearly outweigh the costs and risks. Some level of industry participation may help to promote this approach. Such arrangements are usually based on the concept of concessions in cotton and sugar, where cotton ginners and sugar factories are allocated a certain area in which they are the only buyers. This has been necessary to control varieties or quality grown and the effective distribution of inputs. However, beyond a few types of commercial cash crops in certain markets (for example, cotton, sugar, rubber, and palm oil), such concession arrangements are not common.

Schemes where land is allocated to tenant farmers are also a method of tightening the value chain. This requires the agribusiness to have (or seek to establish) a nucleus estate. It also requires a business case for the agribusiness to engage tenant farmers rather than directly manage the farm as a fully in-house operation. The UK-based specialist agricultural development finance institution AgDevCo has explored extensively and invested in agribusinesses developing in-grower schemes (AgDevCo 2017). Examples of business case motivations for in-grower schemes are shown in figure 5.2.

An alternative technique involves agribusiness support (directly or indirectly) for establishment of an access-controlled "block farm" within which SHFs may be sold or leased land (box 5.2). This may be considered when the agribusiness anchor does not wish to establish a nucleus estate. Rather, the arrangement may be developed and overseen by a third-party farm management company with relevant expertise, or by a financial institution that appoints a farm management company as an agent to work on its behalf. The agribusiness may enter into an off-take arrangement with the farm management company, which intermediates the AVCF relationship with the agribusiness and any participating external financier on behalf of the participating SHFs.

FIGURE 5.2 Business Case Motivations for In-Grower Schemes

Financial business case	Operational business case
The SHF rather than the agribusiness takes on the cost of land management, labor, equipment, and inputs, with repayments against the financing made season by season out of SHF sales proceeds under an AVCF-type arrangement.	The yield or quality of the produce is enhanced by hand-picking or individual attention to the land parcel, better provided by SHFs than by seasonal labor.
Social business case	**Political business case**
In certain value chains, an environmental, social, and governance–related fair-trade premium may be generated for inclusive and sustainable farming practices.	Local or national government may have a stronger motivation to allocate land, among other forms of support, to an agribusiness when it directly benefits local communities

Source: Original figure for this book by the International Finance Corporation.
Note: AVCF = agricultural value chain finance; SHF = smallholder farmer.

BOX 5.2

Case Study: IDH Block Farming Model, Cassava in Nigeria

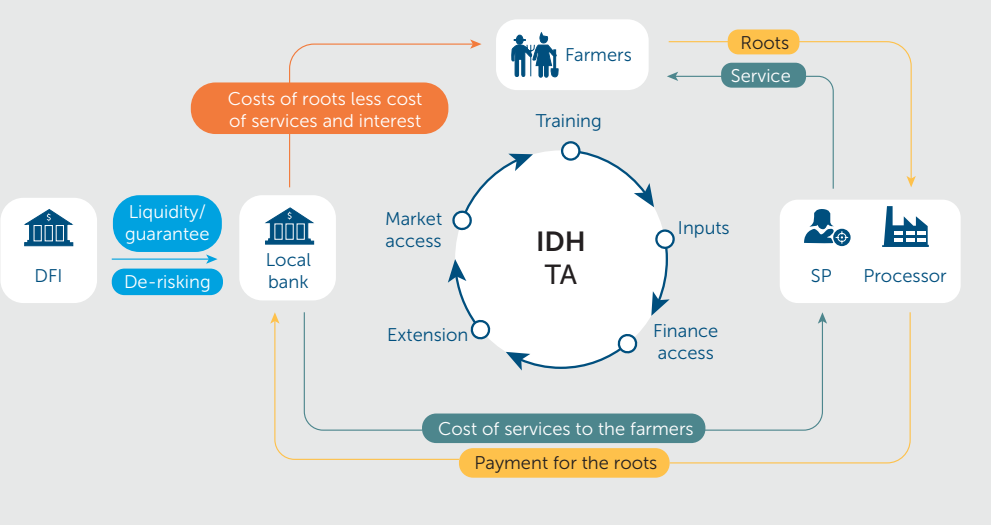
The Sustainable Trade Initiative (IDH) is a foundation that works with business, financiers, government, and civil society to realize sustainable trade in global value chains. IDH deployed its block farming model in Nigeria to increase the productivity and delivered volume of cassava to the rapidly growing cassava-flour, starch-processing, and ethanol-processing sector. This sector included firms such as Psaltry International Ltd, a starch processor founded in 2013 with processing capacity of 50 metric tons per day. Block farms were established and land allocated to smallholder farmers (SHFs) for cassava cultivation against off-take contracts. Training, inputs, extension, and crop management services were supplied by a service provider, which was funded by a local bank that in turn on-lent wholesale funding from development finance institutions (DFIs). The bank pays the service provider 50 percent on delivery of the service and the rest after harvest. When the producer delivers cassava, the off-taker pays the sales proceeds to the bank. The bank deducts the amount due to the service provider and sends the rest to the farmer. Results indicate an SHF productivity gain of 300 percent, post-harvest loss reduction of 50 percent, and income gains of 74 percent. Financing block farming is depicted in figure B5.2.1.

box continued

BOX 5.2

Case Study: IDH Block Farming Model, Cassava in Nigeria *(Continued)*

FIGURE B5.2.1 Financing for Block Farming Model



Source: IDH 2020.
Note: DFI = development finance institution; IDH = Sustainable Trade Initiative; SP = service provider; TA = technical assistance.

Agribusinesses often explore investing in primary production via in-grower schemes and block farms to reduce side-selling risk but also to drive stronger SHF performance within the managed farming environment.

Expanding the range of acceptable off-takers participating in the AVCF arrangement reduces the channels available for side selling and enables improved capturing of SHF cashflows to repay input loans. A solution of this kind can emerge when an AVCF financing scheme involves multiple major off-takers in a given location and value chain. The development of AVCF programs within sector-wide initiatives such as the Government of Nigeria's Anchor Borrowers Program (CBN 2021) and the Farm-to-Market Alliance[4] provide examples of how this approach can be implemented.

Increasing the Financier's Recourse against SHFs

Increasing financier recourse creates stronger deterrence against side selling and reduces financier loss in the event of default. This technique has some limitations, given that the relatively small size of transactions and the informality of SHFs make it hard to enforce recourse actions. Perhaps a better recourse is to exclude farmers that have side sold and not repaid their financial obligations by excluding them from the value chain. Overall, though, it is better to come up with "carrots" rather than "sticks" to incentivize SHFs not to side sell, such as loyalty rewards.

One way to increase the financier's recourse involves lending to a PO, which then on-lends to the individual SHFs, rather than lend to the individual SHF borrower. Aside from leveraging the stronger position of the PO to mitigate repayment risk of the individual SHF, the PO itself may be more likely to have assets that can be used to collateralize or partly collateralize the lending arrangement. In most cases, the PO may not even need to use collateral for accessing finance and can rely on its history of supplying. Also, financing will not be needed to cover the full value of the crop by all its members, which means that the PO can still meet its obligations to the financiers by committing to sell only a certain percentage of its member crop production.

Intermediary-Focused Financing

Working with intermediaries (for example, farmer organizations, retailer-distributors, or trader-aggregators), where they have capacity and incentive to enter into a contract, can offer a "best of both worlds" scenario for agribusinesses. In this way, agribusinesses can avoid the time and cost of dealing directly with a fragmented SHF base while creating sufficient linkage to SHFs via intermediaries.

Agribusinesses anchors tend to focus on providing liquidity (that is, lending) for the intermediaries they work with pre- and post-harvest. This may involve an unsecured lending arrangement: for example, providing inputs in kind to the intermediary for on-lending by the intermediary to SHFs or offering prepayments to facilitate aggregation, particularly for larger and more trusted players. It may also involve taking some measure of security, such as a pledge on the intermediary's movable assets[5]—for example, trucks, machinery, or stock—against which credit is provided. An increasingly popular option for agribusiness anchors is to enter a supply-chain finance program such as reverse factoring. Through reverse factoring, a financier

discounts the agribusiness's deferred payment obligation (for example, 30, 60, or 90 days) to release cash to the supplier soon after delivery.[6] This helps to scale the supplier's business activity while improving the agribusiness's working capital position.

In operationalizing its relationships with intermediaries, the agribusiness anchor can incentivize positive SHF interactions linked to business objectives. This may include capturing pertinent SHF-level data, distribution of inputs and equipment, provision of extension and advisory services, registration for insurance and other services, standards-linked pricing models, on-lending arrangements, and dissemination of market information. The intermediary may be remunerated according to not only overall volume or value of business, but also fulfillment of the defined SHF-related key performance indicators.

Technology Applications in AVCF

AVCF can be supported by the application of technologies. The following sections look at the impact of technology on agrifinance across four dimensions: the strength of the agribusiness–SHF relationship, the amount of pertinent SHF borrower information generated, the capacity to efficiently distribute and manage SHF-focused financial products and services (product enablement), and support for performing the functional processes associated with finance (table 5.2).

Strengthening the Agribusiness-SHF Relationship

Emergent technology can drive agribusiness-financing relationships with SHFs in one of two directions. First, the wealth of new digital tools

TABLE 5.2 Mapping of Technology Impacts on Agrifinance Options for Agribusinesses and SHFs

Domain	Relationship strengthening	Information generation	Product enablement	Functional process
Impact	• Closeness • Loyalty • Incentives • Bundling • Service delivery	• KYC • Credit worthiness • Track record • Communications	• Platform • Distribution • Risk management • Capacity	• Credit scoring • Digital payments • Supply-chain management • Financial management

Source: Original table for this book by the International Finance Corporation.
Note: KYC = know your customer; SHFs = smallholder farmers.

and information flows that have become available enable the agribusiness to create a much closer direct relationship with a much larger number of SHFs than ever before, using the range of financing opportunities presented in this chapter. Second, emerging agtech and financial technology platform operators are offering lower-cost value-added forms of SHF supply-chain and financial intermediation to fulfill agribusiness objectives more efficiently and cost-effectively from working with SHFs (for example, volume, loyalty, quality, resilience, and supply responsiveness). See box 5.3 for an example.

Agribusiness's ability to choose between open and proprietary agtech is one aspect that is driving the evolution of e-commerce in other sectors—who controls access to the customer (or, in this case, the SHF). In an open agtech platform, what are the assurances that it will always remain so? And even if it does, will it continue to create a level playing field? Or will there be privileges for some players over others (analogous to airline loyalty card schemes)? For those agtech platforms that are proprietary, can they scale sufficiently to serve the agribusiness's requirements relative to an open platform? If so, can such scaling be cost-effective to sustain? And even if so, would a proprietary platform encounter regulatory barriers over time relating to anticompetitive behavior? Overall, is there a point when it makes sense for an

BOX 5.3

Case Study: Olam Direct

The Olam Group is a multinational agribusiness offering food, feed, and food ingredients worldwide. Olam Direct is a technology platform to provide farmers that are currently beyond Olam's buying stations direct access to advice, financing, supplies, and sales. Through their cellphones, farmers can obtain prices and transact with Olam via the platform rather than going through intermediaries, thus yielding higher sales price for the farmer and cost savings on last-mile expenditures. Each transaction is geotagged and time stamped to provide traceability and transparency. Farmers can apply through the platform to banks for loans, with credit assessments performed by banks through the platform and funds disbursed into a mobile wallet. The platform has reached over 70,000 farmers in 12 countries.

Source: Olam website, https://www.olamgroup.com/sustainability/innovation-technology/farmgate/olam-direct.html.

agribusiness to create a proprietary platform to serve a wider range of agribusinesses? Would that better enable it to fund further scalability and overcome regulatory concerns?

Arguably, this dynamic in smallholder agriculture is most advanced in China. Advanced, open, agrifocused e-commerce platforms like Pinduoduo and Alibaba's Rural Taobao can be utilized by agribusinesses to source directly from farmers. This connection can be driven by powerful proprietary engines like Syngenta's Modern Agriculture Platform and a range of proprietary farm-to-business or farm-to-consumer e-commerce applications like Wangjiahuan and Songxiaocai. Wangjiahuan is a case in point. Originally, a traditional food supply business, the success of its agtech platform led to the company transitioning into a business-to-business portal for agricultural produce. It has, in turn, secured major investment from Meituan, an open e-commerce platform that uses advanced technology to drive direct-to-restaurant and, more recently, drone-based, direct-to-consumer downstream food supply offerings.

Generating Pertinent Information about the SHF Borrower

Emergent technologies are making it possible to capture and analyze much more information than had previously been possible, overcoming barriers to engaging with and facilitating finance for SHFs. This stems from three main sources, shown in table 5.3.

Product Enablement

Specialized financial technology platforms have been developed to manage AVCF, supply-chain finance, and warehouse receipt finance (WRF) products.[7] Agribusinesses may access such platforms—through an upfront license fee and self-hosted or through a software-as-a-service (SaaS) cloud-based subscription service—to administer specific products end-to-end, including origination, distribution, provisioning, collateralization, monitoring, risk management, repayment, and recovery. An example, in box 5.4, involves the global commodity buyer, Barry Callebaut, using the supply chain finance technology platform provided by Demica.

Functional Process Performance

Financial technologies are offering solutions that can rapidly build capacity and generate process efficiencies for agribusinesses engaging in

TABLE 5.3 Drivers of Improved Information Flows

User-generated data	Monitoring technologies	Analytical capability
The diffusion of hardware (cellphones, tablets), software, and services (for example, social media, communications tools such as text or WhatsApp, and farm management solutions) has enabled extensive flows of user-provided real-time data to displace exhaustive techniques previously used for recipient-initiated one-off survey data. This trend has driven deeper, more dynamic, and up-to-date profiling of SHF borrowers, and has created a two-way data flow for the promotion and origination of financial products and service take-up, as well as cross- or up-selling opportunities.	The mainstreaming of on-farm digital and sensor-based technologies and drone-based and satellite imaging has enabled the efficient gathering of pertinent farm-level performance data. These data can then be used to better tailor financial and other services to drive SHF farm-level optimization of land and water resources, and input and equipment use, as well as provide for early detection and mitigation of production, post-harvest, and side-selling risks.	The deployment of artificial intelligence linked to big data solutions enables agribusinesses and financiers to build and analyze track records, develop and perform credit-scoring appraisal, and monitor individual- and portfolio-level performance for an almost unlimited numbers of SHFs.

Source: Original table for this book by the International Finance Corporation.
Note: SHFs = smallholder farmers.

BOX 5.4

Case Study: Barry Callebaut–Demica–IFC, Sustainability-Linked Sugar Supply Chain Finance, Mexico

The Barry Callebaut Group is the world's leading high-quality chocolate manufacturer. In 2021, it partnered with the International Finance Corporation (IFC) and Demica, a cloud-based financial technology platform specializing in automated working capital and supply-chain finance solutions, to offer short-term working capital finance solutions to Barry Callebaut's small- and medium-sized sugar suppliers in Mexico. The Demica platform is used by Barry Callebaut to increase efficiency of supplier onboarding and automate the payment and financing processes for supply-chain finance. As an additional incentive and benefit for suppliers, the interest rates depend on the sustainability outcomes linked to Barry Callebaut's labor, health, safety, and environmental standards.

Source: Thompson 2021.

finance, including through embedded finance offerings. These solutions may support supply-chain management and traceability, finance, and investment functionality, digital payment solutions, and external fund-raising capacity (for example, e-financial marketplaces and crowdfunding tools). They also include the banking-as-a-service (BaaS) offerings outlined in the section on "Sources of Finance in AVCF," including credit-scoring and risk management systems.

Supply-chain management agtech and financial technology solutions are emerging that are specifically configured to address the realities of SHF-prevalent contexts. Such solutions help to streamline the interface between the agribusiness's field teams and infrastructure (for example, collection centers, distribution nodes, and central warehouses) and SHF and small-scale aggregator suppliers. Their main features usually include capture of pertinent supplier and product data (typically via cellphones or hand-held devices), traceability along the supply chain through barcoding or geotagging, and monitoring and analyzing statistics. Aside from the potential procurement efficiencies that result, the benefit from the financial perspective is to provide a real-time, dynamically updated view on supplier performance and physical stock or collateral. An example, in box 5.5, illustrates how the global commodity trader, Cargill, uses the FarmForce platform to strengthen its sustainable sourcing processes.

BOX 5.5

Case Study: Farmforce-Cargill Enterprise Cocoa Solution (Côte d'Ivoire)

Cargill, the global agribusiness, faced a sizable challenge to attain Rainforest Alliance certification standards across 130 cooperative suppliers, representing more than 250,000 cocoa farmers in Côte d'Ivoire. In 2017, it partnered with Farmforce, a sustainable sourcing platform for value chain actors, to develop barcode-based, bag-level traceability back to the individual farmer in its cocoa supply chain. The solution includes customizable management dashboards consolidating real-time data flows from its cooperative suppliers and along the value chain across Côte d'Ivoire. It assures Cargill quality and traceability of supply as well as visibility into production conditions and farmer-level performance.

Source: Farmforce 2022.

Sources of Finance in AVCF

Involving a financier reduces the agribusiness's cost and risk burden. With the exception of large multinational and regional agribusinesses, financiers typically have access to much higher levels of capital than agribusinesses do, often at a lower cost of capital, with specialized technical capacity to appraise and mitigate lending risk and the ability to package and structure a holistic financing solution blending multiple products and services. Agribusiness anchors should carefully weigh pros and cons.

There are four disadvantages of external financing. First, in some cases, the interest rates levied on the SHF by a financier may be higher than those levied by the agribusiness, according to the relative costs of capital and the costs and margin for passing on that capital: for example, an agribusiness may have more flexibility in deciding how much of the cost to pass on and how much margin to take in SHF lending that achieves broader business objectives. However, the cost of financing offered by the agribusiness may be less transparent compared to financial institutions, as it is blended with the terms of the physical trade. Second, a financier may be more selective than the agribusiness in the number and type of SHFs it is prepared to finance, and the amount of finance to provide per SHF. This is asymmetric information—the agribusiness is closer to the financier and knows the SHFs better; in other words, it is in a better position to assess and take risks. In addition, the agribusiness needs to secure supplies that make it more amenable to financing SHFs. Third, external financiers may have less patience to sustain season-on-season financing if performance levels come under pressure, or if the financier's own situation changes. Fourth, the involvement of a financier takes away some of the discretion the agribusiness may otherwise have, for example, in selecting the input package or supplier or the timing of repayment.

There are also benefits. Not many agribusinesses, particularly local SME agribusinesses, have the balance sheet to borrow and on-lend to SHFs. Furthermore, as mentioned previously, dealing with financial institutions makes terms for lending more transparent. Although agribusinesses are closer to SHFs and have more information, they do not have the rigor of the credit systems that financial institutions have, which may create serious financial issues for the agribusiness if SHF repayments are not timely. Finally, bringing in financial institutions can offer more financial products to SHFs beyond production-related loans, such as savings accounts, payments, digital finance, school fee loans, and the like.

Providing Finance In-House

When an agribusiness provides financing directly, the level of in-house capacity required to administer the finance is an important consideration. Scale, complexity, cost, and risk are key metrics, and at minimum, some credit system would be required. At one end of the scale, an agribusiness operating a small-scale simple financing scheme may leverage its existing in-house finance team in coordination with supply chain managers and field staff. At the other end, the agribusiness may consider setting up a specialized in-house unit or outsourcing; the latter is an increasingly realistic option with the spread of financial technology platforms offering banking and financial services (see the section "Technology Applications in AVCF").

Priorities for an in-house financing unit may cover financial and operational dimensions. On the financial side, establishment of a credit risk function is key, drawing on techniques and systems commonly used by banks, including data source integration, credit-scoring methodology, and effective portfolio monitoring and early warning systems. On the operational side, designing efficient processes and systems to manage the transaction cycle is essential. These endeavors may draw on both human capital and financial technology solutions to manage cost, reduce risk, and improve service levels for SHF borrowers, intermediaries, partners, and the agribusiness.

While an in-house unit may be established initially as a cost center, it could, over time, transform into a profit center. This follows the experience of various industries worldwide in which an embedded financing opportunity has become a significant driver of business growth in its own right. As a profit center, the responsible business unit may have its own balance sheet and targets. In the most successful experiences of embedded financing, in-house units have been spun off or merged with synergistic businesses, creating significant shareholder value for the sponsoring entity.

A relatively new development is the growth of the BaaS industry, which provides banking products and services through third-party distributors, in this case an agribusiness's embedded financing offerings linked to its nonfinancial products and services. Common examples include a digital wallet for producers to receive payment after delivering produce, buyer credit linked to the purchase of inputs, and crop insurance integrated with buyer credit and input purchase to help assure loan repayment.

BaaS is usually a cloud-based service incurring a monthly subscription rather than a high upfront licensing fee. In some circumstances, the BaaS provider may also have obtained a banking license, which it can "export" to the agribusiness to allow the agribusiness to offer financial products and services (for example, cash loans) that may otherwise require licensing from the banking regulator. At present time, it is not clear whether there are BaaS solutions on the market that are specialized for agrifinance rather than general lending. Given that this nascent industry is rapidly growing, customized BaaS SHF-focused agrifinance solutions are likely to become available in the near future.

Sources of External Finance

When considering external funding sources, parameters such as amount, term, rate, currency, repayment schedule, eligibility, and permitted use of funds need to be considered. Development finance institutions (DFIs) such as the International Finance Corporation (IFC) can provide higher-quantum, longer-term, and lower-cost finance than banks or nonbank financial institutions (NBFIs). These loans can be in local or foreign currency, but usually require higher minimum ticket sizes and more extensive due diligence, reporting, and disclosure that could render transaction costs too high for smaller-scale agribusinesses. DFIs therefore often lend indirectly to smaller-scale players by providing credit lines to banks or NBFIs, such as leasing firms, which then on-lend to clients. NBFIs can typically serve the smallest-scale borrowers but often at a higher cost and on more restrictive terms than banks. Impact investors and donors can provide blended or grant funding, but the eligibility, funding terms, and permitted use of funds may be restrictive, with a requirement for high impact.

The common interest between input suppliers or equipment vendors and off-takers to facilitate SHF access to inputs and equipment is well established and may be conducive to sharing risk on input- and equipment-financing arrangements. As rural populations become increasingly integrated into the national economy through mobile and internet services, other service providers—for example, technology vendors, MNOs, retailers, fast-moving consumer goods (FMCG) firms, insurance providers, and media enterprises—also have a growing commercial interest to share risk in building the SHF relationship, especially as an agribusiness usually has a head start when it comes to connecting with the SHF.

An agribusiness anchor has the ability to draw on several new sources of external and blended finance. Additional sources of capital include capital markets (wholesale funding), financial technology–provided funding (wholesale or retail), and climate finance—see box 5.6, which highlights a financial technology platform that links agricultural project owners with capital market investors for sourcing alternative forms, and box 5.7, which illustrates how an agricultural project sourced finance from a climate finance fund. Capital markets and financial technology funding offer access to resources from alternative types of investors. Capital market institutions such as pension or insurance funds are seeking ways to diversify their exposures with returns in agriculture with generally low correlation with traditional investments in stocks and bonds. Financial technology platforms are typically structured as NBFIs, often funded by private equity, wholesale funders, and—in the case of a growing range of crowdfunding financial technology platforms—the general public, which may offer retail financing direct to SHFs.

Over the years, agribusiness companies have recognized the need to work with financial institutions (FIs) for the lending to smallholder farmers. Agribusiness anchor companies lend to farmers usually because of the absence of FIs lending to these farmers. Formal FIs including banks and MFIs may not be physically present in the rural areas. In addition, suitable financial products are not offered due to lack of strategic interest in the sector and/or limited sector knowledge and the high risks associated with farming, such as weather risks and seasonality of income.

BOX 5.6

Case Study: Energise Africa

The Energise Africa financial technology platform combines capital markets, crowdfunding, and blended finance by enabling African firms to generate crowdfunded bond issuances, leveraging matched funding, co-investment, and partial guarantees from donors and development finance institutions. Since its launch in 2017, over US$21 million has been raised. Initially focusing in the African solar and renewable energy sector, Energise Africa recently spread its wings into agriculture with a £500,000 issuance for the Kenyan supply chain agtech iProcure. The platform is technology-enabled with low overhead and wide distribution. It has overcome cost and complexity barriers, and as a result has enabled participation by bond issuers and investors of all sizes.

Source: UNFCCC n.d.

BOX 5.7

Case Study: COOPASER/Althelia Funds, Peru

COOPASER is a Peruvian smallholder cocoa cooperative that supports member smallholder farmers (SHFs) in accessing infrastructure and services (for example, dryers, fermentation facilities, and trucks) and facilitating sales with international cocoa buyers. COOPASER accessed US$5.8 million from the Althelia Climate Fund, an impact investor, to bundle smallholder input credit and enterprise development support, with conservation finance linked to a REDD+ voluntary standard.[a] The full loan amount was repaid by funds generated by the issuance and subsequent sale of carbon credits. Funding covered US$1,500 of farming inputs per hectare over three years, as well as training, certification, and monitoring services for restoration of degraded lands within buffer zones through the establishment of cocoa plantations in SHF-managed agroforestry systems (where cocoa trees are grown underneath the rainforest canopy). A total of 4 million metric tons of carbon dioxide reductions were generated, with a floor price of US$3 per metric ton, for a value of US$12 million. In all, 570,000 hectares of natural rainforest was preserved and an additional 12,000 hectares of sustainably cultivated land developed. The project mitigated volatility in carbon credit pricing and the time lag to monitor and verify emissions reduction through using revenues from the sale of sustainable cocoa to partially repay the loan.

Source: WWF 2021.
a. REDD+ is a framework for efforts to Reduce Emissions from Deforestation and Forest Degradation linked to the United Nations Framework Convention on Climate Change (UNFCCC).

Some informal arrangements through local money lenders may be available, but these arrangements may not serve the requirements of the agribusiness companies. As stated in the previous section, borrowing funds to on-lend to farmers becomes a burden on companies' balance sheets in terms of both cash flow and opportunity costs. Provision of financial services is usually not considered as a core competency or core business for agribusinesses. Their limitation in this respect could prevent agribusiness companies from growing and engaging a larger number of smallholder farmers.

Involvement of FIs could strengthen the business transactions of the agribusiness anchor companies and the value chains. Some formal FIs are attracted to the business opportunities in the agriculture sector and exploring new business models providing financial services. A wider range of financial products from the FIs could increase the resilience of small farmers and as a result, stabilize the business transactions in the value chains. For example, saving products and loans outside of the value

chain transactions would enable farmers to cope with emergencies and diversify their income sources beyond the crops they produce for the agribusiness companies. The smallholder farmers may be able to build credit records and have opportunities to access larger credit from FIs to expand their business activities. The increased flow of credit from FIs may allow the agribusiness anchor companies to engage with a new set of small farmers as the business grows.

External sources of finance may be divided between wholesale and retail sources. Wholesale finance is funding that the agribusiness anchor can take and then pass on to the SHF. Retail funding is that which is provided directly to the SHF, which the agribusiness anchor may help to facilitate directly, for example, by participating in a tripartite agreement with the financier and the SHF borrower, or indirectly by agreeing to play a particular role such as off-taking, input distribution, and information sharing. The following section focuses on retail funding provided directly to SHFs and rural MSMEs by financial services providers.

Agrifinancial Services Provided by FIs

Commercial banks remain the key source of external financing, but there is a growing range of alternative sources, especially as bank financing can be constrained. Sources can be found among the financial and nonfinancial sectors, as depicted in table 5.4. The most formal financing through financial institutions is by public banks (about 64 percent), while the second source of financing is MFIs (22 percent), followed by commercial

TABLE 5.4 Potential Sources of External Finance

Financial-sector sources	Nonfinancial-sector sources
• Commercial banks • Public banks • Nonbank financial institutions (NBFIs): for example, microfinance, rural banks, and leasing firms • Development finance institutions (DFIs) • Insurance and risk-sharing providers • Social lenders • Specialized finance (for example, climate finance) • Blended finance funds • Impact investors • Financial technology platforms • Capital markets	• Other agribusinesses • Service providers • Equipment vendors • Retailers • Government • Donors • Crowdfunding

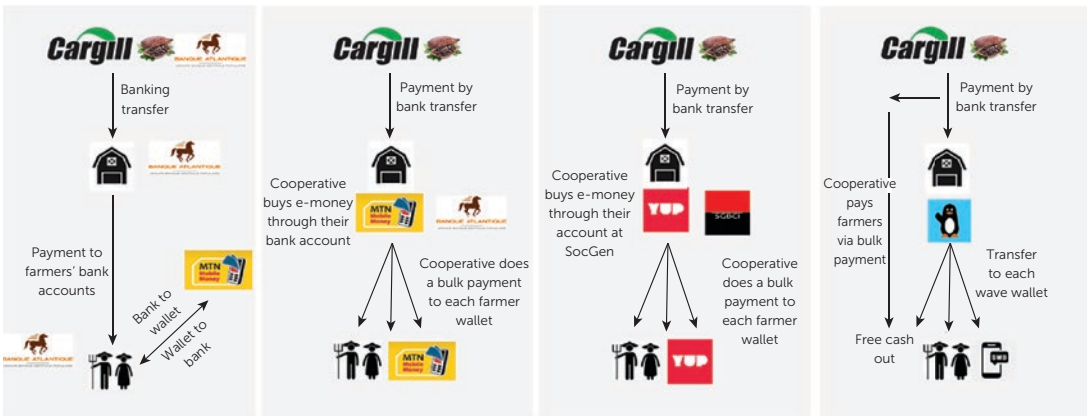
Source: Original table for this book by the International Finance Corporation.

banks (8 percent), with all the rest of the financial institutions accounting for the remaining 6 percent (Dalberg Advisors 2016). Since the Dalberg study was undertaken six years ago, these proportions may have shifted toward newer forms of finance, particularly related to digital finance.

Despite banks being the predominate source for external funding to the agricultural sector, the agricultural portfolio of a bank's loan book is typically well below 5 percent. The primary reason for financial institutions' reluctance to expand their agrifinance portfolio is related to risks, real and perceived. Key risks such as the impact of weather events and the cyclical cash-flow of agricultural producers are difficult to manage. However, financial institutions can be incentivized to expand their engagements in the agricultural sector if some of the risks can be addressed.

Provision of financial services to smallholder farmers as well as rural MSMEs is also impacted by the high transaction costs, a function of small ticket sizes paired with hard-to-reach locations. Here technology can greatly help to lower costs. Especially in eastern Africa, mobile money is widely used, with agents providing access for cash-in/cash-out services in remote areas. Utilizing this infrastructure alongside the digitalization of payment streams, including loan disbursement and collection, reduces the cost to serve. Agribusiness anchors can support digitalization by converting payments within their value chains from cash to digital. IFC has, for example, supported Cargill in Côte d'Ivoire in digitizing payments for cocoa farmers. Figure 5.3 illustrates the

FIGURE 5.3 Cargill's Digital Payment Model for Cocoa Purchases



Source: Original figure for this book by the International Finance Corporation.
Note: SocGen = Société Générale Côte d'Ivoire.

different models that were put in place. Payment to the farmer is triggered at delivery when the cocoa is weighed. Digital scales are connected to the FarmForce app, through which details about origin, quality, and weight of the cocoa are logged.

Agribusiness anchors can also help address financial institution risk concerns in two ways: (1) they can provide some guarantees or share risks so that FIs are incentivized to lend to the farmers; and (2) they can participate in an arrangement whereby FIs take the full risk in lending but the transactions are based on tripartite arrangements among FIs, agribusiness anchors, and farmers, with the agribusiness anchor committing to buy production from farmers. In both models, the financial arrangements tend to be very much customized to a specific value chain as well as the country context. Therefore, a deep understanding of value chains and farmers is indispensable, and the agribusiness anchors normally contribute the private information on farmers (borrowers) gained through historic business transactions.

There are compelling business cases for FIs, especially for lending institutions already active in agriculture, to lend to smallholder farmers in specific value chains. By working with agribusiness anchors, lending to farmers is de-risked for an FI; on the one hand, the off-take is guaranteed, and on the other hand, historic records of past transactions are available. In addition, FIs could delegate the screening and monitoring of the borrowers to the agribusiness anchor companies or the farmer organization (cooperative). Through the agribusiness anchor the farmers may also have access to other additional benefits that improve their productivity, such as technical assistance and high-value inputs. Provision of these services would further reduce their credit risk and increase cross-selling opportunities for financial institutions. Finally, a partnership with an agribusiness anchor company may bring down transaction costs, as financial services can be bundled with other business transactions. For example, a popular model in direct lending from the agribusiness anchors, where loan repayments are bundled with other payments to farmers, could easily be adjusted to involve FIs. In this model, FIs mainly deal with the agribusiness companies, relying on the business transactions between the companies and the farmers.

The other argument to be made vis-à-vis financial institutions to expand their engagement in the agricultural sector is the sheer size of the market opportunity, which in most countries is largely untapped. Globally US$80 billion in investments is needed by the agricultural sector annually. Tapping into this enormous market requires an

understanding of participants of different value chains and the financial flows. Some banks are recognizing this opportunity and aim to expand their agriportfolio to 30 percent of their total assets.

Figure 5.4 is an illustrative example of working capital needed by value chain participants in selected Ghanaian value chains. This type of market sizing can be done by an agribusiness anchor company for its respective value and distribution chain and presented to financial institutions.

Likewise, agribusiness anchors are typically able to provide data on transactions flows and value chain participants. Figure 5.5 presents an example of financial flows between participants in the plantain value chain in Côte d'Ivoire.

FIGURE 5.4 Working Capital Needed by Value Chain Participants in Ghanaian Value Chains

Production

Value chain	Potential borrowers	Share of funding opportunity (US$)	% of opportunity
Cocoa	35,000	120,000,000	40%
Maize	45,000	75,000,000	25%
Cassava	70,000	75,000,000	25%
Rice	20,000	30,000,000	10%

Post-harvest loss reduction

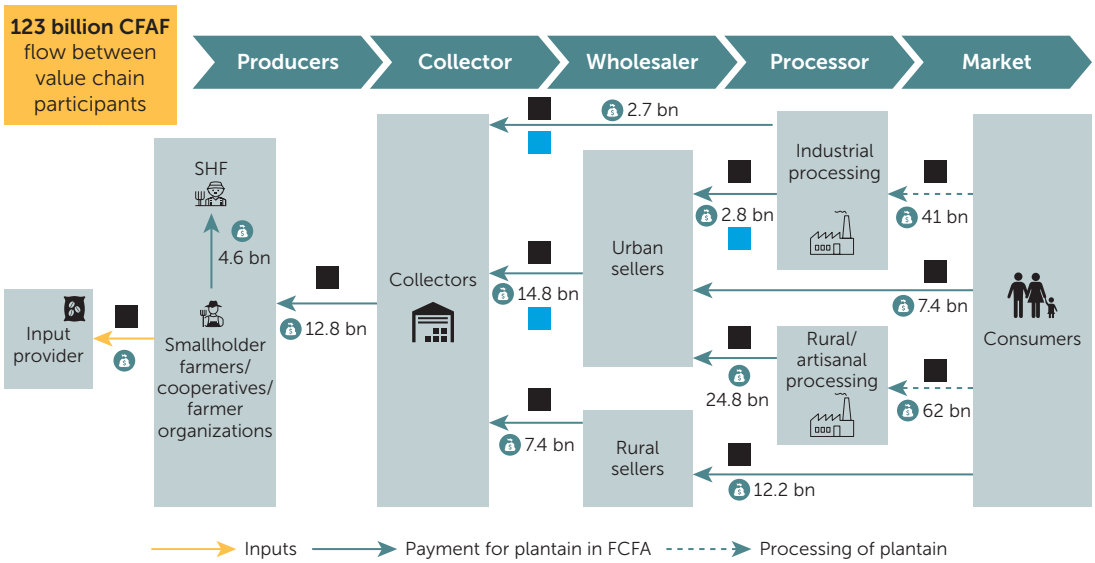
Value chain	Potential borrowers	Share of funding opportunity (US$)	% of opportunity
Cocoa	75	7,500,000	50%
Rice	40	3,750,000	25%
Horticulture	40	3,750,000	25%

Input finance

Value chain	Potential borrowers	Share of funding opportunity (US$)	% of opportunity
Cocoa	600,000	10,588,235	35%
Maize and Cassava	1,000,000	1,764,706	6%
Rice	100,000	17,647,059	59%

Source: Original figure for this book by the International Finance Corporation.

FIGURE 5.5 Financial Flows between Participants in the Plantain Value Chain in Côte d'Ivoire



Source: Original figure for this book by the International Finance Corporation.
Note: bn = billion; CFAF = West African francs; SHF = smallholder farmer.

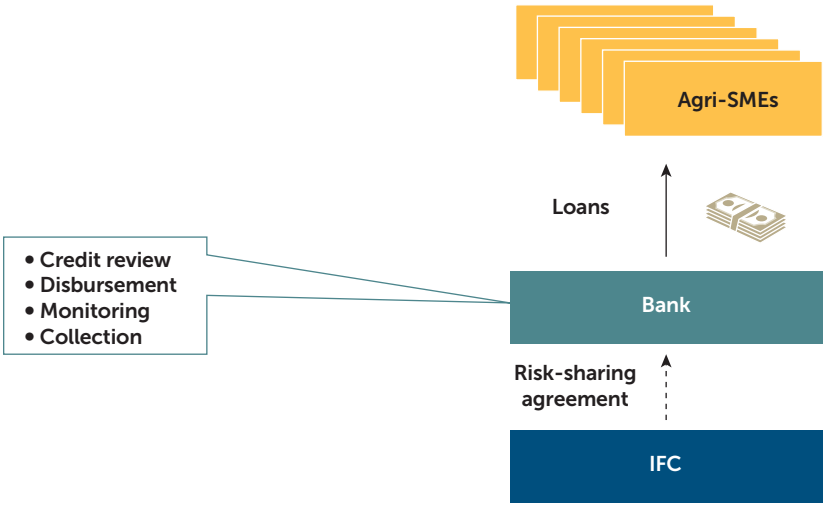
Nonetheless, FIs will likely be seeking ways to mitigate risks associated with agrifinance beyond leveraging value chain relationships. Hence, additional risk mitigation mechanisms are often introduced regardless of a partnership with an agribusiness anchor in a value chain. Such a mechanism can be structured by a DFI, such as IFC, that shares risks with the participating FIs. Other risk mitigants include data analytics, indexed-based insurance, and tools to assess climatic risks.

Risk Sharing

There is a long history of de-risking mechanisms of agricultural risk in order to attract private sector finance. Most de-risking mechanisms address production risks (agricultural or crop insurance) and credit risks. Mechanisms to deal with credit risks range from government run or sponsored partial credit guarantee (PCG) schemes to purely private sector solutions, which could also involve

donor- or DFI-driven guarantees and risk-sharing facilities. The government-run PCG schemes offer partial protection to financial institutions, usually commercial banks, for credit risks. Such partial guarantees usually cover 50–80 percent of losses due to default for a fee that often ranges between 1.0 and 2.5 percent. There are clear rules of what activities/loans such partial guarantees cover, who are the beneficiaries, how claims are processed, and so forth. There are PCG schemes dedicated to agriculture—for example, Mexico's Fideicomisos Instituidos en Relación con la Agricultura (FIRA, a Mexican development finance institution), or agriculture-related trust funds, such as Colombia Finagro—and there are PCG schemes that are broader, focusing on SME lending, which covers agriculture as a sector (primary agriculture and agribusiness loans). Financial institutions that participate in such schemes qualify to participate based on predetermined criteria. PCGs can be made on a loan-by-loan basis or at a portfolio level. The structure of a typical risk-sharing agreement is illustrated in figure 5.6.

FIGURE 5.6 Example of a Risk-Sharing Partnership between Supply Chain Actors



Source: IFC 2014.
Note: IFC = International Finance Corporation; SMEs = small and medium enterprises.

Risk-sharing facilities (RSFs) usually involve a specific financial institution whose credit risks on a specific loan portfolio are shared with external stakeholders, be they donors, insurers, agribusinesses, DFIs, or others. In such RSF structures, the risk is shared between the financial institution that provides the loan and a third party (or more than one) depending on the complexity of the structure. Donors could share part of the first loss (or even beyond—pari-passu) with the financial institution, or the first loss could be shared between the financial institution and an agribusiness whose supply chain benefits from such loans. DFIs could share risks above a certain first loss tranche, and so forth. Structures can vary greatly depending on the market conditions, the stakeholders involved, and risks. Among the key issues for an RSF is the degree of its utilization: how much is utilized by the financial institution that provides the loans. This depends greatly on the structure of the RSF (for example, coverage, first loss tranche, terms) and pricing. The stricture of an RSF needs to balance the need for the financial institution to have "skin in the game" (which would incentivize sufficient attention in approving loans) with the need of the financial institution to de-risk a specific portfolio of loans. Pricing also plays a key role in utilization of an RSF. RSFs in some cases would require a blended approach to keep pricing low enough to encourage utilization. This often brings in donor or impact investor funding to share the first loss risk at low prices. Government funds can also be used for taking first loss risk (or even beyond).

Often RSFs are part of a broader support to FIs and borrowers covered by the RSF. This holistic approach aims at increasing the bankability of targeted borrowers by the RSF and assisting the financial institution to better understand and evaluate the risks in lending to such clients. For example, IFC successfully supported cooperatives of a West African cocoa supply chain through training to enhance their capacity to operate in a commercial environment, which allowed them to utilize the IFC risk-sharing facility.

Other Risk Mitigation for Instruments for Financial Institutions

Providing financial solutions within structured value chains is one approach to reducing risks in the provision of agrifinance. Additional risk mitigation solutions available are the following:

- Data analytics (leveraging value chain/payment data)
- Index-based crop insurance
- Agroclimatic risk assessment solutions

Data Analytics

Digital payments address the inefficiencies of cash by reducing the time and cost of having to travel to transact, increasing the speed at which payments arrive to their intended recipient, cutting the risk of theft and fraud associated with carrying cash on long journeys, increasing the ease and transparency of accounting, and providing a point of entry to broader financial services for previously underserved farmers. Fifty-nine percent of the 235 million unbanked adults worldwide who receive cash payments for the sale of agricultural products have a mobile phone, the basic requirement for mobile money registration, giving a sense of the potential for this modality to scale. While digital agricultural payments are far from a panacea for the financial access challenges smallholder farmers face, they can drive a digital distribution network from which further use cases may expand rural use of mobile money.

The intention for digital agricultural payments is that the facilitated payment to the farmer will be the start of broader and more active DFS usage. Indeed, digital payments intersect or support a number of other products discussed in this section, including digital savings, credit, and insurance, which require payment mechanisms for transfers into accounts, lending and repayment, and premium and payout transfers. Digital agricultural payments can also help agribusinesses overcome the inefficiencies and lack of transparency inherent in paying large numbers of farmers with cash. Digital payments can help agribusinesses enhance their operational efficiencies, build farmer loyalty, and address various business challenges by providing real time input.

Through the use of a digital payments product, farmers not only receive compensation for their harvest or livestock trade but can also make, with greater ease, additional payments for goods and services, such as inputs, construction materials, household items, and new models of installment payments for renewable energy products such as solar lighting and pump irrigation. Digital payments can also strengthen value chain relationships; by digitally paying farmers, agribusinesses build individual profiles of farmers in their networks. Digital agricultural payment transaction records may be the first financial history such farmers possess, and agribusinesses may layer on top of this information other data from the farmers' plots and production to build a more comprehensive profile. Through these records farmers may become eligible for additional digitally delivered products, such as credit and insurance. The combined DFS offering might, for example, allow farmers to receive weather information via text message if they sign up for digital crop payments. Shifting from cash to digital payments also allows agribusinesses

to invest in the sustainable sourcing of certified crops more easily and cheaply. The direct revenue opportunity to DFS providers from digitizing agricultural payments from governments and agribusinesses is estimated to reach US$2 billion by 2020. There are at least two models that allow for "last mile digitization" of agricultural payments. In one model, MNOs offer bulk payments and collection services to agribusinesses via a mobile money platform. In another model, FIs or third-party technology providers leverage mobile network infrastructure and bundle this payment product with additional digital value-added services (VAS) agribusinesses. MNOs are central to both models and there are strong incentives for their participation, which could create numerous benefits, such as attracting new customers and enhancing existing customer loyalty, and increasing the number of total transactions.

Once the digital payment infrastructure is in place, farmers who produce for agribusinesses or cooperatives are typically registered and sensitized in person, by field agents, given the likelihood they are unfamiliar with the technology. Agribusinesses or cooperatives assist the DFS provider with sourcing or confirming farmer mobile phone numbers and proper names. Once a farmer's crop yield or livestock passes the buyer's inspection, the farmer is paid digitally either via the inspecting field agent using a mobile device or by another staff member based in an office using a desktop or laptop. Given the number of roles involved in this arrangement, agricultural bulk payment initiatives benefit from coordinated partnerships. For example, when a tea company in Rwanda, the Wood Foundation, wanted to reduce the inefficiencies of paying tea farmers in cash, it partnered with Tigo Rwanda and the donor-funded initiative Access to Finance Rwanda, which the savings and credit cooperative's (SACCO's) farmers already belonged to, in order to ensure that the resulting product would be usable and useful for farmers who may not even have had mobile phones at the outset. Each partner brought separate expertise that enabled the success of the offering.

In the context of agrifinance, digitizing payment streams forms the basis for developing credit scores for unbanked smallholder farmers and rural MSMEs (see an example with respect to Indonesian fishery financing in box 5.8). Payment data can be paired with other data available in the context of a value chain, such as input provided and produce delivered over a historical period of time. This type of data is often available at the level of the cooperatives and/or to the off-taker and input provider. Digital payments and stored value provide insights into the customers' behavior, especially if this can be paired with additional data points such as use of voice and data purchases or top-ups. The usage of data is

BOX 5.8

Case Study: eFishery, Indonesia

eFishery, an Indonesian agtech start-up founded in 2013, offers a complete aquaculture ecosystem to fish and shrimp farmers structured around its automated e-fish feeder technologies. Farmers can customize and monitor operations and access feed, feeders, loans, and e-marketplace services through their smartphones. The data from the fish feeders are used to automate and optimize feed, automate orders for more feed when required, and project the volume of the fish harvest and sale, allowing farmers to connect with buyers through eFishery before coming to market. Its Kabayan financing service, introduced in 2019, enables farmers to buy feeders and feed on credit and pay later, using automated credit assessment algorithms linked to the data flows and track records captured through the eFishery platform. Over 30,000 fish and shrimp farmers use eFishery. More than 7,000 farmers have received US$28 million in loans through the eFishery platform to date, from multiple financial institutions. eFishery has become Indonesia's largest feed distributor and fish supplier in just eight years of operation.

Source: Shu 2022.

relevant across the life cycle of a customer to gain a deeper understanding of its needs and preferences.

Credit scoring may be broadly described as the study of past borrower behavior and characteristics to predict future behavior of new and existing borrowers. The emergence of big data and the sources and formats of these data have presented additional approaches to the credit scoring process. Incorporating these alternative data sources drives alternative credit scoring models, providing a more complete picture and hence increasing the accuracy of scores and de-risking lending.

Index-Based Crop Insurance

From a weather risk management standpoint, there are two main types of risk to consider. These relate to (1) sudden, unforeseen events (for example, windstorms or heavy rain) and (2) cumulative events that occur over an extended period (for example, drought). The impact of these risks vary widely according to crop type, variety, and timing of occurrences.

Weather risks can be mitigated through weather index insurance (WII), a relatively new type of financial risk transfer product, which

could help overcome some of the problems with traditional insurance schemes. Unlike indemnity-based crop insurance, through which an insured farmer receives compensation for the verifiable loss at the end of the growing season, WII makes claim payments based on the realization of an objectively measured weather variable (for example, rainfall) that is correlated with production losses. The insurance can be structured to protect against index realizations that are either so high or so low that they are expected to cause crop losses. For example, the insurance can be structured to protect against either too much rainfall or too little. An indemnity is paid whenever the realized value of the index exceeds a prespecified threshold (for example, when protecting against too much rainfall) or when the index is less than the threshold (protecting against too little rainfall). The indemnity is calculated based on a preagreed sum insured per unit of the index. Indemnities typically cover loss of assets and investments, primarily working capital (for example, seed, fertilizer, and pesticides). In comparison with traditional insurance, WII is less expensive to administer, which can lead to more affordable contracts and faster payments to farmers, who often need the funds for timely planting in the subsequent season—see an example from Kenya, Rwanda, and Tanzania in box 5.9.

Weather indexed insurance has the potential to de-risk loan products as well as play an essential role in increasing the resilience of small-scale producers to climate related events.

Agroclimatic Risk Assessment Solutions

Climate change poses a significant risk to the agriculture sector, especially for smallholder farmers worldwide. These risks increase the hesitancy among traditional financial institutions to lend to the agriculture sector, which is already severely underfinanced. While most financial service providers (FSPs) have strong market and credit risk assessment capabilities, few are able to properly assess climate risk. A recent increase in digital technologies and applications—such as remote sensing and satellite imagery—has the potential to provide data collection and modeling that can enhance financial decision-making. Technology-enabled data collection can help FSPs analyze climate risks at individual, portfolio, and regional levels, which will be increasingly important for FSPs operating in the agriculture sector. Furthermore, these tools and services can assist FSPs in complying with the shifting regulatory landscape focused on climate-related financial risks.

BOX 5.9

Kilimo Salama Project

Kilimo Salama is the world's first microinsurance product to be distributed and implemented over a mobile phone network. Its use of technology is the key to the product's affordability and the model's scalability. Clients are smallholder farmers scattered throughout rural Africa. In one distribution channel, Kilimo Salama works with agricultural microcredit institutions and local small-scale agricultural retailers who sell farming inputs like seeds, fertilizer, and pesticides. See table B5.9.1.

TABLE B5.9.1 Project Snapshot

Market launch	2013 (Under Kilimo Salama, 121,956 farmers were insured between 2009-2012)
Clients	Between 2013-2017: Kenya—992,214 | Rwanda—391,602 | Tanzania—205,584
Partners	**Insurers:** In **Kenya:** UAP Insurance, APA Insurance, CIC Insurance Group Limited, Allianz Kenya, Jubilee, APA, Heritage, CIC, and AMACO. In **Rwanda:** Soras Insurance, UAP Insurance. In **Tanzania:** UAP Insurance Tanzania. **Reinsurers:** Swiss Re, Africa Re **Delivery Channels:** Seed distribution linked to a mobile network operator's location service; agribusinesses with out-growers or contracted farmers; lending institutions (banks, microfinance institutions); savings and credit cooperatives (SACCOs) providing input loans; and medium-scale professional farmers.
Insured crops/ livestock	Maize, beans, wheat, sorghum, green grams, rice, coffee, tea, potatoes, cashew nuts, sunflowers, and dairy cows
Insured perils	**Crops:** Drought, excess rain and storms, frost damage, fire, uncontrollable pests, and diseases **Livestock:** Risks associated with pregnancy losses for calving cows, and the financial loss caused by the death of livestock due to disease
Insurance portfolio	US$76.9 million (sums insured in 2017)
Average cost of insurance	US$5, average premium 8%
Contact information	Rahab Karanja Kariuki, Managing Director, ACRE Africa RKariuki@acreafrica.com

Source: IFC 2023.

box continued

BOX 5.9

Kilimo Salama Project *(Continued)*

When a farmer purchases insurance, the microcredit officer or agriculture retailer registers the purchase by scanning a quick-response code using a specially developed mobile phone application. The purchase is transmitted to a cloud-based server, which administers the policies and sends the farmer an automated short message service (SMS) text with the policy number. At the end of each growing season, weather statistics collected from solar-powered weather stations are automatically compared to an index of historical weather data. Rainfall measurements are put in specialized agronomic models to determine the impact and potential loss farmers experienced. Insurance payouts are calculated and sent to the insured farmers via automated mobile payments. There is no claims process. The ultimate aim of microinsurance products like index insurance is to reduce the risk from adverse weather and thereby provide a much needed safety net for farmers that simultaneously promotes agricultural investment and improves rural livelihoods.

Mobile phone technology has proven pivotal to the program's success. Syngenta Foundation, on behalf of Kilimo Salama, partnered with telecom giant Safaricom in 2010, which provided a communications network for product sales and customer communication. Safaricom's M-PESA mobile banking system helps Kilimo Salama keep index insurance premiums affordable for smallholder farmers and makes reaching them economically viable for insurance companies for the first time. Farmers receive their index insurance policy numbers and premium receipts via SMS text, and payouts likewise are sent electronically via M-PESA.

Source: IFC 2023.

As noted, climate risk is posing increasing threats to the agriculture sector, which directly impacts lending decisions for FSPs. In the absence of proper methodologies to assess climate risk, many FSPs often choose to avoid this risk, in turn contributing to the already large financing gap for SHFs and agri-SMEs. For instance, FSPs may resort to restructuring their loans or limiting their agriculture portfolio if they feel that climate risks pose too high a risk. In doing so, FSPs miss out on significant opportunities to expand their portfolio in the agriculture sector.

Fortunately, the advent of providers offering innovative tools and services to identify, measure, and manage agroclimatic risks has enormous potential to help FSPs navigate these increasingly apparent risks. FSPs can capitalize on these tools and services to help grow their agriculture portfolios and make informed lending decisions that account for agroclimatic risk.

- *Business development activities:* FSPs can use the tools and services offered by providers to grow their agriculture portfolio, thus promoting increased lending and investment into the sector. While FSPs have historically relied on basic farmer and farm information collected by field officers to make lending decisions, innovative providers can supply enhanced data on the associated agroclimatic risks at the farm or regional level. These data can be incorporated into lending decisions and assist FSPs in growing their footprint in the agriculture sector. With an improved understanding of the sector, FSPs can launch new loan products tailored toward SHFs and agri-SMEs to reach untapped markets.
- *Improving existing operations:* FSPs can also use provider services and enhanced knowledge of agroclimatic risks to improve various aspects of their existing operations: (1) optimizing capital and portfolio planning and allocation, (2) digitizing and streamlining lending processes for smallholder farmers, (3) enhancing risk assessment and management systems, and (4) reducing agricultural loan recovery costs.
- *Promoting climate-smart investments:* FSPs can capitalize on providers to assist in developing financial products that would enable their clients to invest in making their agricultural and livestock product more resilient to climate risks, more productive, and less polluting.

Furthermore, amid the evolving climate risk regulatory landscape, these providers can assist FSPs in complying with new regulations related to climate. For instance, increased demand from UK FIs for their climate risk data services have come in response to the Bank of England's exploratory climate stress tests. Although these regulatory requirements are not yet widespread in developing markets, they will almost certainly emerge in the coming years as countries seek to transition to net zero greenhouse gas emissions and accelerate financing for climate investments. These providers can work with FSPs to supply and analyze the climate risk data they need to meet regulatory requirements. Climate risk service providers can be mapped to five main categories:

1. Climate intelligence providers
2. Supply chain management and decision-making
3. Insurance technology
4. Financial analytics companies
5. Public goods initiative

BOX 5.10

CropIn's Business Model Expansion: From Supply Chain Management to Financial Services

Founded in 2010, CropIn achieved scale as a business-to-business model focused on supply chain management and digitization. To date, it has worked with over 250 business partners to digitize the size and locations of farms covering more than 16 million acres. Its work centers around data capture at the individual farm level, using on-the-ground teams and satellite imagery to assist agribusinesses in farm management and traceability.

While CropIn has historically worked with agribusinesses, the company recognized that its data can also be used to assist financial service providers (FSPs) in the credit decision-making process. Therefore, CropIn launched SmartRisk, a satellite and weather-based artificial intelligence/machine learning platform that assists FSPs in credit decision support and loan recovery. This platform combines satellite imagery, weather data, and on-the-ground data to detail agroclimatic risk at both the individual farm and regional levels.

Source: Original box for this book by the International Finance Corporation.

The majority of providers fall within the first category of broad climate risk intelligence. This category includes both FSP-first providers (for example, SatSure) and those that work primarily with agribusinesses or other value chain participants (such as 6th Grain). A smaller subset of providers—categorized as financial analytics companies—primarily focus on FSPs. The three remaining categories—supply chain management and decision-making, insurance technology, and public good initiatives—are providers that collect and/or analyze agroclimatic risk data, but their business model is not centered around FSPs. Within these categories, only a handful of providers appear to have successfully pivoted or expanded their model to include offerings for FSPs (for example, CropIn) (box 5.10).

The Role of Agtechs in Agrifinance

The global agtech market has expanded rapidly over the past decade. In 2020, The GSM Association tracked more than 700 digital agriculture services—a substantial increase from the 53 services mapped in 2009 (GSMA 2020). This universe of agtech solutions includes digital technologies with promising application for FSPs working in the agriculture

sector to, for example, quantify climate risk and make informed lending decisions. This influx has been driven largely by technological advancements in both agtech offerings and the enabling environment.

On the agtech side, innovative business models—such as digital platforms and pay-as-you-go (PAYGO) offerings—capitalize on technology access and analyze data on rural customers. On the user side, increasing mobile penetration in the region allows users to interact with digital products and services and facilitate payments directly through mobile money.

There are several types of agtech platforms, from software service providers to closed-end platforms. For the purposes of this chapter, we focus on agtech platforms that create an ecosystem of services to serve SHF. Such services often include output e-commerce, input purchasing, agronomic advice, agroclimatic crop data, price information, input loans, equipment leasing, digital payment services, and crop or index insurance. Agtech platforms can be "open" platforms wherein SHFs can sell to any registered off-taker in the platform and purchase inputs from any registered input supplier, or they can be "closed" platforms in which an off-taker uses the platform to organize its value chain so that it could offer several critical services, financial and nonfinancial, to its suppliers.

The value of agtech platforms lies in their integration of the value chain. Platform operators typically engage their own field staff to enroll SHFs (directly or through their POs), incentivize and enable them to contribute data and make use of the platform (usually through the cellphone, sometimes through a tablet), and monitor the SHFs over the course of the season. As a result, the platform enables multidirectional flows of produce, information, finance, and services between enrolled SHFs and agribusinesses, financiers, and other service providers.

Many such platforms are open in nature, taking the form of e-marketplaces for inputs, outputs, equipment, finance, or other services—see box 5.11 and box 5.12 for examples with respect to grains and fisheries, respectively. Multiple agribusinesses, financiers, and other service providers can then access the community of registered SHFs that these platforms create. The platform operators monetize this community by drawing small commissions on the transactions that are facilitated ("merchant services") from advertising revenue, in some cases from direct service provision (for example, quality control, logistics, storage), as well as from providing access to the expanding database of SHF information.

BOX 5.11

Case Study: E-Granary, East Africa

E-Granary delivers crop management, low-cost input supply, post-harvest services, output marketing, and financial services to farmers in Rwanda and Uganda. Launched in November 2018 by the Eastern Africa Farmers Federation, its mobile communication and payment system creates a virtual space for brokering commercial partnerships and contracts among farmers, buyers, and input dealers, while connecting farmers with credit and insurance at low transaction costs. The platform is used by more than 38,000 farmers, almost half of them women.

Source: GAFSP n.d.

BOX 5.12

Case Study: TraSeable, Pacific Islands

TraSeable, founded in 2017, is a Fiji-based agtech that provides a fully integrated value chain management tool through a cloud-based, blockchain-enabled collaborative platform for the deep-sea fisheries sector (and subsequently also for agriculture). This includes fleet management, harvest analytics, permit licensing, and marketing for fishers; raw fishery sourcing, cold chain storage and inventory management, and packaging and export facilitation for processors; traceability and import management solutions for end buyers; and authorizations, verification, certifications, and analytics for regulatory authorities.

However, some agribusinesses—typically bigger players with access to sufficient funding and in-house expertise—have been developing proprietary "industry-vertical" or "closed-end" agtech platforms. While not precluding the agribusiness from working with open agtech platforms, having an in-house closed-end platform enables the agribusiness to build direct smallholder farmer (SHF) engagement under its own corporate brand. As the platform scales, the agribusiness platform operator may invite financiers and other service providers to participate, generating the advantage of bundling and delivering services through one channel. The gateway to the SHF not only acts as a powerful differentiator of the agribusiness from its competitors, but it also provides strong incentives for continued SHF loyalty in its relationship with the agribusiness through carrots and sticks—material, financial, and informational rewards as incentives for deeper engagement, and higher indirect and opportunity costs for switching to competitors.

Source: Orlowski 2020.

Emerging types of agtech models linked to financial services can be split into two categories: business-to-consumer (B2C) and business-to-business (B2B) services.

B2C models capitalize on digital technologies to engage with smallholder farmers, either directly or through farmer cooperatives. These models can establish connections with end clients and collect relevant data on production activities. This allows them to use alternative methods to de-risk smallholder farmers and provide direct financing or act as a financing conduit.

B2C models fall into two broad categories each with distinct model types and internal differences:

1. *Specialized financial technologies* are finance-first models centered around credit provision for smallholder farmers. Credit primarily comes in the form of input financing and, to a lesser extent, cash for farm services. Many of these models bundle products and services, such as embedded finance, training, and insurance. The majority of successful players are social enterprises, such as Babban Gona and One Acre Fund. Kenya-based Apollo Agriculture is unique because it has successfully proven the commercial viability of its model.

2. *Digital platforms* are built upon network effects, enabling multiple users on both sides of an exchange to interact and create shared value. Digital platforms can help smallholder farmers and agri-SMEs overcome market barriers by the following:

   - Removing middlemen from markets, thereby generating greater wealth for the end farmer
   - Connecting multiple users to improve efficiency of interactions between users
   - Facilitating information-sharing, such as the exchange of pricing information or best practice knowledge
   - Providing farmers with a digital financial footprint by recording transactional data on the platform

Digital platforms enable four primary types of embedded financing:

1. *Vendor financing*, for products and services sold on the platform

2. *Input financing*, credit to smallholder farmers in the form of in-kind inputs (or cash for labor) at the beginning of the season, generally to be repaid at harvest

3. *Asset financing*, for productive assets, often in the form of innovative business models, such as PAYGO
4. *Insurance*, bundled for products and services offered on the platform

While B2C models exist to serve the end user (usually the farmer), B2B models target a broader audience, which can be organized into four groups:

1. *Financial service providers*, which benefit from greater understanding of the agriculture sector, improved ability to assess/monitor risks, better customer acquisition, and streamlined loan processing
2. *Agri-SMEs*, which benefit from improved farmer management, reduced barriers to scale, lower transaction costs, and accelerated decision-making
3. *Off-taker agribusinesses*, which benefit from reduced transaction costs, improved farmer accountability, better quality assurance and traceability, heightened profitability, and accelerated decision-making
4. *Input company agribusinesses*, which benefit from improved farmer relationships, heightened input quality, and reduced input counterfeiting

In terms of financing smallholder farmers, B2B models are enablers rather than direct facilitators of finance. The way they enable finance varies based on model type. To illustrate the distinctions between model types, each type of provider was mapped to one of the five enablers of finance: (1) connection with clients, (2) data, (3) data processing, (4) financing capability, and (5) de-risking services/incentives.

B2B model types fall into two primary categories:

1. *Financial access enablers* are primarily focused on offerings for financial service providers. Each of these models and their indirect provision of financial services vary greatly, as noted in the taxonomy:
   - *Alternative credit scoring and remote field monitoring models* collect and analyze data for financial service providers to make objective lending decisions.
   - *Financial service provider digitization models* help financial service providers improve efficiency and effectiveness while making it easier to reach rural customers.

- *Insurance technology firms (insurtechs)* are a bit of an outlier in this category, as they do not serve financial service providers, but they remain a direct financial access enabler.

2. *Supply chain management solutions* primarily serve agribusinesses or agri-SMEs and generally provide digitization services across the supply chain. Digitization for on- and off-farm activities allows for improved data collection and digital footprints for smallholder farmers. A select number of companies, such as CropIn, are packaging their data as a tailored service for financial institutions.

A third category—*climate models*—is an emerging force on the African continent. Beyond Sub-Saharan Africa, the sector is trending toward broad climate solutions (for example, carbon monitoring and agroclimatic risk identification for production) in the coming decades.

Agtechs can be a conduit for increased financing in the agriculture sector when partnering with financial institutions. For example, in Nigeria, partnerships between commercial banks and agtechs are directly supported by Central Bank of Nigeria mandates. The majority of B2C agtechs appear to have developed in response to these mandates and center around agtechs registering farmers, providing them with input financing, and securing the purchase of the crop. These agtechs collect data on smallholder farmers and refer them to commercial lending programs. Thus, financial institutions perceive these agtechs primarily as service providers that assist in basic "know your customer" (KYC) data collection, as opposed to strategic partners.

In Kenya, the diversity of B2C model types indicates a potential for strategic partnerships. However, from the perspective of banks, many of these agtech models are still maturing and trying to achieve a product-market fit. Furthermore, commercial banks face their own regulatory limitations, hindering the potential for innovative partnerships and alternative credit scoring approaches. As a result, strategic partnerships between innovative start-ups and financial institutions are just beginning to emerge.

Agtechs demonstrate great potential to increase financial service provision to SHFs and agri-SMEs—although there is no one-size-fits-all approach. The model types we landscaped, and the individual business models within each category, provide varying competencies to enable financial services directly and indirectly.

On the B2C side, there are dozens of models operating in the space, but only a few commercial players have proven a product-market fit.

One of the biggest challenges is a dearth of debt funding, which prevents agtech models from scaling.

On the B2B side, the number of providers that directly enable financial services is only scratching the surface. A few standout players (such as SatSure and CropIn) are successfully tailoring their services for financial service providers. However, many others are only just beginning to think through how their data can enable agricultural financing.

SatSure works with FSPs to provide predictive agroclimatic data insights backed by satellite imagery analytics, machine learning and artificial intelligence to facilitate decision-making across the loan cycle.

For both B2B and B2C models, there are several emerging model types—many with a climate focus—coming out of other markets, especially Southeast Asia. These include carbon monetization and precision agriculture automation.

How Can an Agribusiness Help Smallholder Farmers Become Bankable for Financial Institutions?

An agribusiness may help make SHFs more bankable for external financiers in three ways: (1) expand information, (2) expand eligibility, and (3) share risk/provide guarantees. Activities to support improved direct SHF relationships with financial institutions may be performed directly by an agribusiness anchor through its field staff, engaging with individual SHFs or with SHF-based groups (POs, village-based organizations or self-help groups, and so on). Alternatively, the agribusiness anchor may partner with organizations that work closely with SHFs, such as aggregators, government, nongovernmental organizations (NGOs), social lenders, agtech platform operators, and farmer-focused service providers. In these partnerships, support for improved SHF bankability may form part of an array of delivered services such as input and equipment distribution, extension services, data and information, retail, and so forth.

Expanding the Range of SHF Borrower Information

Finance is fundamentally driven by information.[8] To establish the bankability of the borrower, the financier must confirm the borrower's identity and address and appraise the borrower's credit worthiness—the required KYC due diligence.

Accordingly, financiers need to be provided with information from the databases that agribusinesses typically develop during ordinary business operations: for example, the customer order book of an input supplier and the supplier logs of an off-taker. Financiers can utilize information extracted from these databases to identify and select which SHFs they are prepared to finance, and whether to finance the SHF directly or through intermediaries. Cellphones and the increasing uptake of email and social media, together with the gradual diffusion of monitoring technologies in SHF production areas, have expanded the possibilities for generating reliable information for farmers from sources including agribusinesses, service providers, and government. Table 5.5 displays some types of borrower information that can help promote SHF bankability. Box 5.13 illustrates a government-led case study in Kenya to consolidate farmer-level data.

Improving the SHF Borrower's Eligibility for Finance

Beyond data-gathering, agribusinesses may consider supporting efforts to improve SHF loan eligibility. One dimension to this may include supporting SHFs to obtain relevant documents and information as identified in the section on "Expanding the Range of SHF Borrower Information," including identity documentation, biometric data, farm plot mapping, and land title.

Agribusiness may also help increase borrower eligibility for finance by supporting efforts to build SHF or aggregator financial and business management capacity as a potential technique to improve supplier loyalty and reduce side-selling risk. Areas to cover may include financial literacy, facilitation of financier linkages, assistance to open mobile money or traditional bank accounts, development of business management skills (for example, record-keeping, business planning), navigation of loan application modalities, and introduction to emergent financial technology opportunities, in particular those that are most accessible to SHFs, such as services delivered via short message service (SMS) texts. For POs and other farmer-based groups, agribusinesses may help to strengthen their governance and capacity.[2]

Mitigating and Sharing in Key Lending Risks

An agribusiness may increase SHF bankability for external financiers by helping to mitigate or share in key lending risks. Potential agribusiness contributions are mapped out in table 5.6.

TABLE 5.5 Types of Borrower Information to Promote SHF Bankability

Information type	Description
Unique verifiable identity	Identification in the form of a passport or driving license number, a tax or national identification number, or a business registration number is a core KYC requirement. A name alone may not be sufficiently unique.[a] Verifiable biometric data are also becoming available in many jurisdictions and may help overcome inefficiencies of administering physical identity documentation.
Contact details	Contact information includes a cellphone number and may include email address and social media usernames/hashtags. In many places, a mailing address or postbox remains important for KYC requirements.
Historical track record	Key metrics include production volume, delivered volume, and credit history. While the past is never a guarantee of future performance, it does nonetheless predict the borrower's capacity and likely willingness to repay. The longer the history, the more assurance it provides. The producer's track record for input, irrigation and equipment usage, extension service and insurance take-up, and membership of a PO may provide a deeper level of insight into producer capacity and resilience.
Farm-plot mapping	Mapping of the farm plot, usually via GPS coordinates, provides useful data about farmer bankability, such as area and yield calculations, while also allowing for validation of land ownership status and for the farm plot to be assessed against microclimate, soil, water/energy access, and other data points.
Intermediary data	Identification of SHF links with a particular intermediary, and capturing pertinent personal information and track record data about that intermediary, can help financiers efficiently deliver services to SHFs.
Household data	Household information includes secondary revenue streams, assets, and expenditures. This kind of data typically takes more effort to gather and is not ordinarily available to an agribusiness. However, it is highly valuable as a foundation for structuring sustainable cashflow-based lending arrangements and identifying opportunities for additional financial services (for example, small enterprise, livestock, or household liquidity loans); building resilience (for example, savings or insurance); or reducing costs to serve (for example, digital payments).
Impact data	To support engagement by development financiers, impact investors, and donors, as well as to track ESG performance more broadly, an agribusiness can proactively define and track key impacts arising from SHF engagement. These may cover agricultural, financial, livelihood, gender, jobs, and climate-related key performance indicators.

Source: Original table for this book by the International Finance Corporation.
Note: ESG = environmental, social, and governance; GPS = global positioning service; KYC = know your customer; PO = producer organization; SHF = smallholder farmer.
a. For example, several persons may share the same or a similar name; names are prone to inconsistent spelling; there are challenges to translating names from local languages or dialects into the prevailing business language; and there may be differing naming conventions.

BOX 5.13

Case Study: KALRO, Kenya

The Kenya Agricultural and Livestock Research Organization (KALRO), with the support of the World Bank through the Kenya Climate-Smart Agriculture Project and Kenya's National Agricultural and Rural Inclusive Growth Project, embarked on digitizing the agricultural sector in Kenya and establishing a big data platform to transform the agriculture and food system in the country. This big data platform is enabling KALRO to integrate agroclimatic data and market data collected from all markets in Kenya and leverage farmer data to provide customized, geospatial, and timely agricultural weather and market information to farmers and policy makers. In addition, climate-smart agronomic advisories (good agriculture practices) across 19 value chains have also been digitized and made available to farmers via apps, a web portal, and an interactive voice response (IVR) system. Through web portals, mobile applications, and short message service texts, agricultural information and knowledge have reached over 8 million smallholder farmers.

Source: Mercy Corps 2021.

Recommendations for Agribusinesses

- *Pay attention to key trends in the operating environment.* In particular, but not only, the social, technological, and environmental elements of the traditional PESTLE (political, economic, social, technological, legal, and environmental (PESTLE)[10] analysis are making possible step-change productivity and post-harvest performance improvements. These advancements address the growing global demand for agrifood products, shaping the socially and environmentally conscious needs of end buyers and other stakeholders along the value chain and impacting business continuity and sustainability risks associated with intensifying climate change phenomena.
- *Think strategically about SHF engagement.* Quantify the potential upside benefits (volume, loyalty, quality, traceability, social responsibility, and so on), map the potential SHF engagement models to achieve those benefits (direct contracting, intermediated engagement, and so on), and calculate the costs and risks associated with each.

TABLE 5.6 Potential Agribusiness Contribution to Mitigate or Share in Key Lending Risks

Risk type	Definition	Drivers	Potential agribusiness contribution
Production	Output is insufficient to repay loan.	• Agroclimatic (for example, low rainfall) • Farm-level (for example, poor soil fertility) • Production-linked (for example, incorrect input application) • Producer-linked (for example, injury or death of the farmer)	• Facilitate provision of pertinent inputs (for example, drought or pest resistant seeds), irrigation, equipment, and extension services, which are usually the purpose of the finance package itself. • Scope out the opportunities for including insurance alongside credit to mitigate the drivers of production risk (for example, crop or index insurance to address climatic drivers, or health or life insurance to address producer-linked drivers). • Provide necessary assurances concerning the efficacy of the products and services provided under the financing package.[a] • Design an effective production-monitoring regime to provide for early detection and remedy of challenges.
Post-harvest	Produce is lost or damaged before reaching market.	Poor harvesting, drying, cleaning, bagging, transport, or storage practices	• Facilitate pertinent equipment and training provision in financing package. • Provide necessary assurances on the logistics and the quality of storage facilities.[b]
Market and price	Sale of produce generates insufficient income to repay loan.	• Absent demand (market risk) • Volatile/falling price (price risk)	• Contract with the smallholder farmer (SHF) to address market risk.[c] • Offer a minimum price guarantee to address price risk.[d] • Facilitate access to price risk management instruments (admittedly uncommon in SHF contexts).

table continued

TABLE 5.6 Potential Agribusiness Contribution to Mitigate or Share in Key Lending Risks *(Continued)*

Risk type	Definition	Drivers	Potential agribusiness contribution
Repayment[e]	Timely repayment of the loan is not made.	• Side-selling risk • Delivery, marketing, or payment delay • Household emergency • Lack of respect for contract sanctity	• Provide necessary assurances the financing is affordable and worthwhile for the SHF borrower.[f] • Design an effective harvest monitoring regime. • Provide necessary assurances concerning a timely delivery or collection modality. • Offer a fair pricing mechanism to reduce side-selling temptations. • Share (or facilitating a third party to share) in overall lending risk, for example, through cofinancing with "skin in the game," and guarantee a minimum loan repayment amount irrespective of performance.[g]

Source: International Finance Corporation.

a. For example, the characteristics of the input package and equipment are suitable to generate upside for the SHF; the insurance policies in place (for example, crop insurance, life and health insurance) mitigate the range of likely downside risk; the inputs and equipment are authentic products from a reputable supplier; the inputs will be available at the right time in the production cycle; there is safe and effective handling of inputs during distribution; efficient equipment repair and maintenance arrangements are in place; and producers have the motivation and know-how to adopt the inputs and equipment and more broadly to perform good agricultural practices and sustainability requirements pertinent to the value chain.

b. For example, certification of conformity with pertinent standards, licensing under a warehouse receipt system, robust operational documentation, qualified staff, and independent oversight.

c. Contracting may involve a reciprocal set of commitments between agribusiness and producer under the agricultural value chain finance framework. However, contracting may also involve a unilateral off-take commitment by the agribusiness without any obligation for delivery by the SHF. This arrangement still addresses market risk.

d. Minimum and fixed-price contracts may be supported through an underlying hedging instrument or through negotiating the contract back-to-back against the agribusiness's own contract with a buyer. An unhedged position may expose the agribusiness to significant price risk.

e. Repayment risk is also known as credit risk. However, credit risk is also sometimes used as an umbrella term covering all kinds of lending risk. "Repayment risk" is used here to avoid ambiguity.

f. The loan amount is a relatively small proportion of production value. The implied cost of the package (principal plus interest) is more than offset by the upside. The arrangement does not deprive the borrower of liquidity when it needs to fund core business or household expenditures.

g. The agribusiness can mitigate some of the risk it takes on board through insurance (e.g., institutional-level products, which payout to the agribusiness if, for example, rainfall is low) or by bringing third parties into the arrangement (for example, donors, patient capital providers, or providers of risk-sharing instruments).

- *Specify targets in quantitative terms.* These may be linked to short- and long-term key performance indicators in the context of overall business plan objectives. For an off-taker, these are sourcing requirements (volume, quality, timing, and location): for an input supplier, equipment vendor, marketing, and distribution targets.
- *Take a portfolio-based approach.* Calculate the number and location of SHFs (and/or intermediaries) with which to work more closely to fulfill the targets and to evaluate the portfolio of SHFs and/or intermediaries, and identify selection criteria (track record, farm size, proximity, grouping, linkage to an intermediary, linkage to a financier, and so on) and challenges (farmer-level organization, capacitation, extension, logistics, access to finance, and so forth).
- *Quantify the overall financing need.* Do this for the agribusiness and for the SHFs (and/or intermediaries)—assess the specific funding requirements of each in terms of cost, term, collateral, and repayment mechanism and appraise the merits of financial product alternatives (prefinancing, post-harvest working capital finance, supply-chain [liquidity] finance, and so on).
- *Identify and map potential funding sources.* These could include internal funding (group, subsidiary, business line), existing external financing sources (shareholders/investors, banks), and alternative potential funding sources (development finance, donors, microfinance, financial technology platforms, social lenders, climate finance, and so on).
- *Blend the funding mix.* Evaluate the relative attractiveness of wholesale funding that would be taken on and lent out to SHFs by the agribusiness versus retail funding that would be provided direct by the financier to the SHF (and/or intermediary), finessing a target funding mix based on factors including funding availability/liquidity, cost of capital, financing terms, cashflow forecasting, collateral availability, credit limits, and financier eligibility criteria.
- *Strategize how best to administer the funding mix.* For example, build in-house capacity for embedded financing, outsource to service providers, collaborate with technology or channel partners, and establish dedicated financing subsidiaries.
- *Understand what cost-effective steps can be taken to improve direct bankability of SHFs to external financiers.* Do this through direct action or through partnership with well-positioned actors that have relevant expertise, experience, and relationships working with SHFs,

including NGOs, agtech platforms, government, and so forth in areas such as expanding the range of available SHF borrower information, improving the SHF borrower's eligibility for finance, and mitigating the risks of lending to the SHF.

- *Appraise the mix of carrots and sticks.* These can be used to incentivize good performance by SHFs within the financing relationship—rewards based on good performance and loyalty, and mechanisms to tighten the value chain or increase recourse against nonperformance.
- *Consider how digital financial service opportunities may best be exploited.* These can drive efficiency and performance in the agribusiness-SHF financing relationship, generation of SHF borrower information, SHF financial product management and distribution, and administration of functional processes associated with finance, such as digital payments and credit assessment.

Notes

1. AVCF is well-covered by existing literature. Miller and Jones (2010), *Agricultural Value Chain Finance: Tools and Lessons*, is an authoritative work.
2. Other prominent risks to AVCF include production, agroclimatic, and price risks. Production risks relate to the capacity of the producer to produce the required volume of crop to fulfill the AVCF delivery obligation and is typically mitigated through provision of extension services to prefinanced farmers. Agroclimatic risks refer to adverse weather and climatic patterns that may undermine production of the required volume of crop to fulfil the AVCF delivery obligation and is typically mitigated through insurance-based solutions. Price risks relate to the market value of the crop at the time of harvest so that the outputs delivered by the SHF have sufficient value to effect repayment on the prefinancing. According to context, it may be mitigated either through the off-taker stipulating a minimum price under an off-take agreement or through a hedging instrument, typically a financial derivative such as a futures or options contract.
3. Typically, this means (1) the prefinance repayment is commensurate to the benefits involved from accessing the inputs, (2) that the repayment does not leave insufficient residual funds for the SHF to support its productive and household activities, and (3) that the SHF has some flexibility to market a proportion of their outputs through other channels if it can obtain better terms.
4. This is an alliance involving the World Food Programme, Rabobank, and a consortium of global input suppliers focused on select African economies. See the Farm to Market Alliance website, https://ftma.org.
5. Leveraging emergent collateral registry and movable-asset-based lending regimes, as noted previously.
6. Exploring supply chain finance is beyond the scope of this chapter. For more details, see IFC (2014), *Supply Chain Finance Knowledge Guide*.

7. The author is not aware of any full-stack agrifinance financial technology solutions offering the full range of agrifinance products, services, and tools to integrate the management of all agrifinancing activities and exposures, although it is likely that such solutions may become available in the near future.
8. Specifically, financial institutions seek to assess the probability of default, which involves estimating (1) the borrower's cash flow, which drives the borrower's ability to repay; (2) the loss given default, which involves quantifying the recourse to collect once there is default; and (3) the willingness to repay, which is drawn from the borrower's repayment track record, accessible via a credit bureau, or in its absence from performance history in nonfinancial relationships such as with off-takers or service providers, supplemented by character references, and in some cases psychometric testing.
9. The Agribusiness Market Ecosystem Alliance (AMEA) is one such global framework. See its website, www.amea-global.com.
10. PESTLE analysis is a favored strategy tool to assess the political, economic, social, technological, legal, and environmental components of an organization's operating environment.

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CHAPTER 6
TRAINING AND COMMUNICATION

Amy Warren and Yemesrach F. Gebremikael

KEY MESSAGES

- Training and communication are key to improving smallholder farmers' productivity, and agribusiness firms play a vital role in delivering these extension services.
- Training by lead farmers, supported by appropriate incentives, is a cost-effective way to increase extension reach and change farmer behavior.
- There is an opportunity to involve women and young people as lead farmers, village agents, and "agripreneurs."
- Information and communication technology (ICT) developments have enabled affordable access to smart phones, global positioning systems (GPSs), and tablet computers. This has transformed how agricultural extension and advisory services are delivered.
- The International Finance Corporation's (IFC's) Agribusiness Leadership Program (ALP) uses face-to-face training and e-learning to develop the business management capacity of producer organizations, agro-input retailers, and model farmers.
- COVID-19 has altered approaches to smallholder farmers' communication and training programs.

The Business Case for Farmer Training and Communication

Training and communication are essential to integrating smallholder farmers into supply chains. Agribusiness firms that prioritize training and communication are likely to benefit by the following:

- Establishing a sustainable upstream supply of raw materials for their business operations
- Building the capacity of smallholder farmers to meet the needs of global markets and to interact with supply chain partners
- Encouraging loyalty, which reduces side selling and forges long-term and mutually beneficial partnerships
- Enabling joint solutions to overcome inefficiencies and other challenges
- Creating the conditions for adaptation and innovation in the supply chain
- Fostering competitive advantages that go beyond output and quality (for example, in the transfer of roles from firm to smallholder for improved traceability systems)
- Enabling an early warning system, whereby farmers provide the firm with advance notice of emerging problems and vice versa

Introduction

Training and communication are two of the biggest components of agricultural extension. Birner et al. (2006, 17) define agricultural extension—also known as *agricultural advisory services*—as "the entire set of organizations that support people engaged in agricultural production to solve problems and to obtain information, skills, and technologies in order to improve their livelihoods and well-being." Agricultural extension can help smallholders obtain advice and market information, source quality inputs (such as seeds and fertilizer), adopt new practices, and build resilience to risks and disasters. For the purposes of this chapter, the terms *extension*, *extension services*, and *extension and advisory services* are used interchangeably.

Extension, as a concept, is nothing new. Modern extension has its roots in nineteenth-century England, but hieroglyphs found on Egyptian columns dating as far back as 1800 BCE advised farmers on how to avoid crop damage from flooding (Jones and Garforth 1997). What *is* new is the

way in which extension is delivered, the role of smallholders in extension, and the challenges (and opportunities) of present-day extension.

Traditional extension was a top-down, government-run process focusing on the transfer of technology and technical information. The "training-and-visit" model, popular in the 1980s, embodied this approach. Public-sector extension agents carried out a prescriptive regime of farm visits, farmer training, and technology transfer based on government-funded research (Davis and Alex 2020).

Today there is more emphasis on smallholder learning and behavior change. In addition to technical content, extension covers business topics (such as finance and marketing) and soft skills (such as communication and leadership). Farmers have a bigger say in the content of extension programs, making extension driven more by demand than by supply (Davis and Alex 2020). Extension providers have also changed. They are less likely to come exclusively from the public sector, and instead represent a range of public, private, nongovernmental, and farmer organizations.

The shift to more pluralistic, participatory, and market-driven extension systems coincided with a decrease in public funding for extension. Over the past 30 years, fiscal pressures caused many governments to cut spending on extension activities—the costs of which can be high and recurring, while results can take years to materialize, if at all (Davis and Alex 2020; Fischer, Byerlee, and Edmeades 2014). Development strategies during this time deemphasized public-sector implementation in favor of a greater role for markets and the private sector. The training-and-visit approach gave way to greater use of lead farmers, volunteer farmers, and young agripreneurs (Davis and Alex 2020). Not all aspects of traditional extension have disappeared: Farm demonstrations, field days, and farmer training courses remain part of an approach that now focuses more on experiential learning and farmer participation.

These changes in extension have occurred against a backdrop of challenges that require urgent and coordinated responses—most notably, climate change, food security, and the inclusion of women and youth. Extension that is completely dependent on government is not the best approach, but neither is a system with no role for the public sector. Government is responsible for enacting policies and coordinating responses to the challenges identified above. It must fill gaps where the private sector has little interest: for example, in working with marginalized or subsistence farmers not connected to global value chains (Davis and Alex 2020; Babu and Zhou 2016). All stakeholders—public and private, nonprofit and commercial, client and agent—must work together "to identify and address problems and opportunities and develop links to other

actors in the agricultural value chain to obtain needed support—financing, inputs, markets, technologies, or services" (Davis and Alex, 2020, 42).

This chapter aims to help agribusiness firms make sense of the changing extension landscape and draw conclusions on how to effectively train and communicate with smallholder farmers. Compared to past editions of this handbook, this chapter includes more on the challenges and opportunities of ICT, particularly in relation to blended learning. It also contains updated cases and addresses the (potentially) lasting changes brought about by the COVID-19 pandemic.

Private Sector–Led Communication and Farmer Training

Although the private sector and other nongovernmental actors have increased their role in extension service provision, extension is still largely publicly funded through grants made to local governments, nongovernmental organizations (NGOs), and producer organizations (Fischer, Byerlee, and Edmeades 2014). Moreover, government remains the dominant extension provider for subsistence smallholders.

A report from United States Agency for International Development's (USAID's) (2019) Developing Local Extension Capacity Project (DLEC) came to the following conclusions on private versus public extension service provision:

- Private extension is suitable for dissemination of innovations embedded in inputs, such as hybrid seeds, chemicals, fertilizers, and feed.
- Private extension is best suited and relevant to farmers with purchasing power for market participation, larger farms, high-value crops, and cash-crop systems.
- Private extension is limited in its coverage of home consumption needs, general livelihood innovations, collective action, and natural resource conservation activities.
- The role of public extension is to encourage the expansion of complementary services to private extension—that is, to provide technical backstopping, to identify gaps in coverage, and to avoid duplication of efforts.

The private sector tends to get involved with extension in cash-crop production systems and when agriculture starts shifting from subsistence toward commercial production. In their analysis of 10 extension cases—spanning Africa, Asia, and Latin America—Babu

and Zhou (2016) identified the following lessons for private extension providers:

- *Create shared value.* Private extension should reduce smallholders' costs and improve their access to inputs, thereby increasing farm profits and yields. This benefits everyone—smallholders, aggregators, input suppliers, and others in the extension system. This shared value model is crucial to the viability of private extension.
- *Provide integrated services.* Agribusinesses working with smallholders are well positioned to facilitate exchanges between farmers and input suppliers. By offering an integrated solution, the private sector can ensure that farmers receive inputs, advice, market information, and other extension messages in a timely manner.
- *Improve research-extension links.* Effective private extension makes use of public research or conducts its own research with the goal of improving smallholder productivity. Agribusinesses have a vested interest in helping farmers adopt better crop varieties or farming practices to meet the standards of output markets.
- *Foster inclusive innovation.* A close relationship between agribusinesses and smallholders improves knowledge on all sides. Smallholders become more knowledgeable about producing for output markets; businesses gain local knowledge and a better understanding of the needs of smallholders. This facilitates innovation across the supply chain.
- *Contribute to communities.* Businesses that work with smallholders can invest in community-based initiatives to solve common challenges. This develops the loyalty of smallholders and gains the community's goodwill toward the agribusiness.

The pluralistic extension systems of today—in which government, firms, producer organizations, NGOs, and others collaborate—can determine what works best in a particular context. Further, such a mix of extension providers, funding sources, and approaches increase the sustainability of extension services (Davis, Babu, and Ragasa 2020). In the current diverse and dynamic extension system, agribusiness firms must continually build the technical, managerial, and leadership capacities of their extension staff. Agronomy training alone is no longer sufficient. Today's extension professional is as much a facilitator and problem solver as a technical trainer. This professional must be able to help smallholders identify problems and opportunities, link them to the right resources, and enable their participation in decision-making, all while addressing the challenges of climate change, health, nutrition, and social inclusion.

Extension Approaches for Smallholders

Extension programs today use a range of approaches suited to different situations. The following sections consider two current approaches to extension: farmer-to-farmer extension and youth agripreneurship. The demand for more participatory and inclusive extension has grown, and these two approaches help respond to that. Firms should consider the advantages and disadvantages of both, as well as practices that can increase their chances of success.

Farmer-to-Farmer Extension

Private extension programs increasingly engage farmers to deliver extension messages and training to other farmers. Farmer-to-farmer extension is "the provision of training by farmers to farmers, often through the creation of a structure of farmer-trainers" (Franzel et al. 2015). Farmer trainers might also be known as lead farmers (the term this chapter will use), volunteer farmers, contact farmers, or community advisers.

Lead farmers have been part of extension for decades. In the traditional training-and-visit model, extension agents worked with lead farmers to disseminate best practices and new technologies. Past programs, however, tended to recruit village elites and rich, well-connected farmers. These lead farmers were cherry-picked by extension workers or politicians (Ragasa 2019). Today's lead farmers are more likely to be selected by the community and more closely resemble the average farmer. There is evidence showing this is the right approach: A few studies have shown that farmers are more persuaded by those with whom they share a group identity and similar agricultural conditions (Ragasa 2019).

Lead farmers are selected to work closely with government, private firms, and NGOs. They are locally based, speak local languages, and are trusted by their fellow farmers (Davis 2020a). Some lead farmers receive a salary, but the majority do not. Governments in countries such as Indonesia and Peru are beginning to pay lead farmers, but nonmonetary incentives, such as social recognition and training opportunities, also play a role in motivating farmer-trainers (Franzel et al. 2015). While roles vary by project or program, the typical lead farmer will train other farmers from their farmer group, conduct demonstrations, provide monitoring services, answer questions, and connect farmers to extension agents and other resources. Figure B6.1.1 in box 6.1 depicts how lead farmers provide extension services for farmers.

BOX 6.1

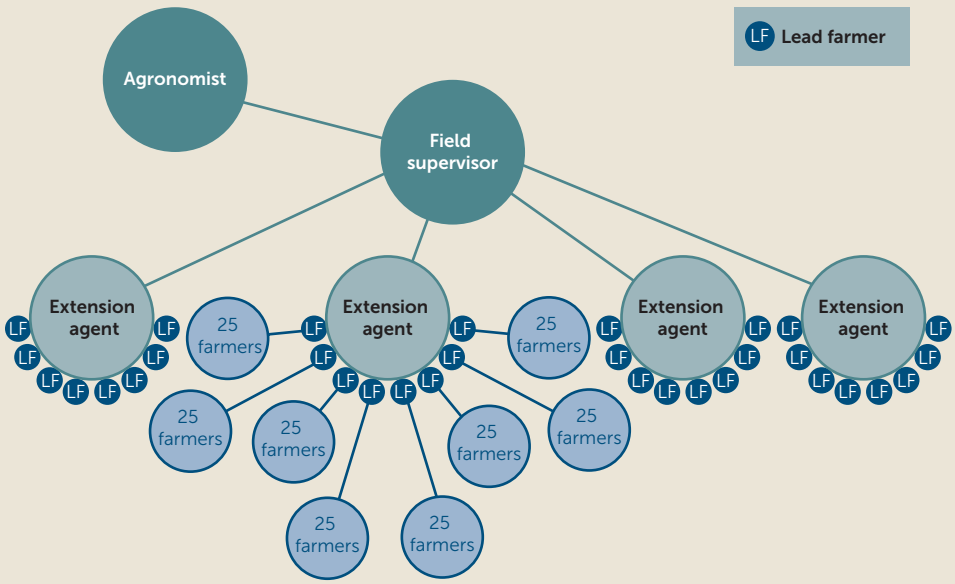
An Extension System Leveraging Lead Farmers

In the sample design shown below, five paid staff train and oversee the output of 800 farmers, transmitting a new message each week according to the crop production calendar. A field supervisor coordinates the work of four field staff who deliver messages and training to lead farmers and farmer groups in an assigned territory. As described in chapter 3, the farmer groups could be pre-existing producer organizations or formed for the purpose of receiving agricultural training.

Depending on travel time between farmer groups, an extension agent can typically meet with two farmer groups daily. This enables an agent to visit eight farmer groups in four days, reserving the fifth workday for meetings, planning, report writing, and vehicle maintenance. The fifth day might also include training from a contracted agronomist who develops the messages and training materials used by field staff.

Firms often employ a "rolling design" that maximizes the number of trained farmers. If one crop cycle of intensive training is enough to reach a critical mass of trained farmers in a given area, the extension team will move on to a new location. The network of lead contact farmers and farmers' groups will then support the learning of late adopters in the first area. The extension program may periodically provide additional performance support through less intensive refresher trainings to reinforce important messages.

FIGURE B6.1.1 Sample Organizational Chart of an Extension Program



Source: IFC 2019, 145–6.

One of the advantages of farmer-to-farmer extension is its low cost. Costs are incurred for initial training (two to three days), follow-up training (about two days per year), and incentives for lead farmers (for example, clothing and contests). A Kenyan study found that those costs totaled $160 per lead farmer per year (Franzel et al. 2015).

In working with lead farmers, firms can do the following to improve program effectiveness:

- *Transparently select the right lead farmers.* The process for recruiting lead farmers should be credible and participatory (Ragasa 2019). Extension staff and the community can work together to achieve this. For example, "A common procedure is to agree on criteria with community representatives and use the agreed criteria to select the farmer-trainers" (Franzel et al. 2015, 2). Criteria might include local language skills, good reputation, farming expertise, and interest in sharing information.
- *Understand lead farmers' motivations.* Some lead farmers are motivated by community recognition. Others are motivated by income earned from extension activities. Still others are internally motivated to help others (Franzel et al. 2015). By understanding lead farmer motivations, firms can design the right incentives, which makes the program more likely to succeed.
- *Develop lead farmer capacities.* It is not enough to train lead farmers once. They need training and retraining on farming concepts, new technologies, and communication skills (Ragasa 2019). They also need support from the wider extension network. Lead farmers underperformed in communities without strong field agents or community leaders.
- *Include women, youth, and the poor.* Farmer-to-farmer extension is an effective way to increase extension diversity and to improve access for underrepresented groups. Some extension programs can more easily recruit women as lead farmers than as extension staff. Franzel et al. (2015) give the example of Uganda's East African Dairy Development Program, where about one-third of farmer-trainers are women, compared to less than 5 percent of extension staff.
- *Build an exit strategy for ongoing support.* The program should be owned by and embedded in local institutions. Plans should be made for government extension staff or a local farmer organization to continue support services after a private sector program ends (Franzel et al. 2015). This increases the likelihood that smallholder farmers will continue to learn from each other.

Ragasa summarizes the lessons above: "Access to quality [lead farmers], adoption behavior of [lead farmers] and regular training received by [lead farmers] have strong and consistent effects on awareness and adoption of most technologies promoted based on the technology adoption models" (Ragasa 2019, 35).

An extension approach similarly embedded in the community is the village agent model. Village agents link farmers to input suppliers, produce aggregators, and other service providers (Franzel et al. 2020). Some agents work directly for the service provider, while others are contracted by NGOs or firms. Village agents receive a fee for their services or a commission from sales of inputs. Rwanda, Tanzania, and Uganda have been at the forefront of the village agent model.

Like lead farmers, village agents help reduce costs and extend the reach of extension. However, the goal of village agents is usually narrower than that of lead farmers. The classic village agent model aims to increase produce volume and quality through the provision of inputs and sharing of knowledge (Feed the Future 2019). Recently, there has been more emphasis on engaging youth in extension and advisory services. The village agent model is one approach to encourage youth participation in extension. Many programs recruit unemployed or underemployed youth as village agents or "farmer extensionists." Youth agripreneurship is now emerging as an increasingly popular extension approach that warrants its own treatment.

Youth Agripreneurship

Along with women, young people are a key target for agricultural extension and advisory programs. Millions of young people are unemployed in economies still driven by agriculture and underpinned by aging farmers and extension professionals (Franzel et al. 2020). Youth-focused extension creates economic opportunities for those who need them and contributes to the sustainable development of the agriculture sector. Innovations in ICT converge with the youth focus, as technology attracts more young people to careers in agriculture (Davis and Franzel 2019).

While there are various ways to include youth in extension, this chapter focuses on the emerging area of youth agricultural entrepreneurship: agripreneurship. Youth can be viewed as recipients of extension services—as they receive training to become agripreneurs, serving as one-stop service providers for farmers—engaging in input supply, aggregation, and facilitation of other services. Youth can also be providers of extension services as village agents, as described above, or as fee-based extension providers.

In a study on how to engage young agripreneurs in Rwanda and Uganda, Franzel et al. (2020) make recommendations on how to engage youth in agripreneurship. These recommendations are not solely directed at the private sector, as the public sector is key to reducing obstacles to youth agripreneurship. For example, government is responsible for setting the right policies, offering foundational education, and lifting restrictions on women's ownership of productive assets. For firms, the most relevant recommendations include the following:

- *Offer market-based solutions.* "Inclusive markets are achieved when youth benefit from engaging with the private sector, and when the private sector benefits from engaging with youth in markets" (Franzel et al. 2020, 42). The agripreneurship, village agent model, and fee-based extension are among the most effective and sustainable market-based solutions. The study found that three-quarters of village agents were youth. However, the proportion of women among those youth ranged from only 16 to 33 percent.
- *Proactively engage young women.* If firms do not address the constraints faced by women, most agripreneurs will be young males. Young women might be hindered by limited mobility and limited access to technology and productive resources (Franzel et al. 2020). Agripreneurship is a way for women to earn their own income, gain decision-making authority, and increase their standing in the community (Palladium 2020). Firms can increase the number of women agripreneurs by consulting women about how they want to participate and encouraging their participation by, for instance, offering childcare during training sessions.
- *Offer integrated services.* Like the farmers they help, young agripreneurs need access to a range of business development services, such as business planning, financing, and mentorship. Firms can either provide these services or link agripreneurs to those that do (Franzel et al. 2020).

Syngenta Foundation India supports youth agripreneurship through its Agri-Entrepreneur program (box 6.2).

In the traditional top-down extension services, farmer training was delivered as a stand-alone service without supporting access to inputs and services needed to apply learning and achieve productivity gains. The lead farmer and agripreneur models—both embedded in local communities—are beginning to realize the benefits of an integrated approach to extension, whereby advisory services are offered together

BOX 6.2

Case Study: Syngenta Foundation, India's Agri-Entrepreneur Program

Syngenta Foundation India's Agri-Entrepreneur (AE) program recruits unemployed rural youth to serve as agri-entrepreneurs to small and marginal farmers. Each AE works with 150 to 200 farmers in a cluster of two to three villages. AEs provide farmers with credit and market links, agricultural inputs, and advisory services.

A recent study sought to understand the reasons for differing performance among AEs, with a view to better supporting them. AEs were classified into three groups based on performance: fast climbers, solid climbers, and slow climbers. The following factors were analyzed:

- *Education.* Higher education levels are associated with better performance. Among fast climbers, 46 percent of respondents were graduates. Among solid climbers, 41 percent were senior secondary students.
- *Age, marital status, and work experience.* Twenty-five to 30 years old appeared to be the optimal age for an AE. Forty-six percent of AEs in that age group were fast climbers, compared to only 8 percent of those over 40 and 28 percent of those under 25. Moreover, AEs married to an employed spouse performed better. Among fast and solid climbers, those with previous work experience performed better.
- *Motivation for joining the program.* AEs across performance categories cited an interest in entrepreneurship, working close to home, and helping their community as top reasons for joining the program. A higher percentage of fast climbers and solid climbers reported an interest in agriculture as a reason for joining the program.
- *Specialized training.* Specialized training (that is, training beyond what is required to start the program) was associated with better performance: 76 percent of fast climbers reported participating in specialized training, compared to 66 percent of solid climbers and 48 percent of slow climbers.
- *Advisory services.* 61 percent of fast climbers offered training twice a month, compared to 38 percent of solid climbers and 24 percent of slow climbers. Farmers were more likely to reach out to those who offered training twice a month, suggesting that they viewed these AEs as solution providers.
- *Business challenges.* AEs across performance groups cited capital as the number one challenge. Unresponsive farmers were a challenge for solid and slow climbers. Slow climbers were more likely to identify knowledge as a major challenge.

What are the implications of these findings for the AE and similar programs? The study suggests the following:

- *Raise skill levels.* An AE with a higher skill level is likely to perform better. Graduates are the best performers. Specialized training can improve the performance of those without much education.

box continued

BOX 6.2

Case Study: Syngenta Foundation, India's Agri-Entrepreneur Program *(Continued)*

- *Understand motivations for joining.* Use this understanding to attract the right candidates. AEs should balance interest in entrepreneurship with the social motivation to help their communities. Interest in agriculture could drive AE performance.
- *Help AEs position themselves as solution providers.* AEs should train farmers at least twice a month. This differentiates them from those who do not offer advisory services. AEs who offer more training are contacted more often by farmers, which positions them for better performance.
- *Offer mentorship on market links.* Across performance groups, few AEs offer market links as a service, although it is a gap farmers face. Boost mentorship in this area and encourage more AEs to offer this service.
- *Improve knowledge among slow climbers.* This challenge is possibly related to slow climbers' lack of training and less frequent contact with farmers. Improving those factors should boost knowledge for this group.

Source: Chowdhry 2019.

with inputs, credit facilitation, agricultural technologies, and aggregation, among other services. Such a holistic approach meets the needs of smallholders, while generating returns that stay in the community. It reduces the risk of smallholder dependence on government, NGOs, and firms, while encouraging continuous service provision on a commercial basis.

The Better Life Farming (BLF) alliance is an example of this integrated approach (box 6.3). Public and private partners work together to create local ecosystems that support smallholders.

Extension and Information and Communication Technology

Extension services have evolved in parallel with advances in ICT. When applied to agriculture, ICT can guide decision-making for farmers, agribusinesses, governments, and others in agricultural value chains. ICT enables farmers to make better production decisions and form market links. It helps agribusinesses better understand their target smallholders and thus offer more effective solutions. It allows governments to create better policies that enable investments, smart subsidies, and risk management.

BOX 6.3

Case Study: Better Life Farming Alliance

Better Life Farming (BLF) is an alliance between Bayer, the International Finance Corporation (IFC), Netafim, and Swiss Re, with more than 20 partners at the country level. BLF helps smallholder farmers become more profitable while also reducing their environmental impact. Its goal is to improve the livelihoods of 3 million smallholders by 2030.

BLF works through local ecosystems that give smallholders access to the products and services they need to grow their farming business. At the core of this ecosystem is the Better Life Farming Center, which is owned and operated by a local agripreneur—usually a local smallholder or young person. Each BLF Center connects as many as 500 smallholders who were previously isolated. With the support of a BLF agriconsultant, the agripreneur focuses on five main areas:

1. *Education:* The agripreneur operates a model farm where smallholders are trained in farming practices that are economically and ecologically sound. This agripreneur also works with local partners to build farmers' financial literacy and entrepreneurship skills.
2. *Customized agronomic solutions:* The agripreneur shares customized solutions that incorporate high-quality seeds, crop protection products, and precision irrigation technology.
3. *Insurance and finance:* The agripreneur works with local partners to provide insurance and financial services to smallholders.
4. *Market access and fair prices:* The agripreneur aggregates farmers' produce and connects farmers to reputable suppliers of inputs—seeds, fertilizer, crop protection, irrigation, and farm equipment.
5. *Partnerships:* The agripreneur helps smallholders connect with other aggregators, distributors, off-takers, and capacity-building partners.

BLF is a locally managed solution that promotes both sustainable agriculture and agripreneurship. It began in 2016 with 20 green-chili farmers in India. Between 2016 and 2020, those farmers' yields tripled, and their annual net income increased from $600 to $3,300. Currently, through the Bayer–IFC partnership, 119 agripreneurs received technical agronomy, business skills, and gender-sensitization trainings. On average, these agripreneurs serve 40,000–50,000 farmers annually. Scaling this, BLF aims to establish 1,000 centers in India, Indonesia, and Bangladesh, reaching more than 800,000 farmers.

Sources: Better Life Farming website, https://www.betterlifefarming.com; Dias, Kaplan, and Singh 2021.

ICT also has the potential to fend off the entwined challenges of climate change and food security. Both the volume and quality of data available for smallholder agriculture are increasing exponentially. A 2019 report on the digitalization of African agriculture states that digital agriculture solutions have already reached "33 million smallholder farmers and pastoralists across the continent" and that the sector is growing at 44 percent per year in terms of farmers reached (Tsan et al. 2019, 8). Some large ICT players are beginning to develop viable business models, and there are early signs of ICT's positive impact on yields, youth engagement, and climate change (Tsan et al. 2019).

Yet barriers remain. Many smallholders and agribusinesses in developing countries do not benefit from ICT. These countries lack investment in the human, physical, and institutional capacities required for ICT. Many are constrained by poor infrastructure (including roads, telecommunications, weather stations, and energy grids), underdeveloped markets, inadequate financial services, and lack of enabling policies and regulations. Progress on removing barriers to ICT use is happening, albeit slowly.

The following sections explore ICT applications in farmer training and communication and provide examples of firms that have used these innovations.

Mobile Phones and Internet

ICT in extension has expanded greatly due to mobile phone and internet penetration in rural areas. Mobile phones have enabled multiple technological solutions, including short message service (SMS) and voice-based messaging. By 2020, there were 8.3 billion mobile phone subscriptions worldwide, greater than the global population of 7.7 billion.[1] In all, 93 percent of the world's population has access to a mobile broadband network, which is defined as third generation (3G) or above (ITU 2020b). The ubiquity of mobile phones is captured by the (sad) fact that more people have a mobile phone than have access to safe sanitation services.

Despite the high global penetration of mobile phones and the internet, there are huge regional access differences. In the least developed countries, 17 percent of the rural population has no mobile coverage, while 19 percent can only access a 2G network (ITU 2020a); 2G mobile phones (feature phones) remain prevalent in much of the rural world. These can be used to collect and disseminate small amounts of information via SMS or text messages, but data-heavy applications (such as video and computer-based e-learning) are not feasible. Internet is even

more limited. In Africa, only 6.3 percent of rural households have internet access. One reason for this is the high relative cost of internet access in developing rural areas (ITU 2020b).

There are gender disparities as well. In the least developed countries, almost twice as many men have internet access as women (28 percent versus 15 percent). Women are closer to parity on mobile, but still 20 percent less likely than men to own a mobile phone in middle- and low-income countries (Rowntree 2020).

Firms should work to reduce these gaps. Mobile phones and the internet are less costly than face-to-face communication. They can reach larger numbers of smallholders and present opportunities to reinforce learning and measure impact. To realize the full potential of mobile phones and the internet, public- and private-sector actors must work together to close digital literacy skill gaps, increase investment in infrastructure, reduce access costs, and create sustainable business models that are inclusive of women and marginalized groups (Tsan et al. 2019).

The Olam India (box 6.4) and Arifu (box 6.5) case studies demonstrate how mobile phones can be used to support smallholder learning.

BOX 6.4

Case Study: Olam India Advisory Program

Rice is one of the largest staple crops grown in India, for consumption by over 500 million people, and it is also one of the main exports from India to international markets. However, rice is one of the most unsustainably grown commodities in the country, with overuse of farm inputs such as chemical pesticides and inorganic fertilizers as well as overirrigation by the vast majority of smallholders engaged in its production.

For Olam India, part of Olam International, rice is a key business, and it aims to procure sustainably grown rice with low chemical pesticide usage. To that end, Olam India is currently working with the International Finance Corporation (IFC) on a project that will build the capacity of 5,000 smallholder rice farmers to adopt sustainable rice cultivation practices, achieve 20 percent efficiency in farm water use and irrigation, support 1,000 women farmers in self-help groups, and implement sectorwide scale-up with key stakeholders covering more than 25,000 smallholders. So far, 800 farmers have been trained in sustainable rice practices and techniques.

IFC is working with Olam to develop a climate-smart, resilient, and sustainable rice value chain with increased yield and income for smallholders. IFC provided technical assistance in training and capacity building to farmers and to Olam's extension team on climate-smart sustainable farm

box continued

BOX 6.4

Case Study: Olam India Advisory Program *(Continued)*

practices focusing on water, optimum crop input usage, and improved crop residue management. Further, to tap into the potential of women smallholders, IFC developed modules on gender sensitization and supported awareness-building efforts.

IFC also designed (in-house), developed, and rolled out a mobile-based digital self-learning application for all extension staff and farmers in the catchment, containing all technical agronomical aspects. Through the app, smallholders can engage in interactive learning on sustainable rice cultivation practices. Olam India integrated this application with its existing digital services. The project also uses a digital platform based on blockchain that will provide traceability services in tracking the rice crop grown and harvested by project farmers. This helps ensure compliance with best practices and ensures the quality of the batch of rice harvested or procured from the field; it enables tracking and tracing of the post-harvest handling, field procurement practices, and warehouse storage information. Smartphone applications have been provided to collect data directly from the farmers and field facilitators. In 2020, 250 farmers used these solutions.

These digital learning applications experienced acceleration in deployment with the onset of COVID-19 restrictions, and farmer outreach or trainings in remote rural areas were able to continue despite the travel restrictions. Further, digitization of farmer and farm data allowed Olam to maintain end-to-end traceability, enabling it to comply with global rice standards, the Sustainable Rice Platform (SRP) standards.

Source: IFC forthcoming, Project Supervision Report on Olam India Advisory Project.

BOX 6.5

Case Study: SMS Chatbots—Training for Farmers and Poultry Agents

A 2019 study concluded that providing agricultural information using digital technologies increased yields by 4 percent and increased the odds of adopting recommended techniques by 22 percent. In addition, mobile-phone-based systems can increase the productivity and accountability of in-person extension agents and enhance supply chain functionality. There are several possible reasons for this. For example, organizations can use mobile phone data to send more customized messages. Mobile phone users are also more likely to share information they receive on mobile phones with others.

box continued

BOX 6.5

Case Study: SMS Chatbots—Training for Farmers and Poultry Agents *(Continued)*

In 2021, the International Finance Corporation (IFC) initiated two mobile learning pilots in Ethiopia to test this hypothesis. The goal of these pilots was to determine if supplementary short message service (SMS) training would be an effective learning tool that could help improve a smallholder's adoption of agronomic and business management techniques.

In the first pilot, IFC partnered with EthioChicken, Arifu, to send 4,000 poultry growers supplemental SMS training via Arifu's chatbot platform. Arifu sent training content on poultry production and business management directly to participants' phones—mostly on feature phones (a class of earlier-generation mobile phones) as SMSs. At the end of the pilot program, IFC will compare adoption and production rates for these participants with 500 poultry agents who received only in-person training.

For the second pilot, IFC worked with Habesha Breweries and Soufflet Malt Ethiopia to send supplemental SMS training messages to 56,500 smallholder malt barley farmers through Microsoft's KuzaBot platform. In addition to in-person training, these farmers will receive training content as SMSs sent directly to their feature phones. The training topics include best agronomic practices for planting, harvesting, storing, and marketing malt barley. As the pilot project evolves, there is potential to expand to more malt barley farmers and add more dynamic content, such as images, audio, and video materials.

Upon completion of these pilots, IFC will use lessons learned to adapt its Agribusiness Leadership Program for mobile learning. This will allow more robust training options for future IFC clients with smallholder supply chains.

Source: IFC forthcoming, Project Supervision Report on AgTech East Africa Project.

Video

While video can be viewed through mobile or internet-enabled devices, this section considers video-mediated extension. In this context, video is shown to smallholder farmers a limited number of times by an extension provider at a time of the provider's choosing (Campenhout, Spielman, and Lecoutere 2018). Such video-mediated extension might be used alone or combined with other ICT extension services (for example, SMS messages) and non-ICT services (for example, discussion groups). Video has multiple benefits for firms and smallholders. It is usually low cost, and it can be customized to the needs and preferences of smallholders (Abate et al. 2019). For example, a video can address location-specific

issues in the local language using local people. Individuals are more likely to pay attention to messages that are customized for them and delivered by people with whom they identify. Video also reduces the inconsistent messaging that can happen in face-to-face communication.

Since 2014, the Ethiopian government has worked with Digital Green on a video-mediated approach to smallholder extension (box 6.6).

Radio and Television

More traditional forms of ICT—including radio and TV—should not be overlooked in the race to embrace the latest technology. Radio and TV are powerful tools for communicating with farmers in developing countries. They are cost-effective and can reach many smallholders over a wide area. They are also available in local languages and accessible to low-literate farmers (Chapota, Fatch, and Mthinda 2014).

BOX 6.6

Case Study: Video-Mediated Agricultural Extension In Ethiopia

In 2014, the government of Ethiopia and Digital Green, a nongovernmental organization, partnered on a video-mediated approach to extension. The partnership aims to encourage farmers to adopt technologies and practices that will boost agricultural productivity in major food crops. Farmers view short videos featuring local content and local actors speaking in local languages. They discuss the videos in groups facilitated by extension agents (known as "development agents" in Ethiopia).

A study conducted by the International Food Policy Research Institute (IFPRI) sought to determine whether this video-mediated approach is effective. The study focused on three priority crops: teff, wheat, and maize. The study compared the results of video-mediated extension with the results of a conventional extension approach. It found that video-mediated extension

- reached a wider audience than conventional extension;
- improved farmers' knowledge of key technologies and practices; and
- led to greater adoption of key technologies and practices.

The study found that the video-mediated approach led to a 3 to 10 percentage point increase in adoption of many of the technologies and practices recommended for teff, wheat, and maize cultivation (for example, row planting and recommended seeding rates). This represents up to a 35 percent increase in adoption of a given technology for a given crop when compared to the control group. Future research will consider whether there is an impact on yields and incomes.

Source: Abate et al. 2019.

Applications of radio and TV to extension include advertising, discussion programs about crops or inputs, farmer interviews, soap operas, radio programs, and reality TV. A combination of radio and face-to-face training, where farmers listen to radio programs with field staff and then practice the skills together, is an effective strategy. Radio has been and continues to be an important technology to reach farmers with information (box 6.7). It reaches more than 70 percent of the world's population (Davis 2020b). A case study of using reality TV is presented in box 6.8.

BOX 6.7

Case Study: Farm Radio International

The International Finance Corporation (IFC) is currently implementing a project developing the distribution of improved poultry breeds and poultry feed to smallholder farmers in Ethiopia. The project aims to increase household consumption and marketing of poultry products by smallholder farmers. The project aims to achieve its objective by professionalizing poultry agents and feed dealers who supply layer and broiler chickens and feed to smallholder farmers. Accordingly, the project provides both business skills (record-keeping, business relationships, contract management, inventory management, and marketing and promotion) and technical poultry management trainings (housing, health, feeding, and sanitation) to the poultry agents and feed dealers.

In addition to the in-person trainings and coaching, IFC launched a targeted poultry-focused radio program that reinforces lessons on business skills and good poultry management practices. In addition, the radio program intended to reach smallholders engaged in poultry farming across the four main regions of the country—targeting at least 300,000 smallholder farmers. For this, IFC partnered with Farm Radio International (FRI) to design and run a 20-week radio program covering 24 topics in collaboration with three local radio stations and using three local languages. FRI's information and communication technology–based interactive voice response system was used with the radio program. FRI's system, ULIZA, enables calling registered farmers and sending short messages. This helps remind registered farmers about the time and date of the program. Mostly, it is rolled out before the program starts. The system also allows farmers to access a brief version of the program in case they missed it. There is also ULIZA Poll, which helps to get feedback from callers via an audio-based system. This allows farmers to ask questions or answer questions raised in each episode. It also helps to gather listeners' feedback on whether the program is benefiting them. Knowledge partners are able to listen to the programs, make additional comments, and respond to farmers' questions using the platform.

FRI's report on this project shows a total of 29,762 calls from smallholders, and out of these, 12,311 were unique callers and 3,080 were women. Weekly participation on the radio programs

box continued

BOX 6.7

Case Study: Farm Radio International *(Continued)*

ranges from 677 to 4,194, with an average participation of 128 women and 394 men each week. A total of 152,408 interactions were recorded on FRI's platform during the 20-week radio program. In addition, 8,918 poultry agents and feed dealers received reminders, poll questions, and information via direct messages to reinforce their lessons from face-to-face trainings and coaching. Overall, results from a survey using the ULIZA platform show that over 70 percent of the respondents benefited from the radio programs.

The lessons captured from the radio program intervention showed that multichannel approaches to trainings and capacity building are effective. Interactive radio programs are not just for awareness creation. Rather, they can motivate and support behavior change. Interactive radio can strengthen impacts from in-person trainings and reach isolated communities.

Source: IFC, forthcoming, Farm Radio International, 2022 Endline Study.

BOX 6.8

Case Study: Reality TV for Farmers

Don't Lose the Plot (*DLTP*) is a reality TV show that showcases young farmers from Kenya and Tanzania. It features young men and women who live and farm side by side, competing to win $10,000. Approximately 4.1 million youth watched the pilot season, which aired in 2017.

DLTP aims to "promote farming amongst the youth as a 'cool' and viable career venture." It uses high- and low-tech channels to provide information to young people on how to start a farming business. The show's website features Budget Mkononi, a web-based budget tool that helps young people start and grow a farming business. The website also promotes iShamba, a call center that takes questions via short message service or phone.

An evaluation of *DLTP* came to the following conclusions:

- *DLTP* led to improved knowledge on farming and agribusiness among high-intensity viewers.
- *DLTP* led to improved record-keeping on production among youth already farming.
- *DLTP* led to increased use of irrigation in Kenya and Tanzania and increased use of fertilizer in Tanzania.
- There is no evidence that the show influenced youth who had never farmed to go into farming.
- In Tanzania, high-intensity viewers demonstrated more positive attitudes toward farming.

box continued

BOX 6.8

Case Study: Reality TV for Farmers *(Continued)*

DLTP offers the following lessons to other implementers of TV-based extension:

- ***Repeat key messages.*** Messages repeated across multiple channels and episodes are more likely to change knowledge, attitudes, and behavior.
- ***Work with others to remove barriers.*** A TV show is not enough. Young people need access to land and financial support.
- ***Follow participants over time.*** A longer evaluation period is required to determine whether uptake of farming increased.

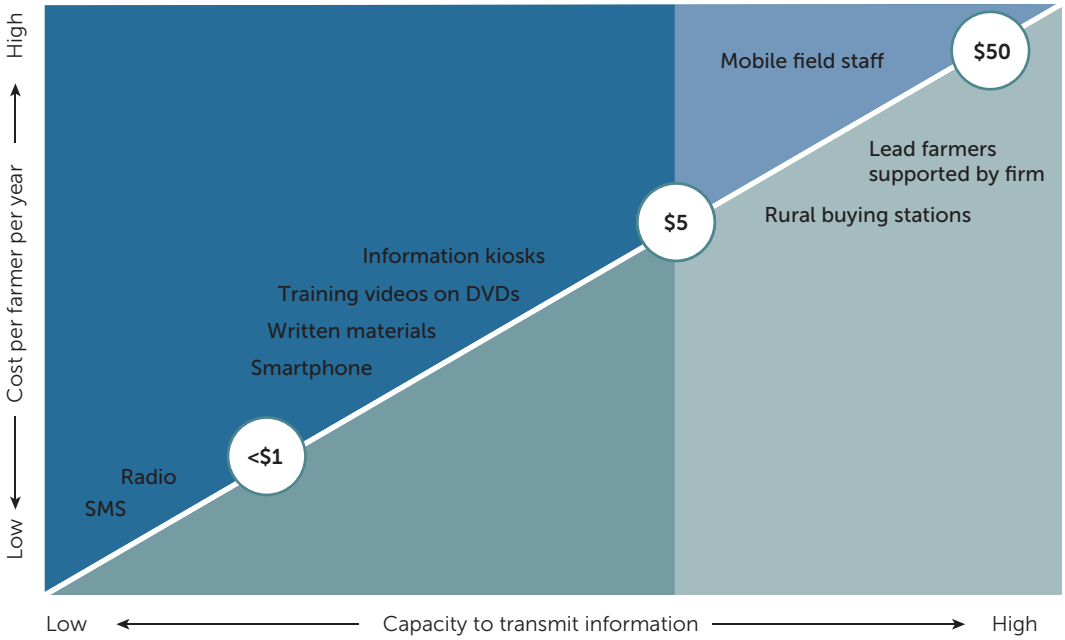
Sources: Don't Lose the Plot website, https://dontlosetheplot.tv/en/; Evaluation of the *Don't Lose the Plot* Television Program, 2018, Kantar Public East Africa, https://mediae.org/documents/9/DLTP_Evaluation_Report.pdf.

Selecting an Extension Approach

The advances in ICT have introduced noncontact methods of extension as alternative options to the traditional face-to-face trainings. The use of technology lowers cost and reduces the need for extension agents while reaching more farmers. This approach, however, might come at the expense of reduced impact. Radio messages, for example, cost less than US$1 per farmer, but they transmit limited information with minimal interaction with message recipients. As a result, message impact might be lower than live interaction and the percentage of farmers adopting new behaviors may be lower. Figure 6.1 shows the trade-off between cost and capacity to transmit information for various extension methods.

Given the in-person and noncontact methods of extension, deciding on which approach to use requires balancing multiple competing factors. On the one hand, in-person approaches (including extension field staff and lead farmers) can be highly effective because they permit comprehensive extension message delivery and two-way communication. On the other hand, in-person approaches can be costly—averaging around US$110 per farmer (see table 6.1). They are also difficult to scale.

FIGURE 6.1 Cost versus Capacity to Transmit Information



Source: World Bank 2018.
Note: DVDs = digital video discs; SMS = short message service.

TABLE 6.1 Benchmarking Training Costs

Reach	247–55,000 farmers	Private sector–driven (agribusiness-driven) extension programs typically reach 250–50,000 farmers.
Duration	26–2,946 hours	The training programs seek to promote specific agricultural practices and use of improved inputs. These trainings are offered in multiple cropping seasons with average duration close to 700 hours.
Cost per farmer	US$13–$227	Training cost per farmer is lower for projects (training programs) reaching a larger number of farmers, indicating scales of economy. Higher training costs are mainly associated with longer training hours. Average training cost per farmer is around $110.
Cost per hour per farmer	US$0.03–$2.40	Training programs with more sessions and longer session hours are associated with higher costs. Farmer training costs an average of US$0.5 per hour.
Farmer benefits	Incremental annual income US$112–$5,955	Average incremental annual income for farmers is US$1,585, which is significantly higher than the incurred per farmer training costs. But in addition to trainings, there are costs of inputs and labor among other factors of production.

Source: Results are from Fischer, unpublished.

Firms offering extension services can use a combination of extension approaches and delivery channels. One is not mutually exclusive to another. An extension agent with a computer tablet can show videos and collect data. A farmer can ask and answer questions via SMS. Such a blended approach both reduces costs (for example, by reducing the need for in-person training) and increases effectiveness (for example, by reinforcing training messages). The following section explores how in-person and digital methods can be combined for a blended learning solution.

Besides cost, other factors to consider when selecting an extension approach include the following:

- *Farmer demographics:* Who is the target of the extension services? Men, women, both? Are they old or young? Men might be more able to attend in-person training. Women face barriers that might make it difficult for them to travel for training (for example, household obligations and the risk of traveling alone). Yet women also face barriers to technology-enabled extension. They are less likely to own an internet-enabled device and less likely to have the skills to access and use digital content. Young people are more likely to have the skills and enthusiasm for technology-enabled extension. Firms must ensure that the approach is accessible to those who need it.
- *Farmer location:* How many farmers need to be trained at each location or village? What is the distance between villages? How many farmer meetings can an extension agent hold per day? If farmers are widely dispersed, only one meeting per day may be possible. In higher-density areas, up to four meetings per day may be possible. Technology can help reach farmers who are widely dispersed, thus reducing the need for more travel.
- *Technology access:* Technology can be used only where smallholders have access to it. There are several aspects to technology access. One is the technology itself: Do they have reliable internet access? Is it high speed? Do they use smartphones or feature phones? If the target smallholders use basic feature phones, firms should send messages via SMS. Knowledge and skills are another aspect of technology access. It is not enough to have technology—learners must be able to access, understand, and apply the digital content to their farming practice. They might need an extension agent to train them how to access the content. They might need further help understanding the content.

- *Farmer behavior:* Firms should research previous training offered. What was the result of past extension efforts? Did farmers adopt the training? If so, why? Were they motivated to adopt practices they saw modeled by others? What gaps can an extension approach help fill?
- *Farmer organization:* It is less expensive to train well-organized farmers because some groups can transmit information among members without outside assistance. Are smallholders organized into cooperatives, associations, or other producer organizations? If farmers are not organized, field staff may need to help them form basic groups before beginning training. If they are organized, is the organization meeting member needs? How can the firm help identify and meet members' needs?
- *Other extension players and supporters:* Are there other organizations who can deliver or co-deliver extension services? For example, are there agro-input retailers in the area who can provide training or other value-added services along with inputs? Are there NGOs who will partner with the firm to train smallholders? Are there existing lead farmers with demonstration plots? Are there media outlets and information providers that can help deliver extension messages?
- *Trainer skills and experience:* If face-to-face extension is combined with digital methods, the trainer must be able to confidently use the technology. Trainers who are both experienced and technology-savvy can participate in virtual training-of-trainers programs and deliver trainings to farmers using digital methods.

ICT-Enabled Blended Learning

As shown in the previous sections, ICT developments have changed how smallholders learn. The traditional approach to farmer training—delivered in person by field agents—is only one of the many available avenues. Today, smallholders can learn through a chatbot on a mobile phone. They can listen to a radio program and discuss it with peers. They can receive reminders about what they learned via SMS. Moreover, these digital methods can be combined with face-to-face trainings to create a blended learning solution.

Blended learning is the integration of multiple learning methods, including e-learning (self-paced learning that requires a computer, tablet, or mobile device), virtual instructor-led training (live training that happens online, for example, through Zoom), and instructor-led training (live training that happens in person). For firms, blended learning offers the following benefits:

- *Increased scale:* Not every smallholder who wants to participate in face-to-face training has the opportunity. It is expensive to offer classroom training. It is logistically difficult to bring to remote areas. A classroom can hold 25 or 30 people. Thousands can access digital learning content, provided they have the right technological infrastructure and digital literacy skills.
- *Greater effectiveness:* Blended learning gives people access to the content they need, when and where they need it. Face-to-face training allows for limited customization to an individual's needs. In a face-to-face session, there might be people who know the concepts and people who are struggling. When learners can access digital learning, they can focus on the topics most important to them and go at their own pace. Digital content also allows learners to revisit what they learned, which aids learning recall and application.
- *Greater sustainability:* It is risky to rely on a few expert trainers who can leave at any time. Digitizing content helps codify it, making it less dependent on any one individual. It also creates "leave behinds"—videos, graphics, e-learning modules—that community members can use after the extension organization has departed.
- *Cost efficiency:* For extension providers, face-to-face training is costly, especially if they are paying for participant travel, food, and accommodation. There is a cost for participants because they are away from their organizations. Replacing some face-to-face training with digital learning will reduce these costs.

IFC's ALP now uses blended learning to build the capacity of producer organizations, last-mile retailers, and lead farmers (box 6.9). Like many organizations, IFC's speed of adapting its capacity-building model to a blended learning approach accelerated due to the COVID-19 pandemic.

BOX 6.9

Case Study: The Agribusiness Leadership Program

The International Finance Corporation (IFC) created the Agribusiness Leadership Program (ALP) in 2016 to strengthen the operations of agribusiness clients who rely on smallholder supply chains. ALP is a capacity-building program for agricultural producer organizations, agro-input retailers (also known as last-mile retailers), and model farmers (also known as lead farmers). The program integrates assessment, training, coaching, and market links to help these target groups build the business management capacity and mind-set to be reliable supply chain partners for commercial agribusinesses. ALP has been used in 35 projects in 23 countries across Africa, Asia, and Latin America and the Caribbean, reaching over 500,000 farmers.

Until 2020, ALP was delivered face-to-face by trainers and coaches, who were trained in person by IFC master trainers. Trainers and coaches used slides, instructor guides, and coaching guides, supplemented by printed handouts and a printed development plan. This approach is costly and difficult to scale; moreover, since March 2020, when COVID-19 struck, it has been difficult to execute. The pandemic meant IFC project staff had to convert classroom training into virtual training. For example, farmers in Nicaragua who were going to meet in person instead used WhatsApp to view training content in the form of graphics and short videos. Agronomists in the same project used the online learning platform Edmodo to access materials they would later discuss during live virtual training sessions.

COVID-19 accelerated ALP's transformation into a blended learning program. As of September 2021, 82 ALP topics were available as e-learning. The ALP training-of-trainers program is also available for virtual delivery in English and French. Even as face-to-face training resumes, ALP will continue to use blended learning to achieve greater development impact at less cost.

The ALP implementation guide contains the following guidance for staff implementing blended learning projects:

- *Consider the digital divide.* Be strategic when replacing face-to-face training with e-learning. Not all target learners will be able to access graphics-heavy e-learning. For those with basic feature phones, use a learning chatbot that sends messages via short message service. If trainers have access to technology, have them facilitate a session using digital content as support.
- *Consider (digital) literacy skills.* Create videos, podcasts, and e-learning voiceovers that convey key concepts. Use coaches to help learners work through the digital materials and provide physical take-aways (for example, posters).
- *Localize learning design.* Determine whether locally popular apps can be used to support learning. For example, messaging apps—such as WhatsApp and Telegram—can be used to deliver learning content in small segments. Apps can enable peer-to-peer learning and the sharing of learning content.
- *Support learning beyond the classroom.* Provide digital content that helps learners recall what they learned during training. Blended learning helps extend the learning to those who did not attend. For example, other family members can watch a video or use a mobile learning app.

Impact of COVID-19 on Extension

Extension and advisory services have always evolved in response to crises and changing environments. Extension institutions are vital partners in helping communities respond to natural disasters, epidemics, and other shocks. Trusted extension providers are well positioned to help smallholder producers who need information, advice, and coaching to overcome the challenges brought by crises (Grove, Archibald, and Davis 2020).

This has been especially true during the COVID-19 pandemic. The scale and devastation of COVID-19 required more radical and faster change than had occurred in previous crises, such as Ebola and avian flu outbreaks. Almost overnight, extension providers were forced to adopt noncontact methods for training and communication. For example, China's Ministry of Agriculture and Rural Affairs created "a cloud-based extension information portal used for digital engagement and access to experts by farmers and dissemination of relevant market- and production-related guidance" (Grove, Archibald, and Davis 2020). Using their smart phones, extension workers were able to provide farmers with training and technical support, market information, and pest monitoring—all while minimizing in-person contact (Davis 2020b).

In Malawi, Strengthening Agricultural and Nutrition Extension (SANE) is one initiative that builds the capacity of the government's Department of Agricultural Extension Services. When the COVID-19 pandemic began, SANE worked with coordinating committees in 13 districts to support extension's adoption of digital communication platforms, such as Zoom and WhatsApp (Davis et al. 2021). SANE provided training on the new tools, in addition to airtime, so participants could join. Despite this, variable internet service and a lack of smartphones made virtual meetings challenging at the village level. Malawi also experimented with virtual agricultural fairs using Zoom and Facebook Live. By virtually connecting farmers and buyers, extension providers helped avoid overcrowding in-person markets. Extension also used digital tools to advise farmers to focus on crops for domestic consumption rather than export crops. This helped mitigate the impact of global supply chain disruptions and improve food security.

More traditional approaches prevailed as well. As noted, radio is a trusted information source in agricultural communities. It is used to reach vulnerable populations with information and advice, especially during crises and in the rebuilding that follows. During COVID-19, radio was a noncontact means of disseminating public health information.

In Africa, Farm Radio International (FRI) is working with 1,000 radio broadcasters to dispel misinformation about the virus (Davis 2020b).

Extension and advisory services are bridges to agricultural communities during times of uncertainty and crises. Extension providers offer strategies that help smallholders bounce back from shocks and build resilience (Davis 2020b).

During the (ongoing) COVID-19 crisis, extension played a vital role in disseminating public health messages, counseling smallholders on how to avoid food insecurity, and helping communities transition toward distance methods of training and communication.

The pandemic also highlighted challenges for extension providers. Digital tools can increase farmers' access to extension services in a cost-effective way. However, they also risk widening gaps between groups with varying degrees of internet access and digital literacy skills (for example, between male and female smallholders) (Davis et al. 2021). It is important to use multiple channels—including internet, radio, TV, and pamphlets—to reach targeted farmers with extension and advisory services. Moreover, extension staff and smallholders need the knowledge and skills to participate in a digital extension system. Capacity building should address not only how to use the tools, but also how to think critically and solve problems related to the crisis.

Implementing Smallholder Training Programs

Based on its experience with the ALP, agribusinesses are recommended to use these six guiding steps in their smallholder training programs:

1. *Select local partners.* There are multiple ways to work with local partners. For example, agribusinesses might directly contract with those who will deliver training. In other situations, the contracted NGOs, targeted producer groups, or other engaged local partners may further hire or contract the trainers. By working with a local partner, agribusinesses can reach more smallholders, achieving scale. Agribusinesses should build the capacity of their local partner to deliver the trainings, and they should ensure community ownership of the program to secure continuity of the service.

2. *Conduct a needs assessment.* A critical part of program design is the needs assessment, which involves talking to a sample of smallholders, producer organizations, extension agents, and other relevant stakeholders. The needs assessment provides insight into the following:

- *Performance gaps:* In what areas can farmers improve? For instance, are they only delivering half the amount of product promised? Are they delivering a substandard product?
- *Farmer characteristics and circumstances:* What are their literacy levels? Do they have reliable access to technology? Can they use technology? What motivates them? (See the section "Selecting an Extension Approach" for more factors to consider.)
- *Existing extension capacity:* Is there an existing network of trainers or extension agents? If not, how will the agribusiness source and train people to deliver the program?

3. *Design the extension program.* Decide on the approach and strategy based on the results of the needs assessment. There are multiple channels for delivering training to smallholders, including the following:
   - Traditional channels, such as extension agents (government, NGO, or firm), agricultural training centers, and farmer field schools
   - Producer organizations, which can be both targets of training and enlisted to provide training to their members
   - Lead farmers and village agents, as discussed earlier
   - Local businesses, particularly small agroretailers, which have a business incentive to offer advisory services that complement their core product offerings
4. *Build partner capacity to deliver the program.* Regardless of delivery channel, firms should train those directly responsible for delivering program services. This helps maintain a consistent level of quality in training delivery. It also fosters the development of a cadre of trained extension professionals who can continue to provide training and advisory services on other projects once the firm's program ends.
5. *Create market links.* Training for the sake of training is not sufficient. An effective extension program will commercially benefit smallholders who are engaged in the program and committed to improvement. Firms that provide training and other extension services should facilitate market and other service links where possible. These include links to providers of credit and financial service, market information, and other business development services.

6. *Monitor and evaluate progress.* Agribusinesses should track progress, measure results and impacts, draw lessons, and use these to inform remaining program activities including future project designs. Chapter 8, "Measuring Results," provides further details on how to measure change and impact in smallholder farming systems.

Note

1. Statista, databank, "Number of Mobile (Cellular) Subscriptions Worldwide from 1993 to 2022 (in millions)," https://www.statista.com/statistics/262950/global-mobile-subscriptions-since-1993/.

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CHAPTER 7
MANAGING RISK FOR SUSTAINABILITY AND RESILIENCE

Kate Bottriell

KEY MESSAGES

- Managing risks in smallholder supply chains entails reducing environmental and social impacts.
- Climate change risks and impacts, including deforestation and environmental impacts on biodiversity, ecosystems, soil quality, water quality, and air quality, must be considered.
- Social impacts on labor and working conditions, communities, land and water rights, Indigenous rights, cultural heritage, antibiotic resistance, zoonotic diseases, and food safety are key issues.
- Environmental and social (E&S) risks are relevant across a range of smallholder contexts, including annual crops, tree crops, and livestock rearing.
- Agribusiness firms are increasingly making prominent public commitments on their social and environmental positions.
- These public commitments are driven by environmental and climate change concerns from a range of stakeholders and include: protecting shareholder and brand value, consumer demands, market access, and financing opportunities.

- Assessing E&S risks against credible, internationally accepted standards is an important first step for firms that are developing and implementing a smallholder engagement and sourcing strategy.
- The advancement of information and communication technology as well as falling prices for remote sensing have facilitated the emergence of systems for geolocating, tracking, and reporting smallholder progress on sustainability criteria.
- For successful long-term implementation, it is critical that firms and smallholders understand the costs and benefits of different approaches.

Introduction

As global agribusiness firms and food brands extend their value chains into frontier and emerging markets in pursuit of lower costs, greater production capacity, and new markets, they are also exposed to a widening array of risks.

Risks in smallholder supply chains include contributions to and impacts of climate change; deforestation; environmental impacts on biodiversity, ecosystems, and soil, water, and air quality; social impacts on labor and working conditions, communities, land and water rights, Indigenous rights, and cultural heritage; antibiotic resistance; zoonotic diseases; and food safety.

Sustainable sourcing—the integration of social, ethical, and environmental factors into the process of selecting suppliers (Ecovadis 2021)—is a way to manage these E&S risks.

The benefits of adopting an E&S risk management approach for smallholder suppliers includes the following:

- Improving the productivity, efficiency, and security of supply
- Access to finance
- Protecting and enhancing shareholder and brand value
- Access to regulated markets and favorable trade tariffs
- Access to preferred markets that pay higher prices for sustainable production

Risk mapping is a first step that firms can use to target their investments in smallholders. Firms that source directly from farmers or from

local intermediaries can use internationally accepted and credible standards to identify which components of a supply chain need targeted capacity building and resources. With that knowledge, they can then build a step-wise roadmap.

Certification can increase access to markets that demand verification of a firm's good practices. This is particularly true for specialty coffee, fine flavor cocoa, and horticultural products, where consumers often seek certified products. Increasingly, government regulations may mandate certain practices, such as the European Union's (EU's) recently approved ban on the import of 14 commodities unless they are certified as deforestation-free. Certification is often combined with other risk management tools, as well as collaborative partnerships at scale. Supply chain aggregation points, such as producer organizations, can facilitate risk mapping, certification, and required farmer training. Advances in technology enable firms to track and manage E&S risks in their smallholder supply.

An agribusiness firm considering whether to adopt voluntary approaches to manage E&S risk along its smallholder supply chain must consider the opportunities and costs of different approaches, for example, the risk of excluding large numbers of smallholders.

The Case for E&S Risk Management along Smallholder Supply Chains

Risks and Impacts in Agricultural Supply Chains

Agricultural supply chains can have extensive and widespread environmental and social impacts, due to the footprint of agricultural production and the number of people involved. These impacts are a major contributor to climate change and pose significant reputational risks to aggregators and consumer-facing companies. Forest fires caused by deforestation to open new agricultural land for oil palm and child labor in the cocoa sector are two recent examples.

Climate Context

Climate change is a critical issue for firms. The initial impacts are felt more acutely in developing countries, exacerbating poverty and inequality. Without drastic action, climate change will impact a much wider part of the global population. Higher temperatures, rainfall variability, severe storms, flooding, and saltwater intrusion will change the agricultural landscape, likely leading to collapse of supply chains and mass migration, with knock-on destabilizing effects on governments and society.

The Intergovernmental Panel on Climate Change (IPCC) estimates that 23 percent of total human-generated greenhouse gas (GHG) emissions (2007–16) come from agriculture, forestry, and other land use (IPCC 2020). Therefore, agribusiness firms have significant responsibility (as well as opportunity) to engage in mitigation and low-emission development (LED) activities.

In December 2015 at the 21st United Nations (UN) Climate Change Conference of the Parties (COP21), 196 countries signed an international, legally binding treaty (widely known as the Paris Agreement) to limit global warming to well below 2°C, preferably to 1.5°C (UNFCCC 2015). The World Bank is now moving toward the Paris Agreement in all its investments (box 7.1). For firms, this means measuring, reporting, and seeking to reduce their direct GHG emissions (known as Scope 1); their indirect emissions (for example, from purchased energy, Scope 2); and their emissions from non-owned activities, including the supply chain (Scope 3). More often than not, emissions along the value chain represent the biggest GHG impact (figure 7.1). For downstream, firms that source agricultural and forestry products, this means taking responsibility for Scope 3 emissions, such as from smallholders, plantations, transport, and processing along the supply chain. This responsibility also includes deforestation from the expansion of agricultural production.

Climate Risks

For agricultural smallholders, the most significant climate impact is likely to be GHG emissions from land clearing and deforestation. The removal of trees releases carbon dioxide (CO_2) from the soil and is a major source of global GHG emissions. When land or felled trees are burned, additional CO_2 is released into the atmosphere. Furthermore, forests absorb CO_2 as part of their growing cycle, and forest loss decreases the global CO_2 absorption capacity.

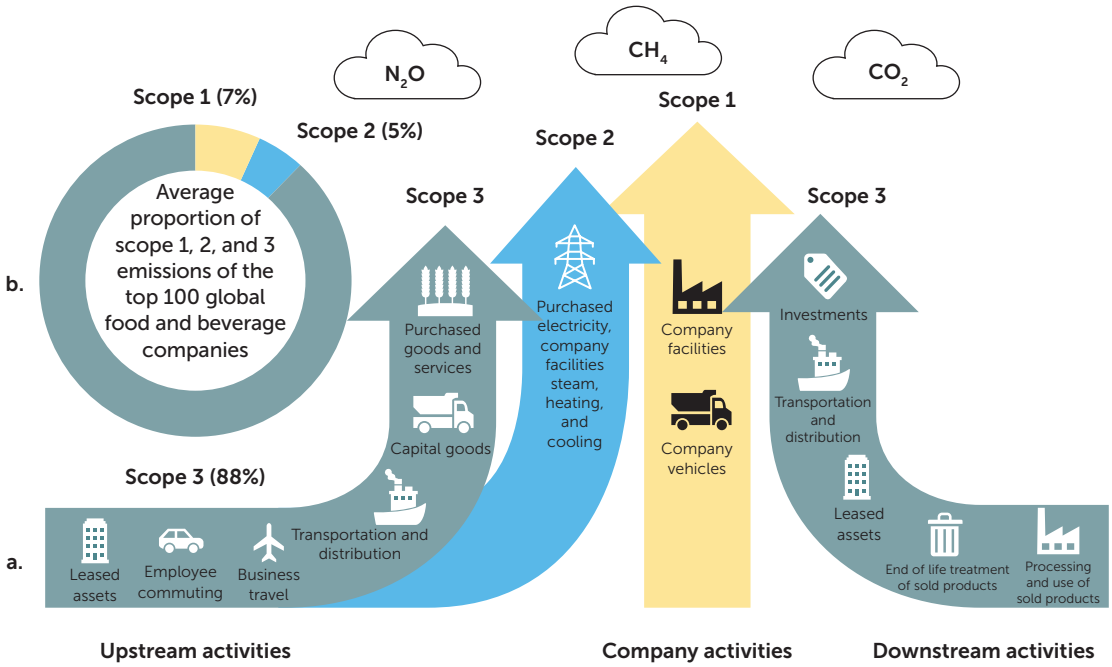
BOX 7.1

The World Bank and the Paris Agreement

The World Bank is committed to aligning financing flows with the objectives of the Paris Agreement. The World Bank is aligning all new operations as of July 1, 2023. The International Finance Corporation and Multilateral Investment Guarantee Agency began to align 85 percent of all new operations as of July 1, 2023. That proportion will rise to 100 percent by July 1, 2025.

Source: World Bank 2021.

FIGURE 7.1 Greenhouse Gas Emissions of the Global Food and Beverage Sector



Source: Reavis et al. 2021.
Note: CH_4 = methane; CO_2 = carbon dioxide; N_2O = nitrous oxide.

Smallholders can also produce GHG emissions on land that has not recently been cleared: Agriculture often involves tilling and disturbing soils, which releases the stored CO_2; use of agricultural fertilizers, which emits nitrous oxide (N_2O); and raising livestock (box 7.2) and rice production, which emit methane (CH_4). The latter two have, respectively, 273.0 and 82.5 times the global warming potential of CO_2 and therefore have a significant impact (IPCC 2021). Low yields and high post-harvest losses associated with smallholder production also increase the intensity of GHG emissions per unit of output. However, note that some smallholder agriculture activities like cocoa and coffee growing may also sequester or store carbon (Grewer et al. 2018).

There is broad consensus in the scientific community that keeping the global temperate increase below 2°C will still result in changes to the climate (IPCC 2018). Therefore, managing future risk must also include smallholders' access to climate-adapted plant and animal species and supporting strategies to protect crops and livestock from climate variability such as extreme hot and cold temperatures, floods, and droughts. Risk reduction thus also entails developing alternative supply sources for firms

BOX 7.2

Global Livestock Environmental Assessment Model

The United Nations Food and Agriculture Organization's Global Livestock Environmental Assessment Model (GLEAM) is a methodology that firms can use to calculate the intensity of the greenhouse gas emissions of their animal operations, as well as identify mitigation opportunities. The assessment takes into account the herd, the feed ration and intake, animal emissions, and manure and feed emissions. An online tool, GLEAM-i, allows firms to input data and export the simulation results.

Source: FAO 2023.

and support for smallholders in case of large-scale regional agricultural product losses. Firms can access country-level climate projection scenarios relevant to their supply chains in the World Bank's Climate Change Knowledge Portal database (World Bank n.d.).

Climate change can exacerbate existing environmental risks, through weather variability and extreme weather events, which then lead to degradation of ecosystems. These may include soil erosion and water pollution (for example, flooding resulting in contaminated waterways), particularly in low-lying coastal areas, river deltas, drylands, and permafrost areas. Climate change can also magnify social risks, such as crop losses and changing local conditions resulting in increased poverty and pressure on labor and operating costs, as well as competition for scarce resources. Such conditions may lead to population migration and conflict with exiting local populations. See box 7.3 for IFC's Performance Standards dealing with the wide range of interconnected risks and their consequences.

Deforestation, Biodiversity, Ecosystem, and Natural Resource Risks

Deforestation and land-use change have wide-ranging impacts on the environment, in addition to the GHG emissions described in the previous section ("Climate Risks"). The *Global Assessment Report on Biodiversity and Ecosystem Services* (Brondizio et al. 2019), published by the UN in 2019, predicts that roughly 1 million species of plants and animals face extinction within decades due to human actions.

When considering the impact on the local natural environment, the aggregate impact of smallholders in the area must be taken into account,

BOX 7.3

IFC Performance Standards

The International Finance Corporation (IFC) Performance Standards are a useful resource for firms. These standards set out IFC clients' responsibilities for managing their environmental and social risks and provide detailed information on strategies for managing and mitigating these risks.

Standard 1: Assessment and Management of Environmental and Social Risks and Impacts

Standard 2: Labor and Working Conditions Performance

Standard 3: Resource Efficiency and Pollution Prevention Performance

Standard 4: Community Health, Safety, and Security Performance

Standard 5: Land Acquisition and Involuntary Resettlement Performance

Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources

Standard 7: Indigenous Peoples Performance Standard

Standard 8: Cultural Heritage

Source: IFC 2012.

rather than the impact of a single landholding. This wider view encompasses a range of impacts: hunting local wildlife populations to extinction; cumulative small-scale land clearing, which can destabilize the functioning of wider ecosystems; firewood collection leading to deforestation; habitat loss; and soil degradation. Nonpoint source pollution is particularly relevant for agriculture, where runoff after rain carries agricultural chemicals such as pesticides and fertilizers and waste into waterways. Additionally, smallholders burning agricultural waste or burning natural vegetation as part of land clearing can significantly harm local air quality. Smallholders may also be negatively affected by these impacts, for example, loss of insects needed to pollinate crops.

Labor, Community, and Human Rights Risks

Respecting people and communities remains the backbone of responsible business practices worldwide. Human rights, women's rights, children's rights, Indigenous rights, and labor rights have been enshrined in a number of international treaties over the second half of the 20th century. Eradicating modern slavery and child labor has been a particular focus of the agricultural sector in recent years. Protecting these rights is relevant for smallholders, as they may not rely solely on family labor,

and therefore issues of slave labor, wages, and working hours are still relevant. Equally, when relying on family labor there is a risk that the work undertaken by children may interfere with their education or involve handling chemicals and pesticides, both of which are prohibited under the International Labour Organization (ILO) Minimum Age Convention (ILO 1973). Furthermore, there is a risk that payments for smallholder products may be insufficient to cover living expenses, and thus perpetuate poverty (see box 7.4). If smallholders are unable to generate a living income from their production activities, they will not be in a position to implement sustainability practices.

Food Safety Risks

Food safety includes the handling, preparation, and storage of food in ways that prevent foodborne illness (caused by bacteria, viruses, parasites, prions, and toxins). It also involves exclusion of foreign materials (metal and glass) and antibiotic or chemical residues (such as improper use of fertilizers or pesticides) from human consumption.

For smallholders producing fresh, perishable products such as fruit, vegetables, meat, dairy, eggs, and seafood, contamination and

BOX 7.4

Living Income

Living income is the net income a household would need to enable all members of the household to afford a decent standard of living. ALIGN, a guidance tool for agrifood firms, helps identify the main areas for adverse wage and income impacts of a household's business activities and supply-chain relationships, measure the living wage and living income levels, visualize the gaps, and take action. ALIGN was developed by the Living Wage Lab (launched by Hivos and Fairfood) and the Rainforest Alliance. Other resources include the Living Wage Community of Practice, the Global Living Wage Coalition, and the Sustainable Trade Initiative (IDH) Roadmap on Living Wage (a joint effort of companies and international and sustainability organizations). Furthermore, Fairtrade International provides living wage reference prices as well as calculation methodologies.

Conflicts over land tenure, land and water rights, traditional use, and cultural heritage may also occur even at a smallholder scale, especially in cases where smallholders have moved onto land either because of new, lucrative production opportunities, government-managed relocation programs, climate change–driven migration, or other inducements.

Source: The ALIGN tool may be found at https://align-tool.com/.

maintaining the cooling chain are major food safety issues. For smallholders producing cereals, mycotoxin fungal contamination (most notably from aflatoxins) is of significant concern, especially for groundnuts (peanuts) and, to a lesser extent, maize. Mycotoxin contamination can also occur in animal feed and has been cited as one of the limiting food safety and quality factors preventing smallholder livestock farmers from progressing to commercial agriculture (Changwa et al. 2021).

Food quality and safety are also linked to GHG emissions. An estimated 8–10 percent of global GHG emissions are associated with food waste, including losses in the supply chain and food wasted by consumers (Mbow et al. 2019).

Animal Health Risks

At the heart of sustainability in the animal protein sector is good animal health. Infectious diseases pose high risks to livestock industries, including avian flu, African swine flu, salmonella, and Newcastle disease, to name a few. However, small-scale farmers rarely have the resources to make the necessary investments in their herd or flock health, and vaccine uptake is low among smallholders. Preemptive expenditure on disease control is minimal, and an outbreak of disease can kill up to 70 percent of a flock. Knowledge is therefore a crucial component of vaccine uptake and of preventive actions to reduce the incidence and spread of infections. Pearl Dairy, an IFC client in Uganda, reduced the risk of tick-borne diseases through farmer training by a network of 50 extension agents (box 7.5) .

BOX 7.5

Case Study: Managing Animal Health Risks in Small-Scale Ugandan Dairy Farms

Snapshot

A milk-processing company offers training in animal health to rural cattle farmers and helps them improve milk production.

Challenge

Cattle farming serves as the main source of livelihood for the majority of rural Ugandans. But even as livestock accounts for 9 percent of gross domestic product, many dairy herds struggle to reach their potential in terms of milk production and quality. Tick-borne diseases in cattle are common

box continued

BOX 7.5

Case Study: Managing Animal Health Risks in Small-Scale Ugandan Dairy Farms *(Continued)*

and pose a key constraint. This has a detrimental effect on smallholder incomes, as well as on the availability of dairy products in a country where more than one-third of all children (2.4 million) have stunted growth.

Opportunity

In Uganda, the International Finance Corporation (IFC) and the Global Agriculture and Food Security Program (GAFSP) have been working with Pearl Dairy, the country's largest milk-processing plant, to extend technical support to the company's small-scale raw milk suppliers. This successful, collaborative approach may prove useful as a template for application elsewhere.

In 2013, IFC and the GAFSP made a joint investment of US$8 million in Pearl Dairy to support expansion of the company's operations, including the establishment of milk-collection centers and cold-storage infrastructure in Uganda's western region, where many small-scale farmers traditionally have not had access to formal dairy markets.

In parallel, IFC partnered with Pearl Dairy on an advisory initiative, the Dairy Development Program, which has built a professional team of 50 dairy extension officers called Dairy Development Executives (DDEs). The DDEs provide technical support to farmers on practical issues, such as the most effective and sustainable tick-control methods that are appropriate and affordable to small-scale farmers. Working with 700 core dairy farmer suppliers, the DDEs reach a network of 10,000 farmers through the core farmers and additional group training events.

Impact

Pearl Dairy's outreach has already made an impact. The majority of Pearl's smallholder suppliers have adopted the projects 10 Golden Rules of tick control, and consequently, farmers have recorded a 60 percent reduction in mortality due to tick-borne diseases. Thanks to the training, farmers are also producing better-quality milk, and raw milk production capacity has increased to 7–8 liters per cow daily, up from less than 4 liters previously. These farmers now offer a stable supply of high-quality raw milk for Pearl Dairy to process, thus increasing the availability of nutritional dairy products for consumers. Pearl Dairy also offers farmers incentives to deliver more milk at higher quality. These incentives include prenegotiated financing with local microfinance institutions for farm improvements, with guaranteed repayments from milk proceeds, timely payments, and improved logistics through additional milk-collection centers adjacent to dairy farms.

"We can only grow if our farmers also grow and so we need to work together to take them to the next level of production," observed Amit Sager, CEO of Pearl Dairy, to IFC interviewers.

Source: Original content for this book provided by IFC.

According to the World Health Organization (WHO), antimicrobial resistance (AMR) is one of the biggest threats to global health, food security, and development today. AMR impedes the global public health responses to the threat from infectious diseases. Systematic misuse and overuse of antimicrobial drugs in human medicine and food production put everyone at risk (World Bank 2017). For small-scale farmers in low- and middle-income countries, misuse and overuse of antibiotics are particularly prevalent among dairy cattle farmers (Suriyasathaporn et al. 2012; Chauhan et al. 2018; Benavides et al. 2021) and poultry and swine farmers (Cuong et al. 2018). In most cases this has been attributed to weak animal health systems, lack of veterinary advice, and easy availability of nonprescribed antibiotics (see box 7.6).

As the global COVID-19 pandemic has underscored, infectious animal diseases have the potential to become zoonotic (pass from animals to humans) and move quickly from local to international significance. Biosecurity measures prevent disease-causing agents entering or leaving any place where they can pose a risk to farm animals, other animals, humans, or the safety and quality of a food product. A robust biosecurity routine is always essential for small-scale farmers, not only at times when there is a major disease outbreak. Good animal hygiene practices must be implemented in livestock operations, as well as by smallholders who use animals for tilling and transport, or who keep animals for domestic use, as demonstrated in box 7.7.

BOX 7.6

Antibiotic Use in Agriculture and Antimicrobial Resistance

Antibiotics are also used on crop plants to control phytopathogenic bacteria, reportedly in all regions of the world except Africa (no data for Europe). In a study of low- and middle-income countries (where antibiotics were reportedly freely available through unregulated supply chains and over-the-counter sales), the main crops antibiotics were used on were rice, and to a lesser extent tomato, citrus, paprika, potato, cabbage, eggplants, pumpkin, onions, and maize. This includes use of critically important antimicrobials for human medicine, especially streptomycin, as well as amoxicillin, tetracycline, oxytetracycline, gentamicin, and cefadroxil. This is a serious concern for antimicrobial resistance.

Source: Taylor and Reeder 2020.

BOX 7.7

Suguna Foods

Suguna Foods, a long-term client of the International Finance Corporation, is one of the largest fully integrated poultry enterprises in India. Suguna's contract-farming system reduces transaction costs on all inputs and veterinary services, transfers best practice farm management to the farmer, and provides regular income to broiler farmers. This outgrower model works well in a low-income setting where farmers have a labor surplus but do not have the capital to invest in their farms. Suguna extension officers visit each of their allocated farms every day.

Among other services, farmers receive hands-on training in good biosecurity practices—from disinfecting vehicles to limiting access to the flock, and from feed and water management practices to disposal of damaged eggs, dead birds, litter, and manure. Crucially, Suguna's contract broiler farmers are paid according to key performance indicators set out in their contracts, with higher payments for better quality and on-time delivery, so farmers are incentivized to follow the advice they receive.

Suguna's model has been proven to be successful for both the contract broiler farmers and the company: In 2019 the company generated revenues of approximately US$1.334 billion and net profit of US$30 million. As for the small-scale suppliers, studies have shown that Suguna's model led to an increase of 114 percent in net profits.

Source: IFC.

Business Context and Benefits

For agribusiness firms sourcing from smallholders, identifying and managing these E&S risks is critical both from a societal as well as a business point of view. The choice of strategy must weigh expected benefits against the costs associated with implementing risk management and mitigation activities.

Improving Productivity, Organization, and Security of Supply

Implementing E&S risk mitigation approaches often requires farmers to be trained on practices that improve farm productivity and quality. The gap between current smallholder farmer yield and potential yield is significant, typically more than 40 percent (Fischer, Byerlee, and Edmeades 2014). Improved farming practices that generate cost savings at the farm level and deliver higher yields or better-quality produce are win-win for farmers and for firms—helping firms secure their supply base and improving farmer rewards. Investing in farmers through training can also increase farmer loyalty to a firm (box 7.8).

BOX 7.8

Better Cotton, Better Supply

Under the Better Cotton Initiative (BCI), licensed farmers must achieve a set of minimum requirements, for example, integrated pest management, soil, water, and habitat conservation. Thereafter, farmers follow a continuous improvement approach, by which they are further assessed—producers who perform strongly on the improvement indicators are rewarded through extended license periods. Cotton-gin members (those that buy from farmers) noted that meeting the BCI standard entailed some upfront farmer training costs for them, but they were then able to secure their supply and their markets, while farmers increased their net revenues per hectare.

Source: World Bank.

Better farmer organization (as a result of a firm's systematic engagement with smallholders) can also help establish shared labor pools, microcredit unions, and other economies of scale. Supporting farmers to implement climate-adaptation strategies will also help firms secure future supply.

Access to Finance

Firms may be able access finance and technical assistance via funding windows and programs reserved for inclusive smallholder or sustainable supply-chain development. Smallholders themselves may gain access to finance as a result of compliance or certification. Some banks require borrowers to demonstrate compliance with guidelines on social and environmental issues (such as those set out in the Equator Principles, see box 7.9), including community consultation, Indigenous peoples, and labor standards. This trend is driven by consumer demands, food safety concerns, and pressure for climate change mitigation and firms wishing to avoid reputational risk.

Shareholder and Brand Value

Proactive management and disclosure of environmental, social and governance (ESG) risks, including those in the smallholder supply chain, can benefit firms if they are listed in ESG and socially responsible investing (SRI) stock market indices. There are over 1,000 indices that evaluate the sustainability performance of firms (BlackRock 2019), for example, the Dow Jones Sustainability Index (DJSI); the FTSE4Good Index Series; the Standard & Poor's (S&P) Paris-Aligned & Climate

BOX 7.9

The Equator Principles

The Equator Principles are based on the International Finance Corporation's Performance Standards and serve as guidance for financial institutions to determine, assess, and manage environmental and social risks in projects. These principles provide a basis standard for due diligence and monitoring to support responsible risk decision-making, and focus on eight key social, environmental, and governance issues. As of April 2021, 117 financial institutions in 37 countries have officially adopted the Equator Principles, covering the majority of international project finance debt in emerging and developed markets.

Source: Equator Principles website, "News," https://equator-principles.com/news/.

Transition (PACT) Indices, and so forth. The Sustainable Stock Exchanges (SSE) Initiative reports that over half of tracked stock exchanges publish ESG public reporting guides for their listed firms (SSE Initiative 2019). Furthermore, in recent years ESG stocks have outperformed the general market (Pástor, Stambaugh, and Taylor 2021).

For private and state-owned firms, nongovernmental organization (NGO) campaigns and consumer boycotts, especially around issues of environmental destruction or human rights violations, can severely damage brand value with impacts on market share and profits. Brand value and perceived company ethics are also important for employee recruitment and retention.

Access to Regulated Markets and Preferential Trade Tariffs

In recent years, national regulations have been introduced to hold firms accountable for E&S practices in their supply chain. Examples include Modern Slavery Acts (Australia, UK); the Transparency in Supply Chains Act (California); the Duty of Vigilance Law (France); the Child Labour Due Diligence Law (Netherlands); Forest Law Enforcement, Governance and Trade (FLEGT) in the EU; the Lacey Act in the United States (the latter two concerning due diligence to exclude illegal timber); and the Forest Code in Brazil being enforced against firms and financial institutions for supply-chain noncompliances (Amaral, Reis, and del Giudice 2017). The EU Commission is currently preparing a legislative proposal on sustainable corporate governance, which will introduce mandatory human rights and environmental due diligence for firms, including risks linked to forced labor (EU 2021).

An example of preferential trade tariffs for sustainable practices is the 2021 free trade agreement (FTA) between Indonesia, a major world producer of palm vegetable oil, and the European Free Trade Association states (Iceland, Liechtenstein, Norway, and Switzerland). This agreement provides 20–40 percent tariff reductions for vegetable oils and their derivatives traded according to the "laws, policies and practices aiming at protecting primary forests, peatlands, and related ecosystems, halting deforestation, peat drainage and fire clearing in land preparation, reducing air and water pollution, and respecting rights of local and Indigenous communities and workers" (Sieber-Gasser n.d.).

Access to Preferred Markets

Consumer demand for goods that follow good social and environmental practices is well established in European and North American markets. Demand is growing in emerging economies, such as Brazil, China (see box 7.10) (Proforest n.d.), and India, where traders and manufacturers are also starting to require that their suppliers deliver responsibly sourced commodities.

Global brands are increasingly making public commitments about sustainability—especially in relation to labor standards and the environment—that are largely driven by the need to protect brand and shareholder value and by market demand. For example, the Consumer Goods Forum (an industry association representing some 400 corporate members with combined sales of $4.1 trillion) has made commitments on maintaining supply chain responsibility, minimizing deforestation, protecting human rights, reducing plastic waste, and ensuring food safety.

Price Premiums Cover Operating Costs

There are indications that consumer behavior is changing, with market research in 2020 indicating that 80 percent of consumers were willing to pay more for sustainable goods, compared to 50 percent in 2013 (Kearney 2020). However, the same study found that there is a gap between how much consumers say they are willing to pay (on average 10 percent more) and the actual average price markup of 75–85 percent for goods marketed as sustainable (see figure 7.2).

Even in markets where consumers pay premium prices for sustainable goods, these may not be realized as additional profit by smallholders or the firms closer to primary production (upstream). Price premiums may be absorbed by the retailers, manufacturers, and other middlemen in the supply chain. If firms do receive a market premium, note that smallholder monitoring and support programs will also incur costs. Thus, higher prices

BOX 7.10

Case Study: Chinese Company Implements Responsible Sourcing with Soy Smallholders in Brazil

Snapshot

A major Chinese buyer of soy implements smallholder-responsible sourcing, including training and remote environmental and social (E&S) data collection.

Challenge

For agribusiness companies sourcing bulk commodities from many suppliers, implementing responsible sourcing commitments can be challenging due to a lack of information about the suppliers and their production. Smallholders can inadvertently be excluded from supply chains when they cannot demonstrate that they have the E&S requirements.

Opportunity

China Oil and Foodstuffs Corporation (COFCO) International is a Chinese state-owned food-processing holding company and is China's largest food processor, manufacturer, and trader. In 2019, COFCO International committed to support the sustainable and responsible production and sourcing of soy oil. It implements this commitment through its "Supplier Code of Conduct," which applies not only to its suppliers but to their suppliers, and well as a support program. COFCO sources from both large-scale farms and smallholders.

COFCO specifically promotes the inclusion of smallholders in its supply chain. COFCO's technical teams visit farms in Brazil and Paraguay to provide expert support to smallholders throughout the production process, from planning, soil preparation, planting, and pest control all the way to harvest and storage.

COFCO International has partnered with the International Finance Corporation (IFC) in Brazil to develop a more traceable and sustainable soy supply chain in the Matopiba region in Brazil, including direct and indirect suppliers that have not been prefinanced. The screening uses farm contours, satellite imagery, and other geographical information and official data. The aim is to ensure that supplying farms are free of forced labor; are not located on land held by Indigenous people, conservation units, or embargoed areas; and are in compliance with the Amazon Soy Moratorium. The project will also establish land conversion profiles for individual farms and assess supplier compliance with the Cadastro Ambiental Rural (CAR), a mandatory electronic registration that combines geospatial data of rural properties with their environmental information, including legally protected areas.

Impact

In 2019, COFCO purchased over 330,000 metric tons of soybean from 24 cooperatives, benefiting over 50,000 smallholder soy farmers in Brazil. In Paraguay, COFCO worked with Solidaridad and Cooperativa Colonias Unidas on a two-year continuous improvement project (the MejorAgro

box continued

BOX 7.10

Case Study: Chinese Company Implements Responsible Sourcing with Soy Smallholders in Brazil *(Continued)*

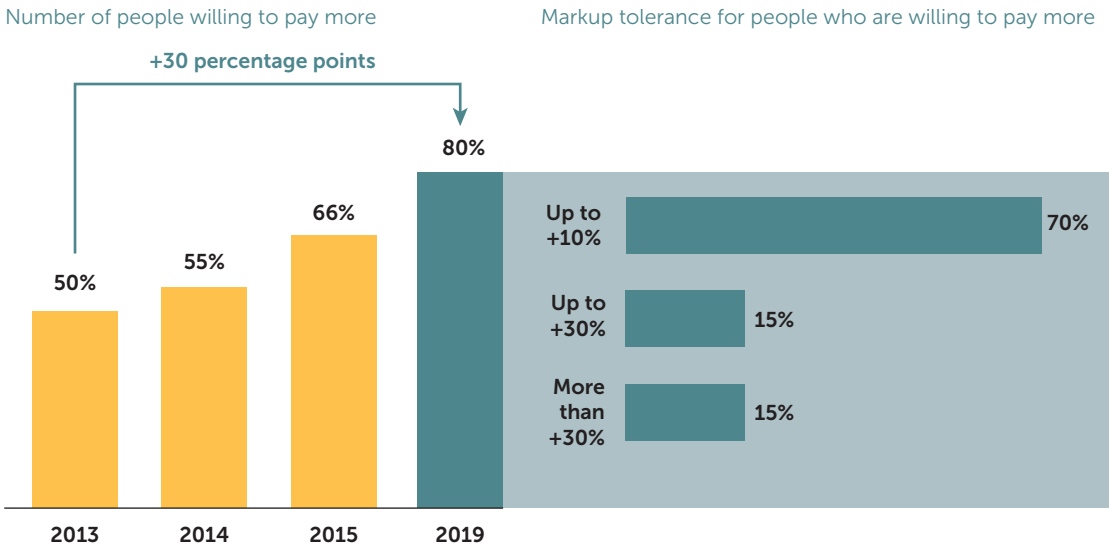
initiative), where 100 smallholder soy farmers learned about a wide range of sustainable farming topics, including disease prevention, soil protection, fair labor practices, and sustainable forestry and wider environmental management, through field visits, training workshops, and various materials. Data showed that 70 percent of farms have improved since the project started in 2017.

COFCO International and IFC expect the traceability project to cover all of COFCO International´s direct suppliers in the Brazilian Matopiba region by 2023.

Sources: COFCO 2019, 2020, n.d.

FIGURE 7.2 Consumer Behavior regarding Price Premiums

Many consumers are willing to pay more for green products



Source: Kearney 2020.
Note: In terms of price tolerance, the study found around 70 percent of all consumers surveyed reported they would pay up to 10 percent more, another 15 percent would pay 30 percent more, and another 15 percent would pay more than 30 percent.

may need to be paid to the supplying smallholders, and consequently, the premium paid may be absorbed by operating costs.

Solutions, Strategies, and Best Practices for Implementing E&S Risk Management

Firms with mature approaches to sustainable sourcing manage E&S risks as a strategy to protect and build their core business. They typically apply a combination of risk management, sustainable sourcing requirements, and proactive engagement with noncompliant sources with high potential to transform. Many firms recognize that for smallholders in their supply chains, achieving compliance with E&S standards can be more difficult and take longer than for larger suppliers, and they have sought ways to support, track, and reward smallholder progress. In recent years, firms have been increasingly involved in collaborative partnerships to achieve change across entire landscapes and tackle deep-rooted sector issues that cannot be solved at the level of an individual producer.

Identifying Environmental and Social Risks

Firms should begin with a systematic approach to identifying E&S risks for smallholders in their supply chain. The topics outlined above in the section "Risks and Impacts in Agricultural Supply Chains" provide a useful framework, as do the IFC Performance Standards (box 7.3) and other sector-specific sustainability standards (box 7.15). Furthermore, the UN's Sustainable Development Goals (SDGs) are also a useful resource for identifying focus areas.

Firms with complex supply chains (for example, sourcing multiple ingredients from thousands of suppliers across multiple geographies) may find it simplest to start with a high-level country and commodity risk analysis based on publicly available information.

Firms with geographically concentrated, single-product supply chains may choose to focus on local risk factors such as proximity to forested areas and waterways, reports in the local media, and government data (box 7.11). At the initial stage, it may be most efficient to focus on risks in a landscape or economic radius of a processing facility. An initial desk-based risk assessment can be complemented by field visits and discussions with suppliers, smallholders, civil society representatives, government officials, and other stakeholders, depending on budget and time constraints. More complex risk analyses, such as individual supplier

BOX 7.11

Useful Risk Data Sources

- Global Forest Watch Forest Change Map, https://www.globalforestwatch.org/map/
- Trase Supply Chains, https://supplychains.trase.earth/
- Global Slavery Index, https://www.globalslaveryindex.org/2018/data/maps/#prevalence
- Transparency International's Corruption Perception Index, https://www.transparency.org/en/cpi/2021
- Human Rights Status of Ratification Interactive Dashboard, https://indicators.ohchr.org/
- Global Map of Environmental and Social Risk in Agro-Commodity Production (GMAP), https://gmaptool.org/

scorecards, can be developed as part of an implementation strategy, once the priority suppliers and smallholder groups have been identified and the targets set.

Prioritization

Firms should prioritize where to focus their time and resources based on the following:

- The highest E&S risks
- The number of suppliers and volumes associated with the highest risks
- The number of suppliers and volumes associated with unknown risks
- The E&S requirements of their buyers

Typically, firms develop a stepwise approach that prioritizes the supply chains with the highest risk and the biggest volumes. Where firms buy directly from smallholders or local intermediaries, they can use the initial risk and priority assessment to select which regions or smallholder groups to focus on, and the approach may include both engagement and exclusion strategies. Given that smallholders are less likely to be able to provide evidence of social and environmental compliance, firms should not unintentionally exclude them from the supply chain.

The next step is to create a baseline understanding of the priority smallholders' current performance status measured against a credible

standard or framework, and to do this, as well, with the organizational status of farmers. Where firms buy from smallholders or local intermediaries, they can undertake this directly. Downstream firms (further away from smallholder production) likely will need to engage with their suppliers to develop this approach in partnership. Firms should refine their strategy based on the results of the baseline assessment, tackling the biggest compliance challenges, targeting capacity building and resources, and defining the end goal of the program.

A Stepwise Roadmap

Firms should set a policy that defines which risks, smallholder practices, and level of performance are targeted. For many sectors, third-party certification systems are tools that can be used to both define the scope of E&S issues and confirm compliance (see the section "Standards, Verification, and Certification"). A firm could, for example, set an end target of 100 percent certification of producer organizations and coops.

Interim goals may consist of setting up an internal verification system for the smallholder supply base, establishing annual targets for the number of farmers engaged in training, or setting targets for the number of farmers included in the verification program (see box 7.12). Firms may stagger the rollout of their smallholder program based on key issues:

BOX 7.12

A Stepwise Approach to Smallholder Environmental and Social Risks and Solutions

- Risk assessment
- Prioritization
- Baseline assessment
- Timebound roadmap
- Smallholder support
- Smallholder verification
- Interim targets and reporting
- End targets and reporting
- Review and update strategy

Source: World Bank.

For example, training and verification may focus first on easy wins and then proceed to more challenging implementation topics. Benchmarking continuous improvement, setting targets for closing out noncompliances, or establishing partial certification targets can also be used to report interim progress.

A stepwise approach can be a cost-effective strategy to respond to buyers' demands for good E&S practices, although firms may be required to negotiate with their buyers on the timescale of compliance. When production practices among smallholder farmers are significantly out of compliance with the market requirements, the approach presented here can lay out a roadmap for firms, farmers, and buyers.

Leveraging Existing Structures

Firms will benefit from integrating E&S strategies into their core business activities and existing quality systems, for example, the International Organization for Standardization [ISO] 14001 certification and food safety systems (such as ISO 2200 certification). Traceability systems that are used for food safety and for monitoring farmer productivity, quality, or payments can be extended to include additional social and environmental verification elements.

Another efficient pathway for implementation—and one that can save time and money—is to build on existing external programs and groups that smallholders are already involved with. Existing farmer field schools and other farmer development programs operated by government, development agencies, or NGOs may present useful synergies and partnerships. Existing farmer organizations can also be useful. Firms should also look beyond the more traditional farmer-based groups to villages, families and clans, schools, religious groupings, and even sports groups to leverage existing relationships and trust between them and smallholders.

Enabling Environment and Collaboration

Firms engaging with others in the sector as partners for implementation represents another opportunity for collaboration, particularly in cases where there are potentially precompetitive challenges, such as child labor, that would benefit from sector or national approaches. Partnerships and pooling of resources can be valuable when firms have limited leverage, such as cases in which smallholders have the flexibility of selling to multiple firms.

Firms may find it helpful to participate in sector or industry roundtable discussions to understand and anticipate what will be required.

These discussions also provide opportunities to share best practices and lessons learned with others, especially regarding how standards can be applied in the context of smallholders. Some of these are identified in box 7.15, "Sustainability Standards."

Demonstrating and Monitoring Smallholder Compliance

It is expensive and difficult to monitor smallholder farmers' compliance with environmental and social standards because the farms are geographically dispersed and usually lack written records. Many smallholders also do not have formal land tenure, so digital maps of farms often do not exist.

Standards, Verification, and Certification

Voluntary certification is a commonly used tool for communicating that a product originates from a farm or landholding that is verified to be in compliance with an established standard. A certification system includes a standard, verification by third-party accredited auditors, and has a governance system (see box 7.13, box 7.14, box 7.15, and box 7.16). The development of voluntary standards is normally undertaken with wide consultation from stakeholders and follows the International Social and Environmental Accreditation and Labeling (Alliance) (ISEAL) Codes of Good Practice for sustainability systems (ISEAL n.d.).

Standards may also be applied outside of certification—when firms use the requirements of the standard to undertake their own farmer and supply-chain checks or use third-party data sources to determine eligibility of suppliers. Some firms choose to develop their own in-house

BOX 7.13

Coffee and Cocoa Standards

The global coffee chain Starbucks has developed its own standard, C.A.F.E. Practices, which it uses to undertake field verification of its coffee suppliers. At the same time, they source 99.7 percent of tea from farms certified by the Rainforest Alliance (a third-party certification system) and 100 percent of cocoa beans from either supply chains verified by COCOA Practices (their own standard) or UTZ-certified farms (now part of the Rainforest Alliance).

Source: World Bank.

BOX 7.14

What Are Standards and Voluntary Certification?

A standard is a written norm or requirement that establishes a threshold of good practice. Verification is the process of evaluating and confirming compliance with a standard.

- First party: A firm verifies compliance with standards using in-house staff (also known as self-assessment).
- Second party: Buyers or other interested parties conduct verification of standards.
- Third party: An external, independent auditor verifies compliance.
- Certification audit: An external, independent auditor approved by the certification system verifies compliance.

Certification is the mechanism for communicating that a firm has verified compliance with an established standard.

A standards system or certification system typically includes the following:

- A standard
- Verification by approved auditors (accreditation)
- A governance system

Voluntary certifications are systems in which firms choose to participate. A primary goal of voluntary certification is to reach a tipping point where the entire industry shifts, although this has not yet been achieved for agricultural or forest commodities (table B7.14.1). While voluntary certifications are valuable tools, neither risk-based exclusion nor certified sources address leakage, where the poorer performing suppliers simply sell to other markets that don't have environmental and social requirements. Therefore, additional collaborative approaches that address root causes are also needed.

TABLE B7.14.1 Portion of Global Market Sustainably Certified

Timber	Cocoa, coffee, and tea	Cotton	Palm oil	Soy
28.5% of tropical timber, 18% of all timber[a]	20–30% certified	22% certified	19% certified	2–3% certified

Source: Original table for this book provided by IFC.
a. ATIBT 2019.

BOX 7.15

Sustainability Standards

Sustainability standards are valuable tools for firms to measure their performance against widely accepted practices, plan their strategy, and when used as part of certification systems, to communicate environmental and social performance to buyers. They are mostly voluntary and market driven—and therefore are not regulated (with food safety and environmental health concerns a significant exception). Some firms have also developed their own standards and verification systems. Within each category there are myriad schemes (more than 400 in all), each with slight differences in reach and requirements. The International Trade Centre has developed a "Standards Map"[a] tool to help firms find the best fit for their needs.

Source: World Bank.
a. ITC Standards Map (database), International Trade Center, Geneva, http://www.standardsmap.org/.

BOX 7.16

Examples of Agricultural Standards

Management Systems

Management system standards provide a framework for setting policy and developing and implementing policy and procedures, but they do not define what these should be. For example, the International Organization for Standardization (ISO) 9000 series is for quality management, and the ISO 14000 series is for environmental management. Formal management systems are unlikely to be implemented by smallholders, but firms sourcing from smallholders will often have these in place.

Sustainable Forestry and Agricultural Commodities Standards

For primary agriculture commodity production, standards focus on environmental and social (E&S) practices and increasingly include requirements related to climate-smart agriculture and reducing emissions. These standards also typically include traceability and control systems for the supply chain. Examples for forestry are Forest Stewardship Council (FSC) and Program for the Endorsement of Forest Certification (PEFC); for soy, the Round Table on Responsible Soy Standard (RTRS) and the Proterra Standard; for palm oil, the Roundtable on Sustainable Palm Oil (RSPO); and for coffee, cocoa, tea, and hazelnut, the UTZ-certified farms (now part of the Rainforest Alliance). Many of these certification systems have specific standard requirements for smallholder farmers, as well as options for group certification.

box continued

BOX 7.16

Examples of Agricultural Standards *(Continued)*

Fair Trade Standards

Fair trade standards aim to ensure that producers are fairly paid. There are 20 national fair trade organizations that are members of Fairtrade International. These organizations use a standard that requires buyers to pay a price to producers that aims to cover the costs of sustainable production and to pay an additional sum that producers can invest in development. Advance payments and signed contracts are also included in the approach. The World Fair Trade Organization, the Network of European Worldshops, and the European Fair Trade Association are other examples.

Sustainable Livestock and Animal Products Standards

Sustainability standards for livestock typically cover good E&S practices, with additional focus on animal waste and nutrient management as well as animal welfare. In general, these standards are designed for large-scale operations (for example, the Global Roundtable for Sustainable Beef [GRSB] and its national standards), although some niche standards for small-scale animal farmers do exist: for example, the Aid by Trade "Good Cashmere" certification system.

Organic Standards

Organic certification is used in primary production. Organic certification includes avoidance of synthetic chemical inputs not on the National List of Allowed and Prohibited Substances (fertilizer, pesticides, antibiotics, and food additives), genetically modified organisms, irradiation, and the use of sewage sludge. The International Federation of Organic Agriculture Movements unites 750 member organizations in 116 countries. Nongenetically modified organism standards are also available.

Climate and Carbon Standards

The Fairtrade Climate Standard (a collaboration between Fairtrade and the Gold Standard) is a voluntary carbon credit project standard that includes minimum pricing for forestry, renewable energy and energy-efficient projects implemented by smallholders, and additional fees to support communities with climate adaptation and market them as fair trade carbon credits. The Gold Standard also includes specific guidelines for smallholders (Kratz n.d.). The International Sustainability & Carbon Certification (ISCC) is a system for certifying biomass and bioenergy. Smallholder certification is available and is based on group certification.

Good Agricultural Practices

Primary producers apply standards that focus on good agricultural practices and traceability, typically applied to crops, fruits and vegetables, horticulture, and animals. These standards are

box continued

BOX 7.16

Examples of Agricultural Standards *(Continued)*

particularly relevant for products that are directly consumed, and are often legally required for market access as they typically include elements of food safety when applied to food. Productivity, soil, water, and animal health production and welfare are key focus areas. For example, GLOBALG.A.P. is applied to fruits and vegetables, combinable crops, coffee, tea, flowers, and ornamental plants. GLOBALG.A.P. offers a mutual recognition system for a number of national standards.

Food Safety Standards

Food safety standards include practices that aim to lower the incidence of foodborne illness in the supply chain and traceability back to source. Traceability is very important in isolating the cause of food safety problems. Food safety standards tend to be regulated in international and domestic markets, and as such, they differ from many of the other voluntary standards discussed here. Examples include the Global Food Safety Initiative, Safe Quality Food, British Retail Consortium, International Food Safety, and Food Safety System Certification 22000. Many of these are based on the Codex Alimentarius, a collection of internationally recognized standards, codes of practice, guidelines, and other recommendations published by the Food and Agriculture Organization relating to food, food production, food labeling, and food safety.

Source: World Bank.

standards and verification systems. However, without the benefit of third-party oversight and governance, the credibility of the results is reduced and creates a larger administrative burden to pass information along the supply chain.

Firms should evaluate the availability of standards and certification systems for their products, whether group certification is available (an approach specifically designed for smallholders), and what their buyers are demanding. It is possible to combine several different standards in a single smallholder support and certification program.

Group Certification for Smallholders

Group certification models issue one certificate to a number of smallholders complying with a standard (box 7.17). Groups may be formally registered or not, depending on the prevailing regulations. This model of certification is important for smallholders, as it allows the costs and administration to be shared across groups of producers with small volumes.

BOX 7.17

Structure of Group Certification

Group certification generally requires the following:

- A central body, such as a producer organization
- A defined group of smallholders
- Files on all members
- At least an annual internal inspection
- Set procedures and sanctions to address noncompliance

Source: World Bank

If smallholders sell to multiple firms or have a strong existing group organization, it may be more appropriate for the group to maintain and manage an internal control system (ICS) for group verification. However, if the smallholders are effectively tied to the firm due to geography, land-lease and input agreements, or other contracts, it may be more appropriate for the firm to manage certification initially and build group capacity to deploy some of the elements of the system.

The ICS may be set up so groups of farmers are trained and verified, feeding the group results into a central system (much as a plantation might manage blocks or a large farm might manage fields), or individual farmers can feed directly into a single internal control system. In many cases, standards systems require homogeneity of group members regarding geographic location, production system, size of holding, and common marketing system.

The ICS holds records on each farmer in the group and coordinates an internal verification program that measures each farmer's performance. The system also tracks reported noncompliances and remedial actions taken in response. In doing so, the ICS provides full traceability of suppliers to the producer organization. Some systems include mechanisms to exclude nonperforming farmers or farmer groups. Third-party verifiers inspect the functioning of the system and spot-check the practices of a sample of individual farmers. See box 7.18 for a case study.

Jurisdictional or Landscape Approaches

Jurisdictional approaches seek to drive good E&S practices over a large geographic area, by engaging both local governments and civil society

BOX 7.18

Case Study: Integrating Independent Oil Palm Smallholders into Supply Chains

Snapshot

An Indonesia palm oil producer supports independent smallholders in forming farmer groups and meeting international sustainability criteria for market access.

Challenge

To gain access to markets that demand sustainable certification, such as the Roundtable on Sustainable Palm Oil (RSPO), smallholders need to implement a group certification system and meet environmental and social (E&S) criteria. Grouping strangers into a farmer's association for certification requires the smallholders to trust not only the field assistants but also each other to prevent the farmer association from disbanding and losing the certification. Indonesia has over 633 ethnic groups and 583 dialects, bears a history of civil conflict, and has nearly 1 million internally displaced Indonesians, which presents a challenge to palm oil smallholders.

Opportunity

Musim Mas (MM) is an Indonesia palm oil producer that has its own plantations and mills and also buys from smallholders. With support from the International Finance Corporation (IFC), MM set up a program that sought to improve the livelihoods of smallholders by integrating them into sustainable palm oil supply chains, with the objective of increasing not only financial value but also sustainable value, as well as having the surrounding environment and community benefit.

Following a diagnostic study on smallholders, IFC and MM developed and implemented a program in North Sumatra (Rantauprapat) and Riau (Pelalawan, Rokan Hilir, and Rokan Hulu), Indonesia. These mills were prioritized because they source mainly from independent smallholders. After successful pilot programs, MM developed and implemented a modified version in their mills and supplier mills.

The program's smallholder support modules mirror the RSPO's "Principles and Criteria," and the program prepares smallholders for RSPO group certification. There are four pillars: environment, business management, social, and other issues that smallholders may face in their journey toward sustainable palm oil.

The program also helps smallholders access government subsidies for replanting and includes advisement on finding partnerships with and completing the necessary paperwork for financial institutions or banks. Replanting aging oil palms (with decreasing yields) is also a challenge for smallholders, as costs amount to Rp 50–60 million (US$3,400–4,100) per hectare, and smallholders may not have enough savings. This financial assistance encourages smallholders to adopt more sustainable methods of replanting and improves their productivity per hectare.

box continued

BOX 7.18

Case Study: Integrating Independent Oil Palm Smallholders into Supply Chains *(Continued)*

Impact

Since the start of the program in 2015, MM and IFC have engaged over 30,000 smallholders. As of December 2020, 2,092 independent smallholders have been certified by RSPO, and the program continues to support other smallholders who wish to be RSPO certified. The program has helped independent smallholders sell RSPO Credits to Nestlé, Unilever, and PepsiCo.

According to one MM supplier, "We could maximize our yield on our farm by implementing good agricultural practices. . . . This learning made me reassess my strategy to buy more land. Instead, I focused more on maintaining the existing land that I currently have and maximizing its land production."

Source: World Bank.

organizations in issues that are difficult to solve at the level of an individual landholding (ISEAL 2020). This may include, for example, the protection of forests and high conservation value (HCV) areas, the traceability of supply material, land rights, or the application of free prior and informed consent (FPIC).

Jurisdictional approaches may be linked to certification, where all production in a defined landscape or geography is awarded compliance certificates with recognized standards (which is equivalent to existing individual certificates), or they may be linked to commitments made by a group of actors to source from or finance a specific jurisdiction in order to incentivize progress. This approach can be particularly valuable for firms sourcing from smallholders in a defined geographic region (see box 7.19).

Environment and Social Data Analytics

The availability of large-scale data sets has evolved rapidly over the past decade and has given rise to tools that can help firms to identify and monitor performance in their supply chains (box 7.20). For instance, tracking deforestation and forest fires can now be done in nearly real time using satellite data. If firms have mapped their supply chain to regions (for example, smallholder aggregation points and their economic delivery radius, or specific smallholder parcels), then it is possible to

BOX 7.19

SourceUp Certification through Compacts

SourceUp is an online platform that links agricommodity firms with multistakeholder initiatives in producing regions called compacts. There are currently 18 jurisdictional and landscape compacts in eight countries (Brazil, Cameroon, Colombia, Côte d'Ivoire, India, Indonesia, Liberia, and Vietnam) listed on the platform. Verified sourcing areas (VSAs) are those that have started reporting on the core indicators and whose results have been assessed by a panel. A committed buyer can support a compact through one of three engagement modes: support to establish or run a compact (financial or in-kind), a preferential sourcing commitment, or financial or in-kind support to a project.

Source: SourceUp 2021.

BOX 7.20

Case Study: End-to-End Traceability and Farmer Sustainability Data

Snapshot

A global food and agribusiness company implements a traceability and data management system for its farmers.

Challenge

Data on smallholders can be extremely valuable for planning and implementing targeted support activities, as well as communicating progress to buyers. However, collecting and managing a large volume of field data points for farmers can be challenging—and even more so when this information is being requested by buyers several steps removed from production.

Olam International, a major food and agribusiness company, is among the world's largest suppliers of cocoa beans and products, coffee, cotton, and rice. Olam operates in 60 countries and has an estimated 4.7 million farmers in its supply chain, the vast majority of whom are smallholders growing crops such as cocoa, coffee, and cashews in emerging markets.

Opportunity

Olam has developed the Olam Farmer Information System (OFIS), a survey tool that allows field staff to collect data, record global positioning system (GPS) data points for farms and social infrastructure, manage training activities, and track all "first-mile" transactions, including financing, input distribution, and crop purchases. Data are collected across 12 sustainability topics, with over

box continued

BOX 7.20

Case Study: End-to-End Traceability and Farmer Sustainability Data *(Continued)*

80 indicators. All metrics related to improvement of economic, environmental, and social factors are independently verified. This data provides comprehensive and detailed models of activities on the ground to help farmers and other participants in the supply chain maximize the effectiveness of their efforts.

For example, OFIS is being used by Olam Cocoa to help cocoa farmers improve productivity and earn a living income on their existing land, which reduces pressure on deforestation. This support from Olam helps farmers adopt better farming techniques, like pruning, or encourages them to diversify their income, for example, by providing seed funding for apiaries or for other cash crops. The biggest opportunity by far is in agroforestry, where farmers plant other native plants alongside cocoa, thus making protection and restoration of forests and sustainable farming practices economically feasible.

OFIS is also being used for child labor monitoring and remediation, with a smartphone app that is provided to community leads and linked to the system. The program was launched in Cameroon in 2020 and will be used to cover nearly 223,000 farmers in three countries across West Africa, prioritizing those countries where the risk is highest.

OFIS is integrated with AtSource, Olam's sustainability insights platform for its agricultural supply chains. AtSource provides Olam's clients with a single view across their supply chain sustainability parameters, as well as with insights into how to improve these elements. Farmer and impact stories are also available on the customer portal. The end-to-end metrics, action plans, and corresponding narratives can be used by customers to meet sustainability requirements, build brand trust and confidence, and report on sustainability.

Impact

So far, over 550,000 farmers in more than 30 countries have been registered in OFIS, which is continuing activities.

All of Olam Cocoa's directly sourced cocoa (two-thirds of its cocoa purchases) has full end-to-end traceability, equivalent to tracking approximately 12 percent of the world's cocoa beans.

Source: Olam n.d.

BOX 7.21

Data Platforms for Sustainability Assurance

New approaches to sustainability assurance are being built on data platforms such as Enveritas, which uses satellite data and machine learning to identify small coffee farms within a selected catchment area of a cooperative. Once the farms are identified, a random sample is generated and field visits undertaken. Field visits are combined with landscape monitoring using satellite imagery, which provides an up-to-date database for coffee buyers.

Source: World Bank.

monitor land-use change remotely, using Global Forest Watch's deforestation alerts, or MapHubs and Satelligence services, which provide custom daily deforestation alerts for their clients' supply-chain data (box 7.21).

Trase, a data-driven supply-chain transparency tool, allows firms to follow historic trade flows to identify sourcing regions (local and national) and volumes associated with exporters and importers, in order to profile their supply-chain risks (Trase database n.d.). Data analytics can be used to identify the actual sourcing footprint. For example, Orbital Insight, a California-based geospatial analytics start-up, worked with Unilever to aggregate mobile phone data to analyze the patterns of movements of truck drivers to determine the origination of palm oil fruit being delivered to mills. Nestlé has also trialed implanting radio frequency ID (RFID) chips (a tag, label, or card that can exchange data with a reader using radio frequency signals) in palm fruit bunches in Mexico to track the truck journey from the plantation to the mill, to ensure it doesn't pick up palm fruit bunches from other farms (Andhare 2021).

Satellite data can also be used proactively as part of an overall smallholder engagement program to identify smallholdings that have reached an age where production starts to drop. This information can help smallholders allocate resources to avoid clearing new land. Falling yields observed by satellite can also signal pests and disease.

Traceability and Information and Communication Technology

Supply chain traceability is the process of tracking the origin and journey of products and their inputs, from the very start of the supply chain to end use (box 7.22).

BOX 7.22

Traceability for Certification

Certification systems typically include four types of traceability:

1. Identity preserved, in which the precise origin of the product is traceable back to the landholding from which it came
2. Segregated, in which the certified ingredient was kept separate from noncertified ingredients all the way through the supply chain
3. Mass balance, in which certified ingredients can be mixed with noncertified ingredients in the supply chain, as long as the certified "credits" are accounted for at each stage
4. Volume credit/book and claim, in which end buyers purchase credits directly from producers, with no supply-chain tracking

Industry-accepted standards, used in combination with certification, allow firms to easily communicate a large quantity of information about good practices to their buyers. Certification systems typically include chain-of-custody certification, where firms in the supply chain are audited to ensure that they are correctly accounting for and communicating about the products sold as certified, which significantly reduces the administrative burden of data sharing along the supply chain (box 7.23).

When agricultural and forestry products are traded outside of certification systems, alternatives must be in place to record, manage, and communicate data. If firms are sourcing directly from smallholder farmers, then software platforms linked to field data collection can be used to record detailed information about the E&S performance of each farmer. This information can be combined with farmer support programs, which would track data such as inputs and yields, training received, credit, and so forth. Some of the software is based on blockchain platforms (IBM Food Trust n.d.), where smallholders upload their information directly, and it is available through the supply chain to the final consumer.

If the production base is fragmented with individual farmers providing small quantities of produce that is aggregated shortly after harvest, then establishing full traceability is particularly challenging and costly. For agricultural commodities that are traded in bulk quantities, then transformed and traded internationally (such as vegetable oils or animal feeds), identity-preserved supply chains are generally prohibitively expensive. For products that keep their original form along the supply

BOX 7.23

RSPO PalmTrace

Some certification systems have gone beyond individual chain custody audits to ensure the robustness of the system, such as the Roundtable on Sustainable Palm Oil (RSPO), where certified members must register their physical sales and processing of palm oil in an online system to ensure that there is no double counting. Data are available from the RSPO PalmTrace platform, which enables the buyer (a manufacturer or retailer) to see the certified mills and independent smallholders where the palm oil originated (but not the supply chain in between, to protect commercial confidentiality).

Source: RSPO, https://rspo.org/as-an-organisation.

chain (such as coffee beans, fresh fruits and vegetables, and some meat products), tracking devices such as barcodes, quick response (QR) codes, or RFID tags can be attached to the products for full traceability.

Firms farther away from production (downstream) may choose to undertake supply-chain mapping through engagement with tier 1 (direct) suppliers and tier 2 (and beyond) suppliers, or by implementing traceability software. However, for bulk commodities, even when the specific origin is known, claims may only be possible about known sources over a specific time period, rather than linking a specific product molecule to a smallholder, because of the need for bulk storage in the supply chain.

Cost Considerations when Deciding on Engagement Strategies

Firms should set out a clear approach with targets, personnel, and budgets, including the costs of compliance, implementation, and upgrading of the system:

- Monitoring, verification, and certification
- Supporting smallholder compliance
- Cost of compliance for smallholders

Monitoring, Verification, and Certification

These include time spent by the firm's staff monitoring and recording data on the performance of smallholders; costs associated with new

TABLE 7.1 Budgeting for Independent Assessment of Compliance

	Cost	External robustness/credibility
Self-assessment	$	Low
Second-party verification	$$	Low
Third-party verification	$$$	High
Certification audit	$$$	High
Satellite data	$–$$$	High, but limited scope

Source: Original table for this book provided by IFC.

software systems, apps, and smartphones; access to satellite data and analytics; and costs of field assessments.

Budgeting for certification is straightforward. Full audits are typically undertaken every three to five years, with annual surveillance visits. Third-party auditors can also be used for gap assessments and preassessments, to identify any final outstanding issues before the audit (provided it is not the same audit company). Costs may include membership fees for the firm to join the national or global organization that administers the standards system and may also include a certification fee levied by the auditor. Price quotes can be obtained from accredited certification bodies, or, using the guidance provided by the standards systems on auditing, firms can calculate the number of days it will take to audit their smallholder operators and estimate a day rate for auditing.

Even in situations where certification is not sought, third parties can provide an independent assessment of compliance as both a tool for managing the program internally and for communicating externally, and this can be budgeted in the same way (see table 7.1).

Supporting Smallholder Compliance

When firms make the decision to engage with smallholders to address risks and impacts, they need to plan for the time needed for managing the implementation. Responsibility may reside within the function of a quality manager or a smallholder sourcing manager, and additional staff time should be included for field activities.

Firms will likely incur costs such as salaries for additional extension staff, training, and other materials and resources to improve practice, facilitate access to inputs, support processes to formalize land rights, strengthen farmer organization, conduct gap assessments of current smallholder practices, conduct ongoing first-party verification of

smallholders, and so on. Firms may also consider paying a premium to smallholders that meet certain progress targets.

To estimate costs, consider the baseline practices of smallholder suppliers, the existing degree of smallholder organization, the number of smallholders supplying the firm and the country in which they operate, market demands, and the level of performance required. Depending on the number of smallholders and the status of their current practices, these costs will vary significantly. However, if a firm is investing in strengthening smallholder supply chains more widely, these costs may go beyond managing E&S risks.

Cost of Compliance for Smallholders

As with any smallholder investment, smallholders' incentives must be aligned with the firm's incentives. Firms should ensure that smallholders fully understand their additional costs, such as increased labor or working hours. Smallholders can undertake their own cost-benefit analysis as well. If farmers do not perceive any benefits to changing their practices or incurring additional costs, they may be unwilling to adopt and implement the practices required to comply with the standard.

The costs of compliance for smallholders may include additional record keeping and maintaining an ICS with first-party verification. If the benefits are too small or accrued only in the long term, firms may propose a cost-sharing mechanism with farmers during the first few years of the program (see box 7.24).

There are also potential costs linked with changing practices. For instance, weeds at the base of tree crops may be controlled with herbicides such as paraquat, motorized weed trimmers, or through hand

BOX 7.24

Challenges of Organic Farming

A challenge with organic farming is that yields tend to be lower than those from farms using chemical fertilizer—studies estimate 15 percent lower yield across all crops. Farmers who are certified organic may see a lower income if there is no price premium, and if the premium does not recover the productivity loss, they will likely discontinue the practices.

Source: Knapp and van der Heijden 2018.

cutting. However, many E&S standards prohibit the use of paraquat, and smallholders may not have access to motorized weed trimmers. Therefore, they must use machetes to hand-cut weeds, which is a labor-intensive and arduous task. Another potential cost to smallholders is the purchase of protective gear for spraying chemicals and constructing secure storage for the chemicals (prudent use of agrochemicals is permitted in certification programs like Rainforest Alliance, RSPO, and RTRS). Some firms purchase these additional investments for farmer suppliers in order to mitigate farmers' costs.

The Value of Implementing Climate and Environmental and Social Risk Management

As with any supply chain investment, firms should weigh the expected benefits of E&S risk management strategies against the costs.

In markets where price premiums are paid for verified or certified products, this is a simple calculation of volume times premium. Where premiums are not paid, but E&S risk management is required for market access, the opportunity cost associated with loss of market access can be calculated.

Quantifying the impacts of climate change is more challenging, since by definition these impacts will result in more variability. Furthermore, there is no direct relationship at the firm level between investment in climate-smart agriculture and mitigating the global effects of climate change: they represent both an individual and a common global responsibility. A number of climate scenarios show widespread crop and livestock losses, and thus decreases in yield, due to extreme weather. Therefore, it is possible for firms to calculate the cost of single-event losses and extrapolate total cost over time or calculate a drop in yield over time. It may be possible to mitigate some of these impacts on a local scale through adoption of new varieties and breeds or water storage systems.

Some markets may introduce a carbon tax, in which case firms can use the GHG Protocol Corporate Standard to estimate their carbon emissions, and multiply kilograms of CO_2 equivalent (kg CO_2 eq) emissions by a carbon price. Another calculation can be done to show the financial value of avoided emissions, when the firm is able to measure and quantify kg CO_2 eq through new climate-smart practices and/or avoided deforestation.

Biodiversity losses are also difficult to quantify financially at the individual firm level. Loss of species and collapse of ecosystems can have significant impacts on agriculture systems: for example, the local disappearance of bees and other insects as pollinators, or pest outbreaks when natural predators are gone. Firms can evaluate the natural processes their smallholder production relies on and therefore estimate the potential financial cost of compromised processes.

Firms should ensure that their implementation programs include showing smallholders (and groups of smallholders) how to calculate costs and benefits for themselves. Firms should also encourage smallholders to consider additional benefits, such as health, drinking water, and other ecosystem values. Providing training to farmers on the benefits to their health and groundwater protection may help them recognize the nonfinancial benefits to compliance. Improved social and environmental practices that generate cost savings at the farm level and deliver higher yields or better-quality produce (either directly or as part of a package of improved practices) can offset the costs of compliance with productivity gains rather than a market premium. Even if the firm is proposing to pay a higher price, the firm should calculate the likely costs of compliance and any additional costs that might be borne by the smallholders through implementation of climate and environmental and social risk mitigation. It is the firm's responsibility to ensure that the farmer has a net positive outcome.

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Additional Resources

Committee on Sustainability Assessment (COSA) conducts research on the impact of sustainability standards. https://thecosa.org/.

Food Safety, Trade, Standards, and the Integration of Smallholders into Value Chains: A Review of the Literature

John Humphrey. 2017. *Food Safety, Trade, Standards, and the Integration of Smallholders into Value Chains: A Review of the Literature*. IFAD Research Series 11. ISBN 978-92-9072-738-5. https://ssrn.com/abstract=3284472.

GLEAM-i

The UN Food and Agriculture Organization (FAO) has an open, user-friendly, and livestock-specific tool designed to support governments, project planners, producers, industry, and civil society organizations to calculate greenhouse gas emissions using Intergovernmental Panel on Climate Change (IPCC) Tier 2 methods. https://gleami.apps.fao.org/.

The Gold Standard Agriculture Requirements (A/R) Smallholder & Microscale Guidelines

These guidelines were developed to overcome some of the obstacles smallholder and microscale projects face to access the carbon market. https://www.goldstandard.org/sites/default/files/ar-guidelines-smallholder-microscale.pdf.

Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard

The GHG Protocol Corporate Accounting and Reporting Standard provides requirements and guidance for companies and other organizations preparing a corporate-level GHG emissions inventory. https://ghgprotocol.org/corporate-standard.

IFC Food Safety Handbook

https://www.ifc.org/wps/wcm/connect/industry_ext_content/ifc_external_corporate_site/agribusiness/resources/food+safety+handbook.

IFC Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets

A six-step process to assist private sector companies in emerging markets identify cumulative impacts and guide them in the effective design and implementation of measures to manage such cumulative effects. https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/publications/publications_handbook_cumulativeimpactassessment.

Resources for Accelerating the Professionalization of Farmer Organizations

The Agribusiness Market Ecosystem Alliance (AMEA) keeps a register of professional farmer organizations that are able to partner with firms and seek finance from banks. This register uses standardized SCOPEinsight assessments, linked to systematic training and mentoring to address gaps, followed by reassessments. http://www.scopeinsight.com/ and https://www.ameaglobal.org/.

Standards Map

The International Trade Centre has developed a "Standards Map" database tool to help firms find the best standards fit for their needs. http://www.standardsmap.org/.

UNHR Status of Ratification of 18 International Human Rights Treaties

The Status of Ratification Interactive Dashboard provides a wealth of data. https://indicators.ohchr.org/.

CHAPTER 8
MEASURING RESULTS

Kalyan Neelamraju and Victoria Chang

KEY MESSAGES

- Just as firms routinely monitor and measure business performance results, so must they also evaluate their smallholder agriculture supply chain performance.
- Farm-level impacts are important: Farmer well-being is key to supply chain security, and companies can use smallholders' well-being to self-promote and/or to account to others.
- Companies find it hard to measure development or social impact.
- Income and livelihoods can be measured using rapid assessment tools, including poverty scorecards that ask a series of easy-to-answer questions related to assets and other topics. Rapid tools are also available to measure household food insecurity and diet diversity, which may encourage changes in the quality of life of smallholders in the supply chain.
- The digital applications that are transforming agribusiness engagement with smallholders can also provide important monitoring information.
- New tools are available that simplify and speed the collection and analysis of field data, including computer-assisted personal interview systems, using smartphones and tablet computers.

The Business Case for Measuring Results

As with any new initiative and investment—whether commercial, governmental, nongovernmental, or even personal—it makes sense to monitor the implementation to see if it is working as intended and delivering the anticipated results. Companies often refer to key performance indicators (KPIs). A firm running an advertising campaign to boost sales will review the outcome to see if the campaign has been successful—and it wants to understand the relative performance of certain aspects: Was the message, medium, and target group correctly selected? That logic applies equally to a new development in the value chain:

- A bank with a new credit line for farmers will want to know if there has been uptake, if farmers are paying back their loans, if the initiative has been profitable, and whether there are future prospects for expanding the program. Going a step further, depending on its mandate, business strategy, and perhaps the origin of the fund, the bank will want to know if and how farmers have benefited.
- A veterinary medicine company that has decided to train local agrodealers, so that they can provide better sales backup and provide training sessions to farmers at their stores, will want to know if its products are more likely to be used correctly and if sales are increasing as a result of that intervention, and so on.

The collection and analysis of data are important, useful, and pervasive in business and development. Common practice is to initially test a new approach via a pilot; the data collected during the pilot will help the firm modify the approach. If impact can be demonstrated with convincing data, it will attract more attention from senior management. With wider rollout, timely monitoring data can signal a need to adapt approaches, or it may support kaizen[1] improvement approaches. Moreover, firms increasingly want to be able to make claims about positive impacts on local farming populations, and to do so they need to understand outcomes to reduce exposure to brand-damaging risks of, for example, poor working conditions or environmental harm. Independent evaluation findings can underscore a firm's commitment to sustainability among the broader public.

In short, "what gets measured, gets managed," as a popular phrase put it. And the growth of mobile computing and the internet has enabled higher levels of data quality and availability. Rigorous results measurements allow a firm to do the following:

- Track progress, steer activities, and plan (for example, crop volume projections may signal the need for more storage capacity)
- Account for the use of resources (perhaps to the board, donors, farmers, and certification agencies)
- Learn: What really works? What are the costs and benefits?
- Self-promote and convince others of outcomes

This chapter serves as a primer on the potentially vast topic to measure results. It aims to do the following:

- Explain key concepts
- Steer firms through key steps and considerations for data collection and analysis
- Highlight how firms can simplify this task by, for example:
  - Focusing on selective use of data collected as part of firms' own management systems
  - Integrating the use of farmer logbooks into their results measurement
  - Using the growing range of tools and devices that make data collection and analysis easier and quicker
  - Recognizing more complex areas where expert input is advised
  - Drawing upon the many excellent information resources on this topic
- Offer practical advice, insights, and examples

Monitoring and Evaluation (M&E), Process, and Impact

A distinction is usually made between monitoring and evaluation:

- *Monitoring* consists of regular checking. For example: Is the program on schedule? Is it meeting its KPIs? Is it proceeding as planned? Monitoring data are generally easier to gather as collection is often done through existing systems or processes (sometimes called *process* monitoring).

- *Evaluation*, and in particular *impact evaluation*, considers bigger questions, generally over a long time frame. Evaluation endeavors to link outcome and impact to activities, which requires careful design to ensure the validity of the results. For example: Did the supply chain investments lead to improved crop or livestock quality and quantity at the times they were required? Does the program deliver significant benefits to smallholders? Has bank lending to farmers made them good customers for other banking products? Has the program had significant unforeseen side-effects (good or bad)?

In general, impact evaluation can happen only when a project is well advanced or after its conclusion, although regular monitoring data may contribute useful information that can be incorporated into the evaluation's analysis and provide interim pointers on the direction of change.

A baseline survey that probes specific indicators for the development intervention or partnership, provides a useful reference point against which both monitoring data and evaluation data can be compared (FAO 2013; Save the Children 2014). See the next section for more on information needs.

Solutions, Strategies, and Best Practices for Collection and Analysis of Supply Chain Data

Identifying and Planning for Information Needs from the Outset

The first consideration is to identify what needs to be monitored. This decision relates directly to the question: How do you define success? The answer helps to determine how success can be assessed or measured. We must also consider the obstacles that might block success. These two aspects—how success can be measured and the obstacles that might get in the way of achieving success—form the building blocks of a monitoring framework.

It is much easier to identify and plan for data collection at the outset than to retrofit identification decisions into the program later—particularly if the opportunity for baseline data has been missed. If necessary, forms that field agents routinely fill out (including electronic forms on mobile devices) can be adjusted to include monitoring data. Farmer training can also emphasize the importance of farm records and how data may be collected and recorded.

If change is to be measured, then a baseline is needed. Baseline surveys should be conducted before the intervention begins (although in practice, they are often conducted in the early stages of an intervention). They can vary enormously in scope, but the basic principle is the same: If change is expected in certain variables and the firm wants to measure that change, then information must be collected initially and at periodic intervals. Such changes may be, for example, in coffee yields per hectare, number of farmers using fertilizer on target crops, farm household income, or women's nutritional status. Depending on the topics of interest, this could be relatively straightforward or a very large undertaking. Fortunately, recent developments in rapid assessment tools are simplifying this task.

It is almost inevitable that additional data needs will be identified during implementation—the point is simply that it is best to identify as much of this as possible as early as possible. Keep in mind the two broad categories of information:

1. Monitoring of activities and immediate and/or straightforward outcomes (sales of fertilizer, number of farm visits, number of training events held, and so on)
2. More evaluative data, which will help answer bigger-picture questions but may be harder to obtain and involve specific one-off or sporadic data collection (for example, improvement in livelihoods for farmers)

Initiatives that involve multistakeholder partnerships (see chapter 12, "Partnership Strategies") may entail reporting and data collection obligations that are different from normal firm practice. Even a company with strong corporate social responsibility may find that the level of reporting and scope for donor-funded projects are more rigorous and demanding.

SMART Indicators and Objectives

SMART is a useful acronym to remember the nature of good indicators and objectives: specific, measurable, achievable, relevant, and time-bound. An example of a non-SMART objective is "to increase farmer coffee yields." A SMART objective might be: *To increase yields of coffee of participating farmers by 30 percent, by the end of the 2024/25 season, as measured by sales of green bean equivalent (50 percent processing loss and 12 percent moisture content) in kilograms per hectare.*

SMART objectives or indicators are much easier to monitor and will yield results that can be compared across regions or programs, because they are so precise.

A Logical Framework for Planning and for Measuring Results

For decades the development community has used a tool called a "logical framework" or "logframe." The inclusion of such a framework is a requirement for many donor-funding applications (USAID 2012). Developing a good logical framework is not necessarily easy or quick—and it is not a perfect solution—but it nonetheless has a number of advantages for planning and M&E. A logframe should be developed early in the planning process (table 8.1).

- The logframe summarizes the logic of an intervention, whereby a goal (or overall objective) is identified and lower-level results or outputs are planned to contribute to its achievement, with activities, in turn, contributing to the achievement of each of those outputs. This is sometimes referred to as the *theory of change,* that is, a representation of the intended goal and then mapping backwards to identify the preconditions for its achievement.
- The range, quantity, and nature of inputs or resources needed for a project can also be estimated during the preparation of a logframe.
- Key assumptions are also identified, with the logical sequence being "if those outputs are achieved and if those assumptions hold true, then the goal will be achieved."
- Developing the logframe subjects the logic and the assumptions to intense scrutiny: If we do x and y, will that really be enough to make z happen? The integrity of the framework means that all its components and their precise wording are critical; it also makes it easier to identify elements that contribute little to key objectives and deal with them accordingly.
- The logframe requires that the objectives are described by SMART indicators (see above), for which sources of information must be identified—so M&E is built into the program design. The focus on how achievement can be measured injects realism into the design, reducing the scope to defer measurement or being vague about how results are measured.

TABLE 8.1 Sample Logframe for a Coffee Off-Taker

	Summary	Indicators	Verification	Assumptions
Goal	Increase volume of coffee purchased.	Metric tons purchased	Purchase receipts	n.a.
Purpose	Increase productivity of coffee suppliers from *x* to *y* within *z* years.	Tons per hectare	Logbooks maintained by farmers	• The supply chain is compliant with relevant E&S standards. • Coffee prices remain stable.
Outcomes	Farmers adopt improved coffee-growing practices.	Number of farmers using improved pruning practices and replanting with new seedlings	Logbooks maintained by farmers, supported by field survey	• There are no significant climatic or other external shocks that affect coffee production. • Farmers have time and/or sufficient interest to apply the techniques.
Outputs	• *X* seedlings sold per year. • *X* farmers trained on correct pruning methods.	• Number of trees sold • Number of farmers trained	• Records of nursery owners • Reports of field staff	• Farmers have the time and ability to attend training. • Seedlings are affordable to farmers.
Activities	• Establish *x* coffee seedling nurseries. • Conduct 15 on-farm training events on pruning.	• Number of nurseries established • Number of training events held	• Weekly reports from field staff • Monitoring visits by supervisors	• The project has sufficient resources to conduct the required activities.

Source: IFC.
Note: E&S = environmental and social; n.a. = not applicable.

The Right Metrics in Business Practices

The hierarchy of logic in the framework mirrors the nature of the M&E data required; at the lower level, activities are monitored, whereas at the higher level, the broader questions are in focus: Is the program achieving its aim? Is the project design right? The term *metrics* refers to what will be measured. See table 8.2, showing how the appropriate choice of metric changes, depending on the level of achievement described.

TABLE 8.2 Measuring Results: A Process, Not an End Point

For each level of achievement, the metric should closely describe what is expected to happen. These metrics provide a measure against which the achievements can be assessed.								
Inputs		Activities		Outputs		Outcomes		Impacts
The resources that went into the project, for example, funding, technical expertise, administrative, and logistical support	➔	The specific actions undertaken within the project, for example, 15 on-farm training sessions on proper pruning techniques	➔	The activities' immediate results, for example, 250 farmers trained on proper pruning techniques	➔	How the outputs changed participant behavior, for example, the percentage of farmers adopting new pruning techniques	➔	How the outcomes affected the overall program goals, for example, the percentage increase in productivity after three years

Source: IFC.

Sources of Data

Given that there may be many sources of data serving different objectives, conducting in-depth surveys is not always necessary. Useful information may be found in the firm's own records; producer organizations or farmers may keep (or be encouraged to keep) certain records; local information may be available from the district authority or available from surveys conducted by other organizations; and information may be available from satellite imagery, drones, or remote sensing. Even if further information is needed, there may be some shortcuts. For instance, it is not necessary to ask all farmers about the frequency of bus services to the market town. Obtaining this information from other sources may be easier—such as the bus company.

If a survey is conducted, a carefully drawn, robust representative sample may be quite adequate, without the necessity to survey all farmers. Focus group discussions with selected groups can be useful in probing complex issues (qualitative approaches are discussed in greater detail in the section "Tools Available for Data Collection").

Another key source of data may be farmer records, often formatted as logbooks, paper-based or electronic. Logbooks provide an organized means for farmers to log their farm management practices, input costs (including paid labor), and sales revenue. Logbooks can also be formatted to encourage logging of weather or other important data. It is notoriously difficult for farmers, and field agents, to retrospectively relate costs, revenue, and cultural practices such as planting, weeding, fertilizing, harvesting, or sales with acceptable levels of accuracy. Logbooks

provide a convenient means for farmers to record these data in a timely manner.

When coupled with financial awareness or farming-as-a-business training, the benefits to farmers of record keeping include the ability to analyze and professionalize their operations, as well as forming a sound basis for discussion about finances. Benefits to the firm include the ability to identify and compare operations to identify gaps, document improvement over time, and highlight side selling of contracted output.

The designer must consider how the data will be aggregated and ultimately used. The logbook designer also needs to be conscious of the time expected for farmers to fill out the logbooks (whether written or digital) and aware that a relatively small number of data points can become an immense database when multiple farmers record their data over a growing season or seasons. Consideration of how paper-based data may be transferred to digital media also needs to be made.

Results Measurement—Data Needs

Monitoring: Management Information for Firm and Other Stakeholders

Most agribusinesses will already have appropriate systems in place for the collection and analysis of routine monitoring data, and these systems are increasingly digitized. When working with smallholders for the first time, existing tools may need to be adapted—particularly if the field agent is to play a greater role in collecting and verifying farmer data, as smallholder farmers' own records are likely to be poor. There are now many suitable off-the-shelf systems available to support the operation and management of agribusiness value chains with smallholder suppliers. This is a rapidly developing field as demand grows for information about traceability, sustainability, and other requirements. New platforms and agricultural technology (agtech) tools, some involving blockchain, are emerging (see chapter 4).

Before selecting an agtech tool for monitoring and operation purposes, firms should consider the following: (1) the number of users allowed for the tool, (2) scope and availability of the tool to the operating locations of the firm, (3) timely and responsive availability of technical support, (4) rules on data privacy, (5) cost structure for different features of the tool, and (6) choice of covered features, such as traceability, harvest predictions, managing buying or selling inputs, and so on.

Aside from the management information generated, these types of farm management records can help firms answer questions such as, What percent of farmers in the supply chain are pruning their cocoa trees correctly? Although these records provide a means of assessing the implementation of the program, they do not explain how the results were achieved, nor can the results be generalized beyond the direct beneficiaries being evaluated. These questions are addressed by evaluations that incorporate a sampling strategy.

Firms may also collect data to check for compliance with standards and certification. For this purpose, digital systems are available that can dramatically reduce costs (see chapter 7, "Managing Risk for Sustainability and Resilience").

In summary:

- Data collected before and after an intervention can be used to assess a change in behavior or outcome.
- This method is useful for telling stories about a firm's smallholder strategy and for demonstrating results that contribute to improved livelihood outcomes.
- These data may help to identify which aspects of implementation were more successful than others.
- These data may provide firms with an indication of a strategy's cost-effectiveness (particularly with digitized, integrated data systems and depending on the analysis conducted).

Impact Evaluation

Distinct from monitoring for management and standards-compliance purposes, impact evaluations take place less frequently and seek answers to bigger, more complex questions such as: How can one establish causal links between the firms activities and outcomes or impacts? Those studies need very careful design in order to generate valid information as well as value for the invested costs. Evaluations may assess outcomes and impact but can also review the intervention strategy (for example, whether it was effective). There is no one-size-fits-all methodology—the approach used depends on the scope of the evaluation, how the information will be used, the complexity involved (for instance, the extent to which multiple factors must be taken into consideration), the resources (including skill sets) available, the timetable for when the results are needed, and the degree of reporting rigor required (for example, if the firm wishes to make public claims about its achievements). In rural

societies, where obtaining accurate data can be difficult and multiple factors affect outcomes, evaluations often combine multiple methods to better understand processes and outcomes. Although evaluations tend to take place once an intervention is reasonably well advanced, they should ideally be initiated at an early implementation stage. Early assessments, whether or not they are termed evaluations, nonetheless seek preliminary answers to important evaluative questions—and those results may be used to adapt program design. Evaluations may entail specific survey work and also draw on data collected over a longer period (including monitoring data).

If a firm does not have specific in-house expertise in evaluation, then it should seek outside expert advice. Moreover, if the firm wishes to make public statements based on such investigations, the use of independent external evaluators will underscore the impartiality and validity of those results.

Farm trials can be used for impact evaluation. Randomized control trials (RCTs) are sometimes used as part of an evaluation. They seek to compare participant outcomes with outcomes from those who did not participate in order to make a claim attributing the changes observed in the participant outcomes to the project, program, or intervention. However, undertaking RCTs in agriculture can be challenging and costly, because large sample sizes (as many as 400–500 farmers) may be needed in each group to ensure statistical validity. To establish a control group, one strategy is to stagger implementation into two or more rounds. Farmers who will receive training or other interventions in subsequent rounds serve as a control group for the farmers receiving training in the first round, but this is still challenging as the control group may still learn some of the new techniques and change their practices as a consequence of contact with the first group. This approach also requires sufficient time lag (at least one crop cycle) between implementation rounds to assess the program results.

Quasi-experimental studies can also be used to compare the group receiving program assistance with a group of nonparticipants. This method ensures comparability between the two groups through statistical methods. However, unlike RCTs, the two groups are not randomly assigned (so there may be less "purity" in the control group). Instead, program managers identify a group that is similar enough to the participant group that it may serve as the counterfactual or control group (in theory what would have occurred without the program intervention). Quasi-experimental methods can be particularly useful in agricultural interventions because they are more cost-effective when working with groups of farmers.

Impact Metrics to Consider for Smallholder Supply Chain Interventions

Farmers Reached

The most aggregated and basic metric a firm can use is "farmers reached," which counts the number of farmers who participated in a supply chain intervention. For firms with multiple supply chain interventions affecting farmers across various sectors using diverse methodologies, the farmers reached metric provides a single, summary indicator of the scale of the firm's work with smallholder farmers. If more detail is required, it can be broken down, for example, by gender, district, and type of intervention or approach.

However, it does have some limitations. Farmers reached does not indicate by how much farmers' livelihoods improved or how their production changed. It does not provide firms with information about how the supply chain was strengthened as a result of an intervention. Therefore, while farmers reached is a useful summary of reach or scale, it should not be the sole impact metric used on a single project.

Productivity

Most farmer training programs intend to increase productivity (for example, tons of wheat per hectare, tons of fish per unit of pond area, or liters of milk per cow). Firms building traceable supply chains usually want to determine their suppliers' productivity as a way to forecast crop procurement and calculate farm income. However, measuring productivity can be challenging.

- Productivity data self-reported by farmers are not always reliable (Wollburg, Tiberti, and Zezza 2021); triangulation is advisable (farmer interviews, crop-cutting, farmer records, and buyer interviews).
- When smallholders sell crops, they may not be properly dried, which may lead to discrepancies in reporting. Crop weights at the farm level should be adjusted to standard moisture levels for the crop, to be comparable with the United Nations Food and Agriculture Organization (FAO) data or other published statistics.
- As crops are often sold wet, many traders use volume measures, which may not correspond to standard metric volumes. To ensure data accuracy, firms should determine correct conversion factors.

- Most tree crops are harvested a few kilograms at a time, over the course of several months or the entire year. Unless farmers keep written records, it is difficult for them to remember each sale.
- If farmers are part of an outgrower scheme that provides inputs in exchange for crops at harvest, they may be reluctant to report crops that have been sold to other buyers (side selling).
- Many smallholders plant more than one crop on the same land (intercropping). If the planting density for each crop is not optimal, yields will be lower than expected and not easily comparable with yields reported elsewhere. Nonetheless, producing two crops from the same land may increase overall profitability and reduce risk for the farmer.
- Farmers may switch to alternate crops, depending on price, availability of inputs, or other factors. In this scenario, the farmer would still be producing something, but is no longer supplying the off-taker with the desired crop.
- Smallholders often do not know the exact size of their farms, especially if they have irregularly shaped plots or more than one plot. Even within a single plot, some areas may not be planted due to the terrain. Without accurate area measurement, productivity cannot be determined accurately.

Quality

As with prices, firms usually collect data on the quality of the crops they purchase. These data can be used as part of impact measurement. The challenge is to maintain this information in a form that facilitates program design and helps to measure the results of training interventions.

Income and Livelihoods

As the private sector is taking on an increasingly important and recognized role to achieve the global Sustainable Development Goals, agribusiness firms are likely to be called to support equitable and improved livelihoods for farmers in their supply chains. Measurement of livelihoods is typically multidimensional—in other words, agribusiness firms will want to consider what is likely to change in the livelihoods and quality of life of farmers and their families in the supply chain.

Reliably tracking farmer incomes is challenging but important. If new practices or inputs do not improve household well-being, their use is unlikely to be sustained (unless there is an enforceable regulatory requirement). Yet farmers rarely keep track of the costs associated with growing each individual crop on their plots, and their self-reporting information on net income may not be very reliable. Standard monitoring systems (see the section "Standard Off-the-Shelf Farm Management Packages for Monitoring Data") allow the calculation of net revenue from the firm (output purchases net of input costs) per farmer or per unit area of crop—and allow those calculations to be tracked over time.

Beyond measuring incomes, agribusiness firms may find it important to track access to services (including nonagronomic services, such as health care for the farming household and educational access and attainment for children) as well as to household nutrition, particularly household food security and diet diversity. Research has shown that both measures tend to be strongly correlated to other household welfare measures and are typically quite responsive to improvements in household income sources.

Several tools are also available to track changes in farm household income and household welfare measures, such as household food security and diet diversity.

Tools Available for Data Collection

Until recently, surveys were conducted using small armies of enumerators equipped with clipboards and forms. The data collected were subsequently input into a computerized database, which could then be analyzed to generate information and answer specific questions. That has changed, and enumerators are now much more likely to use tablet computers or smartphones. Due to the travel restrictions and health protocols imposed by the COVID-19 pandemic, phone surveys have been increasingly used to reduce close contact and the time and cost of data collection. Global positioning system (GPS) coordinates can identify a farm or a field, making repeat visits and follow-up easier. Questions about farm size and yield can also be supported with the use of GPS tools. Careful survey design and training of enumerators is still important, but the direct use of computers and handheld devices provides a shortcut in the process of data input and analysis. The risk of human error is also reduced.

Standard Off-the-Shelf Farm Management Packages for Monitoring Data

As the use of digital technology becomes more ubiquitous in everyday tasks, firms can access important monitoring data in real time. Field agents regularly record information. Companies track input sales or crop purchases—and use GPS or smartphone apps and software to monitor the day-to-day activities of their field teams, generating real-time analysis and infographics. The collection of georeferenced data permits spatial analysis. These tasks (data collection, analysis, and the development of recommendations) are being transformed by the use of smartphones, tablet computers, and faster internet with wider reach, combined with rapid development of software, the scope to interface with landscape data derived from remote-sensing or drone surveillance, and site data captured via handheld devices, for example, for soil and water testing.

Agribusiness as a whole has embraced the digital revolution, and many digital systems are now available to support firms working with multiple smallholders. These systems encompass the following:

- Supply chain management and traceability
- Supervision and management of field staff
- Extension management
- Precision agriculture

Firms are using these systems for data collection, analysis, and reporting; to make payments and monitor loans; to track goods and services; to connect service providers with clients; for inventory; to support farmers with advice and weather forecasts; for targeted marketing; and so on. This shortens more routine monitoring data collection. Standard systems for supply chain management and traceability will, for example:

- Allow entry of basic farmer identity information, address, plot size, and so on;
- Track farmer use of inputs and cost of inputs;
- Show sales of output per unit area; and
- Record payments made to the farmer.

Many include the option for customized data collection and surveys—to address particular issues that fall outside the standard list of variables.

Generating farmer- and campaign-level monitoring reports thus becomes very easy, covering variables such as the following:

- Number of farmers reached
- Quantity of inputs used per farmer—averages and measures of distribution
- Farmer yields (productivity)—averages and distribution
- Farmer net income from the activity per unit area (or per unit animal and so on)

Records can be separated or disaggregated for different groups of farmers—farmers in different zones; possibly male or female farmers; or farmers using different technology, for example, with or without irrigation. Monitoring reports can be produced almost instantaneously, covering a selected set of variables with visualization choices, and are remotely available to supervisors, once the field officer has entered the data and connected to the internet.

Survey Tools to Measure Farmer Household Income

Household surveys: Large surveys, such as the World Bank's Living Standards Measurement Study (LSMS) surveys can be used to collect data on household consumption, which is a proxy measure for household income. Responses to questions about consumption (including consumption of food produced on-farm) tend to be more reliable than responses to questions about income. The survey's purpose is generally to understand income patterns and trends in a large area or across an entire country (showing differences among different household types, areas, changes over time, and so on), but not to monitor an individual household's well-being. To generate reliable results, these surveys cover more than 1,000 households with questionnaires that could take several hours to complete. Ideally, the survey would be repeated after 5–10 years. Given the high levels of poverty in developing countries (especially rural poverty), these surveys are very important and are mostly undertaken by governments, possibly with donor support. In a sense, the detailed information they provide substitutes for much of the data collected in developed countries by a variety of different means (aggregate data from tax returns, market research by telephone, meta-data on the use of services, and so on). For rural populations who still operate largely in the informal (unrecorded) sector, the LSMS surveys and others still have a place.

The planning, design, field testing, data collection, and analysis of traditional household surveys is a specialized field that is generally costly and time consuming. Government permissions may be required, and teams of enumerators will need to be trained—and it may be several years before the full report of the survey is available.

SWIFT rapid assessment tool: The Survey of Well-Being via Instant and Frequent Tracking (SWIFT) was developed by the World Bank to estimate household income and expenditure data in a cost-effective, timely, and user-friendly manner. LSMS data (that is, from an earlier survey) and advisory input are required, in order to identify poverty correlates and use those in the design of a short questionnaire, which is then administered using computer-assisted personal interview (CAPI) software (see figure 8.1). A World Bank team supports survey design and process, while the firm arranges for the survey to be implemented.

Questions and reporting can be tailored to the client's needs; a typical output would be a short report with graphics of 5–10 pages. SWIFT can be used to collect socioeconomic baseline data or answer very specific questions. For example, one firm wanted to know if side selling was associated with poverty. The survey established that there was indeed a link, and the client was able to use the information to adapt its approach to reduce side selling.

Poverty scorecards: Scorecards are a simple and quick tool to assess whether households are above or below a poverty line—either a national poverty line or an internationally accepted standard—or even a program target. A score is generated based on the response to a short set of questions that probe characteristics of the household and the things they own, tailored to local circumstances (see figure 8.2). The results (1) can indicate if a household is above or below a poverty line; (2) can measure a group's poverty rate at a point in time, and hence be used to track changes in poverty rates for a group over time; and (3) can be used to target services or interventions. The scorecard does not measure changes that occur above or below the poverty line.

Survey Tools to Measure Household Food and Nutrition Security

Food security is a key concern among low-income groups, including smallholder farmers. Changes in farming practices can affect food security unpredictably. Land may be diverted from food crops to cash crops, but increased income may not necessarily be used to meet food needs. It is very important to consider the food security impacts of an agricultural program, including for smallholder farmer households, and build in mechanisms to ensure positive outcomes.

FIGURE 8.1 Survey of Well-Being via Instant and Frequent Tracking (SWIFT)

WHY SWIFT?

Income data is scarce. Collecting reliable income data is costly, time-consuming, and complex. Countries spend millions to collect data and it takes them more than two years to produce poverty statistics. Lacking data often makes the poor invisible, marginalized, and voiceless.

SWIFT measures poverty rates for your project. So you don't have to.

SWIFT IS QUICK, RELIABLE, AND LOW-COST

Using cutting-edge statistical methods, SWIFT estimates income, growth or poverty from **10–15 simple questions.**

SWIFT collects data using tablets or smartphones. This **reduces errors** in data collection and shortens processing time.

SWIFT is **customized** to your specific project needs, context, and contributions to the World Bank's twin goals.

SWIFT FOLLOWS 4 SIMPLE STEPS

Survey design and data collection
Enumerators interview the household members either face-to-face or over the phone.

Data recording and formatting
Results are recorded on tablets and sent to a cloud server.

Analysis and reporting on results
Data are downloaded and analyzed.

What you can do with the data
Results can help you monitor and report on your impact, and better target your project design.

Source: Original figure for this book.

International Finance Corporation (IFC) projects employ two tools that measure diet diversity and food insecurity at the household level. These can be incorporated into data collection efforts for projects that are expected to impact households' ability to access sufficient, safe, and nutritious food to meet their dietary needs and food preferences. Diet diversity has been shown in the literature to be a good proxy measure for household food security, per capita daily caloric availability, household assets and education, and household income.

FIGURE 8.2 Poverty Scorecard Example

Simple Poverty Scorecard® Poverty-Assessment Tool		
Interview ID: _____	**Name**	**Identifier**
Interview date: _____	Participant: _____	_____
Country: MOZ	Field agent: _____	_____
Scorecard: 002	Service point: _____	_____
Sampling wgt.: _____	Number of household members:	_____
Indicator	**Response**	**Points Score**
1. In what province does the household reside?	A. Gaza	0
	B. Nampula, Niassa, or Zambézia	2
	C. Inhambane	3
	D. Cabo Delgado	6
	E. Manica, or Maputo Província	12
	F. Sofala	13
	G. Maputo Cidade	16
	H. Tete	20
2. How many household members are 15-years-old or younger?	A. Five or more	0
	B. Four	9
	C. Three	15
	D. Two	22
	E. One	32
	F. None	36
3. Can the male head/spouse read and write?	A. No male head/spouse	0
	B. No	5
	C. Yes	8
4. What is the main construction material of the floor of the residence? *(Enumerator: Observe on your own, and ask respondent only if not obvious)*	A. Dirt, rough planks, or other	0
	B. Adobe, cement, tile/marble, parquet, or sawed wood	3
5. What is the main source of energy for lighting in the residence of the household?	A. Firewood, candles, oil/paraffin/kerosene, LPG, or other	0
	B. Electricity, generator, solar panel, or battery (large or small)	4
6. Does the household have a table in good working order?	A. No	0
	B. Yes	3
7. How many beds and cots does the household have in good working order?	A. None, or one	0
	B. Two	5
	C. Three or more	10
8. Does the household have a television in good working order?	A. No	0
	B. Yes	7
9. Does the household have a charcoal or electric iron for clothing that is in good working order?	A. No	0
	B. Yes	5
10. Does the household have a cell phone in good working order?	A. No	0
	B. Yes	4
SimplePovertyScorecard.com		Score:

Source: Schreiner 2017.
Note: LPG = liquid petroleum gas.

To measure food insecurity, IFC projects rely on the Food Insecurity Experience Scale (FIES) developed by the FAO. The instrument incorporates eight key questions, which are available in several languages on the FAO website, along with additional information to help enumerators (FAO 2017).

To measure diet diversity, IFC has adopted the Food Consumption Score (FCS) tool from the World Food Programme. Prior to implementation of the baseline survey, the project team will need to leverage local knowledge to identify localized food examples for each of the dietary categories mentioned in the FCS tool (WFP 2008). Since the FCS tool is based on the seven days prior to data collection, the results are extremely influenced by seasonality, including harvesting seasons as well as seasons when communities are following specific diet regimes, such as Ramadan. Seasonality should be considered when planning any nutrition focused data collection or interpreting and comparing the results.

Qualitative Approaches Including Participatory Rural Appraisal

Qualitative methods are generally better at teasing out causal relationships, process detail, and variation within a group (for example, farmers describing the factors that affect their maize yields). With qualitative methods, enumerators use checklists and a set of tools and skills to elicit information. They include focus group discussions, key informant interviews, case studies, direct observation (for example, walking along a transect—a straight line that cuts through a natural landscape so that standardized observations and measurements can be made—systematically recording certain types of detail), and other methods. Participatory (or rapid) rural appraisal (see discussion in chapter 11, "Women's Participation") uses these methods. Sometimes they are good at establishing trends and orders of magnitude. Qualitative methods also provide the flexibility to probe an unexpected issue that may emerge during the course of fieldwork.

Participatory approaches centrally engage the stakeholders in evaluation and teasing out lessons. These methods may yield more accurate and richer insights, and stakeholders may take more ownership of the results and of addressing the lessons that emerge. In practice, almost all evaluations of rural interventions tend to be participatory, at least in part. Although this may appear straightforward, conducting,

for example, a focus group discussion demands good facilitation skills and careful attention to probe the views of those who are quieter or less visible than others. It is all too easy to hear only the voices of the most dominant participants.

Using a mixed-methods approach is often beneficial as well. For example, initial qualitative work may inform the planning of a quantitative survey, to make sure it covers key issues. In certain circumstances, it is also considered good practice to follow up on quantitative results with qualitative research for a better understanding of the results (for example, to probe why a certain trend is evident).

Computer-Assisted Personal Interview Systems

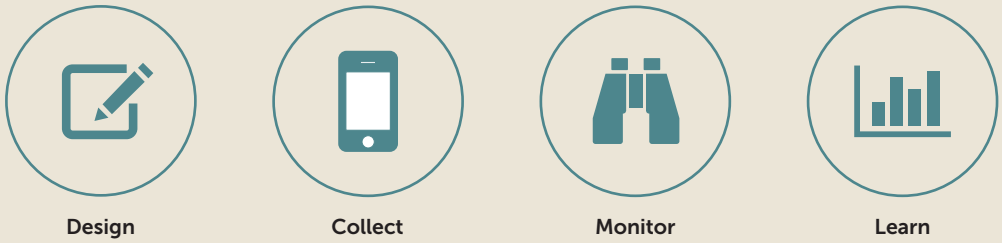
Quantitative surveys can now be supported and conducted using CAPI systems, including survey options available with supply chain management systems. These use handheld tablet computers or smartphones, eliminating the need to manually transfer data to a database, speeding up review and analysis, and reducing human error. See the example in box 8.1.

BOX 8.1

Features of Computer-Assisted Personal Interview (CAPI) Systems

SurveyCTO is an example of the features CAPI survey software can offer (figure B8.1.1).

FIGURE B8.1.1 SurveyCTO Pathways



Source: SurveyCTO website, https://www.surveycto.com.

box continued

BOX 8.1

Features of Computer-Assisted Personal Interview (CAPI) Systems *(Continued)*

It includes the following primary components:

- A central repository for both blank and filled-in survey forms and a website to assist in designing and managing surveys: it also provides a universal web interface for users filling out forms online.
- An android app that data collectors use to fill out forms on their android phones or tablets: after being collected, the data are uploaded to the SurveyCTO server (or, for more advanced offline set-ups, synchronized over local Wi-Fi networks).
- A desktop application that enables monitoring of incoming data in real time can be used to safely download, transport, export, and process data. It also handles data decryption—including on cold-room computers for the most sensitive data.
- A built-in data monitoring and visualization tool that enables one to quickly review and learn from data—even encrypted data—as it arrives right in one's browser.

Some Practical Considerations for Data Collection and Analysis

Learning Culture

A firm's staff members should be a key source of information, and their knowledge of critical issues can help shape the focus of an evaluation. If possible, encourage a learning culture among staff. This also means taking the time to understand disappointing outcomes and teasing out the lessons, applying the adage, "It is a failure only if we fail to learn from it." It is not always easy—because sometimes staff fear retribution if the results are poor and may try to cover up or transfer blame. At the extreme, the absence of a learning culture can really obstruct understanding, improvement, and innovation by masking outcomes and contributory processes. Developing a learning culture usually requires deliberate actions—and clear management support—to make the time for the necessary processes and to explicitly recognize and value the learning.

In-House or External Teams

Several factors affect a firm's decision to field the necessary skills in-house or to look for external assistance:

- The scale of field operation and frequency of data collection and analysis tasks
- The skill set needed, depending on the issue to be probed and type of data to be collected and analyzed
- Whether the use of in-house teams will affect the reliability of the data collected or bias farmer responses (any more than it would with an external team)
- The genuine desire for external insights and perspectives
- How important it is that the work is perceived as impartial, regardless of the competence of in-house teams

Routine, operationally focused monitoring can be competently handled in-house, but evaluations and special studies often benefit from external assistance. Sometimes there is merit in a dual approach—with external assistance to assist with design and analysis (and it is important to design the survey in the light of the planned analysis) and in-house teams carrying out some of the data collection.

While technology developments are making surveys easier to conduct and analyze, there is still a role for specialists in the design of questionnaire surveys (asking the right questions, of the right people, in the right way) and other data collection instruments such as qualitative interview guides or satellite imaging.

Partnerships need clarity on which partner is responsible for results measurement, and this should be mentioned in the memorandum of understanding (MOU) (see chapter 12, "Partnership Strategies").

Preparations: Training Enumerators, Testing Surveys, and Special Considerations

Enumerators need training on conducting a survey, so that they will understand the questions and be able to read them aloud verbatim without conveying any misunderstanding or asking them in a leading way—"You don't use fertilizer, do you?" versus "Do you use fertilizer?" Enumerators also need to know how to record valid responses. Check that concepts—not just words—are well understood. For example, *access*

can be understood in several very different ways. Enumerators may need training in how to interact with respondents, too.

If a survey is to be conducted in a local language different from that in which it was developed, the translation must be agreed upon and scripted. Written translations prevent different (mis)understandings of the translated questions.

Surveys should be tested before they are implemented. Certain questions may not work well in different languages and will need to be adapted to the interview language and context. Questionnaires may need to be shortened or questions rewritten if they are unclear.

Special consideration may be needed to survey particular groups (language, gender, indigenous peoples). Enumerators may have to work unusual hours to fit the respondents' schedules.

Choice of Data and Methods: Be Judiciously Pragmatic

It is often difficult to measure exactly the variable of interest—and to try to do so would be very costly, with varying levels of data quality. Smallholder income is an obvious example. Impacts may also take time to emerge. A scorecard measuring change in household assets may not detect immediate change, because there may not be immediate change.

Often, the best option is to try to understand outcomes and results by considering a number of different measures and what they mean when taken together. That implies choosing metrics that can be measured and mixing methods—particularly combining qualitative and quantitative approaches—to both measure and explain. It also requires experience to interrogate and interpret those results.

In the same vein, be discriminating in survey design—by asking only questions likely to yield reliable answers. Questions requiring farmers to recall details are not likely to be answered well: "What was the price last year?" "How much crop was sold last year?" Both farmers and enumerators can find long surveys tedious. Keeping them as short as possible will help ensure that they are completed properly.

It is always possible to dig deeper, to extend the scope of the survey or analysis, and implement it with a larger sample. With any data collection, a cost-benefit perspective is helpful: Will a pragmatic approach deliver sufficient information? What would be the additional cost of obtaining more accurate data, and how much additional benefit would that deliver? It may be more cost-effective to triangulate data from multiple sources, to generate more certainty, than to seek a definitive and possibly elusive answer from a single elaborate survey.

Checklist

Solutions, Strategies, and Best Practices for Collection and Analysis of Supply Chain Data

Identify and plan for information needs from the outset.

- How do you define success? ☐
- How can success be measured? ☐
- What might stand in the way of success? ☐
- Which activities need to be monitored over the course of the intervention? ☐
- Which variables need to be measured in the baseline data collection? ☐

Use SMART indicators and objectives.

- Are the set indicators and objectives formulated according to the SMART method—specific, measurable, achievable, relevant, and time-bound? ☐

A logical framework is useful for planning and for measuring results.

- What is the goal of the project? ☐
- What is the purpose of the project? ☐
- What are the outcomes of the project that help to achieve the set goal? ☐
- What are the required outputs of the project to achieve the outcomes? ☐
- What activities will lead to the required outputs of the project? ☐
- What are the key assumptions that inform the achievement of the goals through the outputs? ☐

The right metrics can improve business practices.

- Which lower-level metrics can be measured through monitoring of the project's key performance indicators (KPIs)? ☐
- Which higher-level questions need to be answered in the evaluation? ☐
  - For example, is the project achieving its aim? Is the project design right? ☐

Investigate all sources of data.

- Is information available through other sources that are more efficient than an in-depth survey? ☐

Results Measurement: Data Needs

Monitor management information for firm and other stakeholders.

- Does the agribusiness have an appropriate system for the collection and analysis of routine monitoring data in place? ☐
- If it has, does it need adjustments for the data needs of this project? ☐

- If not, which off-the-shelf solution is most suitable to support the operations and management of agribusiness value chains with smallholder suppliers? Consider: ☐
  - Does the number of users allowed for the tool match the data needs? ☐
  - Do the scope and availability of the tool cover the operating locations of the firm? ☐
  - Does the solution provide timely and responsive technical support? ☐
  - Does the solution meet the required rules on data privacy? ☐
  - Is the cost structure of different features of the tool suitable for the firm? ☐
  - Does the tool provide the needed features? (for example, traceability, harvest predictions, managing buying or selling inputs) ☐

Conduct impact evaluation.

- Which evaluation methodology is most suitable? (for example, quantitative, qualitative, mixed methods, RCTs), considering: ☐
  - What is the scope of the evaluation? (that is, what questions do you want to answer and what will it take to answer them?) ☐
  - How will the information be used? ☐
  - How complex is the evaluation? (that is, should multiple factors be taken into account?) ☐
  - What are the available resources? ☐
  - When are the results needed? ☐
  - What are the reporting requirements? (for example, does the firm want to make public claims about the achievements?) ☐
- Does the firm need to seek outside expertise to successfully implement the evaluation? ☐

Impact metrics to consider for smallholder supply chain interventions

- Which impact metrics should be measured? (for example, farmers reached, productivity, quality, income) ☐

Tools available for data collection

Consider survey tools to measure farmer household income.

- *Household surveys:* Large surveys asking about household consumption can be a proxy for household income (for example, the World Bank's Living Standard Measurement Study [LSMS] surveys). Large surveys aim to understand income patterns and trends in a large area or across an entire country, canvassing more than 1,000 households; such surveys are very costly and time-consuming. ☐
- *SWIFT rapid assessment tool (Survey of Well-Being via Instant and Frequent Tracking):* SWIFT is a tool developed by the World Bank to estimate household income and expenditure in a cost-effective, timely, and user-friendly manner. ☐

- *Poverty scorecards:* Such scorecards are simple and quick tools that assess whether a household is above or below a poverty line (national, international, or program specific). ☐

Consider survey tools to measure food and nutrition security, which can be important proxies of smallholder household welfare.

- Does the project drive change in farming practices? ☐
- Will a change in farming practices lead to changes in food and nutrition security? ☐
- Tools: ☐
  - *Food Insecurity Experience Scale (FIES):* A tool to measure food insecurity among households developed by the Food and Agricultural Organization (FAO) ☐
  - *Food Consumption Score (FCS):* A tool to measure diet diversity among households developed by the World Food Programme ☐

Consider qualitative approaches, including participatory rural appraisal.

- Will qualitative methods be more suitable to uncover causal relationships, process details, and variation among a group? ☐
- Is a participatory approach suitable to reveal more accurate and richer insights for this project? ☐
- Can mixed methods be used to gain in-depth insights into the project? ☐

Consider computer-assisted personal interview (CAPI) systems.

- Are CAPI systems available for the data collection efforts? ☐

Some Practical Considerations for Data Collection and Analysis

Consider learning culture.

- Does the firm's staff have a learning culture (for example, reflecting on disappointing outcomes)? ☐
- If not, how can management encourage a learning culture? ☐
- Develop a plan on how the analysis will inform future operations before committing resources, and reaffirm that plan with the firm's team. ☐

Consider whether to use in-house and/or external teams.

- Does the firm have the necessary skills in-house or does it require external assistance? Consider the following: ☐
  - Scale of field operations and frequency of the data collection and analysis task ☐
  - The skill set needed, depending on the issue to be probed and type of data to be collected and analyzed ☐

- Whether the use of in-house teams will affect the reliability of the data collected or bias farmers' responses ☐
- The genuine desire for external insights and perspectives ☐
- How important it is that the work is seen as impartial, regardless of the competence of in-house teams. ☐

Make preparations: training enumerators, testing surveys, and special considerations.

- To what extent do the enumerators require training? ☐
- Does the questionnaire have to be translated into the local language? ☐
- Does the questionnaire have an appropriate length? (Long surveys, for example, can lead to fatigue among respondents.) ☐
- Has the questionnaire been sufficiently tested? ☐
- Do particular groups (by language, gender, indigenous status, and so on) require special considerations? ☐

Choose data methods—be judiciously pragmatic.

- Which methods, or their combination, will lead to the most in-depth understanding of the variables of interest? ☐
- Which questions will yield reliable answers? ☐
- Which questions could be answered reliably through other sources? ☐

Note

1. A Japanese business philosophy of continuous improvement of working practices and personal efficiency.

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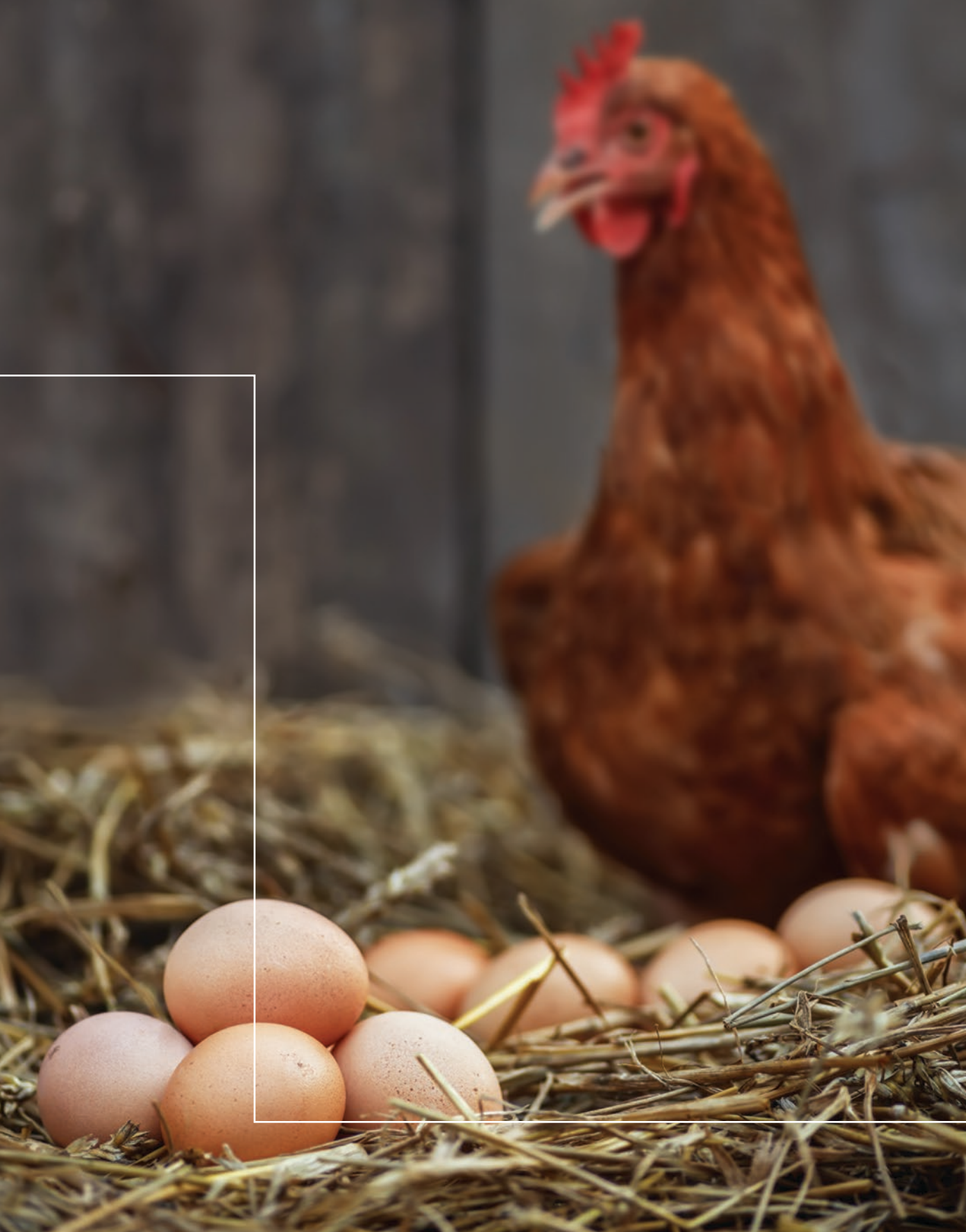


CHAPTER 9
NUTRITION

Richard Colback, Liudmila Pestun, Olivia Elliott, and Victoria Quinn

KEY MESSAGES

- Nutrition constitutes one of the most critical factors of human health and well-being.
- Food security is an important requirement to improve the nutrition of farmers, but by itself it is not sufficient to guarantee better nutrition, because there is a range of other contributing factors.
- Although smallholder farmers produce a large share of the world's food, they are often the most food and nutrition insecure.
- Good nutrition requires not only access to nutritious food throughout the year (that is, food security) but also adequate dietary and care practices within the family and access to sufficient health and hygiene services. This approach to improving nutrition is embodied in the food-care-health framework.
- An investment in the nutrition of farmers and their families is a smart business investment that may yield significant return on investment (ROI) from improved farmer productivity, climate resilience, and loyalty as well as from the boost in a company brand image.

- Helping farmers understand the importance of intercropping and cultivating nutrient-dense crops as well as rearing livestock and poultry that are already adapted and culturally accepted in their agroecological zone can lead to improved dietary diversity while increasing the productivity of cash crops through improved soil health.

Introduction

Poor nutrition or malnutrition is a challenge for smallholder families, who often do not have access to a variety of nutritious foods and thus rely on often insufficient nutrient intake. Poor dietary quality is an underlying factor contributing to malnutrition. A central component of dietary quality is dietary diversity. Generally, more diverse diets are associated with a higher intake of micronutrients: for example, vitamins and minerals (box 9.1). Deficiencies in micronutrients, such as in iron, zinc, or vitamin A, often lead to serious poor health outcomes, decreased educational achievement, onset of disease, and even death, especially in children.

Unfortunately, levels of malnutrition across the world today continue to be high and affect about 700 million people.[1] Progress has been made in some areas, as reported by several United Nations (UN) agencies (FAO et al. 2022). The UN estimated that malnutrition, in the form of stunted growth in children under age 5, fell from 33 percent in 2000 (UNICEF, WHO, and IBRD 2021) to 22 percent in 2020 (FAO et al. 2022). However, the emergence of a global COVID-19 pandemic in 2020 resulted in an increase in all types of malnutrition and erased some of the gains made in prior years to combat the problem. Mitigation efforts

BOX 9.1

What Is Good Nutrition?

Good nutrition is broadly defined as the ability to secure access to energy and essential macronutrients and micronutrients to meet all of the body's nutritional needs to grow, fight infections, repair, and perform desirable activities.

to contain the spread of the virus disrupted food, health, and transport systems and thus worsened food insecurity and hunger, especially in rural areas. This pandemic also highlighted the strong link between certain types of noncommunicable diseases and overweight/obesity, which is a form of malnutrition, where the poor health and comorbidities related to a low-quality diet can lead to increased mortality.

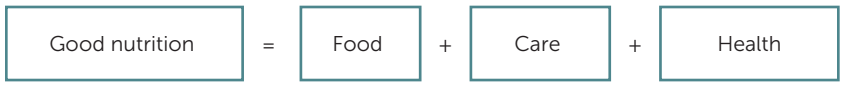
Achieving good nutrition entails much more than just consuming more calories. And assessing nutritional challenges is more than an assessment of food security. The two concepts are connected but not interchangeable, as improved nutrition typically means improved food security, but the converse may not always be true. Good nutrition requires having access to diverse, nutrient-dense food, which may be sourced in local markets, provided in workplace environments, or grown by farm families as part of their cropping choices. See box 9.1 for a shared definition of nutrition, which is an important first step to addressing the problem.

It is vital that people, especially women and children, eat nutritious foods in the right amount to meet their biological needs at different points in their life cycles. This encompasses the notion of family care, which is one the cornerstones of appropriate nutrition. A combination of (1) knowledge of good nutrition and dietary practices and (2) financial empowerment is required to enable action following informed decisions at a household level, typically led by women.

For individuals to fully utilize the nutrients eaten in food, they need to be in good health. Certain illnesses interfere with utilization and/or absorption of nutrients: for example, calories may be burned through fever and nutrients lost through diarrhea. Therefore, another important requirement for families to achieve good nutrition is to have access to adequate health care, clean water, and sanitary conditions (see figure 9.1). Significant public sector and civil society support is required because investment is needed for communal infrastructure such as wastewater treatment, drinking water distribution, and rural health care facilities. In short, achieving good nutrition requires that all the members of farm families have access to adequate food, family care, and health and hygiene services.

In addition to a shared notion of what nutrition is, it is also important to have a shared understanding of the various types of malnutrition that exist today (see box 9.2 and box 9.3), especially in emerging markets.

FIGURE 9.1 Essential Elements of Good Nutrition



Source: Original figure prepared by IFC for this publication.

BOX 9.2

Types of Malnutrition

Malnutrition refers to deficiencies, excesses, or imbalances in a person's intake of energy and/or nutrients in relation to their biological needs and includes three broad groups of conditions:

1. *Undernutrition* that results in deficits in height and weight
2. *Micronutrient deficiencies* (also known as "hidden hunger"; see box 9.3) caused by inadequate dietary intake of essential vitamins and minerals needed for good health, growth, and development
3. *Overweight and obesity*, which increase risks of diet-related noncommunicable diseases; for example, diabetes, cardiovascular disease, and certain cancers

Poor dietary quality is linked in one way or another to all three types of malnutrition.

Sources: Development Initiatives 2021; INDDEX 2022.

The Business Case for Nutrition

Improving farmer or farmworker nutrition should not be viewed solely as a charitable act or only in corporate social responsibility terms. Investing in better nutrition along the value chain is a sound business decision because of its proven links to improved human development and increased economic productivity. The range of quantifiable benefits may include increased workforce productivity, increased staff presence at work, and increased yields in farming supply chains. Several agribusiness industry trendsetters, including Olam, Unilever, and Ferrero, recognize the importance of nutrition for their business and not only invest in nutrition of their employees but also ensure that the smallholder suppliers have access to good nutrition. Agribusinesses also see the benefits

BOX 9.3

Hidden Hunger: The Pervasive Problem of Micronutrient Malnutrition

Micronutrient deficiencies have detrimental health and economic effects for both children and adults. Micronutrients—such as iron, vitamin A, and zinc—are essential to support healthy child growth and brain development, to limit the risk of infectious disease, and to maintain and increase workforce productivity. A deficiency in one or more of these essential micronutrients can lead to serious negative outcomes, such as weakened immune systems and increased risk of death. Also affected are child growth and poor educational outcomes, both of which have lifelong consequences for adult earnings when physical capacity and mental acuity are necessary.

Despite the clear correlation between micronutrients, human health, and economic performance, the majority of populations in low- and middle-income countries (LMICs) are deficient in one or more of these vital micronutrients. The outward signs of micronutrient deficiencies are frequently not visible, and therefore this phenomenon is known as "hidden hunger," which denotes a chronic lack of vitamins and minerals even when the overall diet may provide adequate calories.

The Lancet Global Health recently estimated that one in two preschool-age children and two in three women of reproductive age have at least one micronutrient deficiency, globally (referenced in von Grebmer et al. 2016; IFPRI 2016). In Sub-Saharan Africa the situation is worse, with these figures increasing to 62 percent and 80 percent, respectively. This new data have shown that the widely cited datapoint of 2 billion people globally suffering from hidden hunger is a major underestimate, as the problem is greater than previously realized and is important to address.

A healthy and nutritious diet requires not only adequate calories but also adequate levels of micronutrients and macronutrients, especially protein, to meet an individual's nutrient requirements at different points along the life cycle from infancy to childhood to adolescence to adulthood. Animal-source foods provide an extremely rich source of these nutrients and are important to promote in diets as a strategy to support good health, physical growth, cognitive development, and future productivity.

A cluster-randomized feeding trial in Kenya demonstrated this point. The study found that intake of micronutrients that animal-sourced foods provide—folate, iron, vitamin B_{12}, zinc, and riboflavin—were significant contributors to the positive change in school test scores (Development Initiatives 2021). In the study, primary school age children were randomly assigned to a snack of meat, milk. or nothing (the control group). Compared with the control group, both the meat and milk groups showed significant improvements in test scores in subjects such as arithmetic, English, Kiembu (the local language), Kiswahili (the national language), science, and geography.

Increasing dietary diversity in LMICs by promoting animal-source foods and nutrient rich crops is important to reduce hidden hunger and improve nutrition outcomes. A challenge facing

box continued

BOX 9.3

Hidden Hunger: The Pervasive Problem of Micronutrient Malnutrition *(Continued)*

low-resource families is accessing animal-food sources, because these foods are often more expensive, which may account for their infrequent consumption by these families.

The International Finance Corporation (IFC) works hand in hand with its investee companies, such as Suguna Poultry (see box 7.7 in chapter 7), to improve the affordability of micronutrient-dense foods, like meat, milk, and fish, thus enabling populations that are particularly food insecure to access these essential micronutrients. For example, Pearl Dairy, an IFC client in Uganda, with the support of IFC Advisory established itself as the fastest-growing dairy company in East Africa that provides nutritious, affordable, and safe milk and dairy products to its customers in several African countries.

of investing in nutrition along their value chains, as they fulfill their sustainability commitments and improve brand image and therefore cater to the new generation of consumers who care about the impact associated with the products they choose (Speelman et al. 2019) (see box 9.4 and box 9.5).

On a broader scale, investments in nutrition have a very high economic rate of return. For every US$1 invested in children's nutrition there is a return of US$18, accrued mainly through increased productivity from improved health and reduced illness (Hoddinott et al. 2013). Breastfeeding is one of the best investments in global health, as every US$1 invested in improving suboptimal breastfeeding practices generates US$35 in economic returns (World Bank 2017). In the longer term, improving child nutrition leads to better cognitive development, improved educability, and, in time, increased productivity and earnings in adulthood. (For more on the economic benefits of nutrition, see box 9.6 and box 9.7.)

The poor health and reduced productivity associated with malnutrition not only affect the lives of farm families but also have adverse effects on the economies of local communities and countries (Siddiqui et al. 2020). To illustrate this, it has been estimated that the economic losses of malnutrition on the global economy are upward of US$3.5 trillion, more than the gross domestic product (GDP) of all African countries combined (Global Panel 2016).

BOX 9.4

Case Study: Lessons Learned from Integrating Nutrition Support into Supply Chains—Building Partnerships to Reduce Costs and Achieve Impact

A review of the experiences of six global supply chain companies that support the nutrition of their workers indicates that nutrition programs in the supply chain may not require significant investment beyond start-up costs and initial capacity building, and that some nutrition interventions can be self-perpetuating. The companies reviewed are Unilever, Twinings, VF Corporation, Olam, Nestlé, and Nature's Pride.

Specific nutrition interventions range in cost, but many need only a tweaking of existing activities to incorporate nutrition elements or a leveraging of existing community health programs and related structures to extend nutrition to the company's workforce, rather than building nutrition support systems from scratch. Given the potentially significant public health and social impact of such programs, coordination and cofunding opportunities can be sought with national governments, donors, and partnerships with civil society groups working in nutrition (ATNI 2021, 7).

One good example is Olam's Sustainable Cashew Growers Program, located in Côte d'Ivoire. This program has joined forces with the government's Ministry of Health and Public Hygiene's National Nutrition Program and its partners (United Nations Children's Fund [UNICEF], the World Health Organization, Helen Keller International, and the government of Canada) to help increase coverage of essential nutrition services, such as vitamin A supplementation and screening for acute malnutrition. While Olam provides funding and in-kind contributions to support community mobilization and logistics, the nutrition expertise, nutritional supplements, and materials are provided by the government and development partners (Development Initiatives 2021).

Source: OFI 2020.

BOX 9.5

Case Study: How Touton Supported Improving Nutrition and Hygiene in Smallholder Cocoa Communities in Ghana

Touton is a leading French company that trades and processes cocoa for global chocolate manufacturers like Ferrero. The main driver for Touton in Ghana to support nutrition in its smallholders was not to derive direct financial returns but rather both to strengthen its sustainability approach by responding to the nutrition needs in cocoa-growing communities and to attract global customers.

box continued

BOX 9.5

Case Study: How Touton Supported Improving Nutrition and Hygiene in Smallholder Cocoa Communities in Ghana *(Continued)*

Hence, brand positioning was at the core of the business case. The company decided that being a sustainability thought leader and innovator would help it become a top choice supplier for its buyers. The underlying idea was that without healthy cocoa farmers, the cocoa sector would not be sustainable over the long term.

Touton recognized that in Ghana, malnutrition was a problem in the cocoa farming communities in which it operated. Cocoa farm families were affected by a vitamin A deficiency in children and anemia in both women and children, all of which contributed to physical fatigue, reduced immunity, and poor health. The company increasingly understood that nutrition and hygiene interventions could be a way to address these problems and secure improved outcomes in health, food security, and income diversification for cocoa farm families.

Touton relies on a network of rural service centers as hubs to deliver their agribusiness and other support to cocoa growers. Touton's pilot nutrition program was designed to be integrated into the company's existing service delivery model with the objective of improving access to good-quality food and diverse diets among cocoa-producing farm families. The company's two-pronged approach included both increasing awareness of the importance of nutrition and hygiene and improving access to nutritious food products (for example, vegetables, fruits, and animal-source foods), including through homestead food production. Therefore, both the awareness and access perspectives of improving nutrition were addressed.

Touton staff initially delivered the program to families through direct awareness raising and training. However, the high demand on staff time necessitated exploring other channels to implement the program. One of these other channels was to embed nutrition and hygiene training into the existing agricultural-related training delivered by Touton's staff through the rural service centers. These training modules included good agricultural practices training, specific crops trainings, farm development plans, farmer business school curricula, and information from village savings and loans associations, among others.

Touton's nutrition pilot was supported by the Cocoa Nutrition Innovation Project, as well as by Ferrero, the Dutch government, and IDH (the Sustainable Trade Initiative). In 2018–19, the pilot reached a total of 700 cocoa-growing farm households.

Touton's approach aimed to weave nutrition interventions into broader services, such as its own agriculture training and existing community nutrition services. The belief is that this approach will reduce implementation costs and increase potential for future scale-up, thus making nutrition programs a more viable long-term investment for the company.

box continued

BOX 9.5

Case Study: How Touton Supported Improving Nutrition and Hygiene in Smallholder Cocoa Communities in Ghana *(Continued)*

A key lesson learned by Touton was that having "company nutrition champions" was crucial to continuously motivate staff and advocate for the nutrition and hygiene activities.

Touton recognizes that its efforts are still generating evidence on the most effective and scalable approaches to improve the nutrition and health of cocoa communities. At the writing of this case study, results were not available.

Sources: "Cocoa Nutrition Initiative" (IDH n.d.); "Touton" (IDH n.d.).

BOX 9.6

Nutrition Affirmed by World Economists as the Best Economic Investment

A decade ago, a group of the world's top economists—including four Nobel laureates—was charged with reviewing the economic evidence to identify the smartest ways to allocate money to respond to 10 of the world's biggest challenges. Fighting malnutrition came out on top as the best investment.

In the words of Nobel laureate and economist Vernon Smith, "One of the most compelling investments is to get nutrients into the world's undernourished. The benefits from doing so—in terms of increased health, schooling, and productivity—are tremendous."

Source: Copenhagen Consensus 2012.

The link between increased smallholder productivity and reduced malnutrition is primarily based on the body of research showing that improving anemia caused by iron deficiency in workers can lead to higher productivity. Addressing iron deficiency anemia through simple, low-cost interventions has been proven to increase worker productivity levels: an increase of 1 percent in hemoglobin level (a measure of anemia) is associated with a 1.5 percent increase in productivity. In one case, reducing anemia in agricultural workers led to a 17 percent increase in their work productivity (Horton and Ross 2003). With a direct

BOX 9.7

Improving Nutrition in Farm Families Increases Economic Growth and Reduces Poverty

- Stronger and healthier farmers are better able to be physically productive in the agribusiness sector, resulting in fewer sick days and days they are unable to work.
- Well-nourished children of farm families are better learners at school and will become more productive and successful as adults.
- Well-nourished families spend less money on health care than others, freeing up their resources to invest in local markets, thus helping to fuel the local economy.

Source: Self-Help Africa 2021.

connection among productivity, global sourcing that seeks to produce commodities at a cost-competitive level, and the desire to increase the profitability of smallholders who are constrained by labor availability, raising productivity by addressing anemia can have a direct competitive benefit in the agriculture sector.

A recent study of a community of coffee farmers in Indonesia showed that over one-third of the farmers reported being absent from work due to illness (mostly related to different forms of malnutrition). Over 10 percent of farmers reported being frequently unable to work (Arsyad et al. 2019).

Other benefits that may arise from improving the nutrition of farm families along the supply chain include the following:

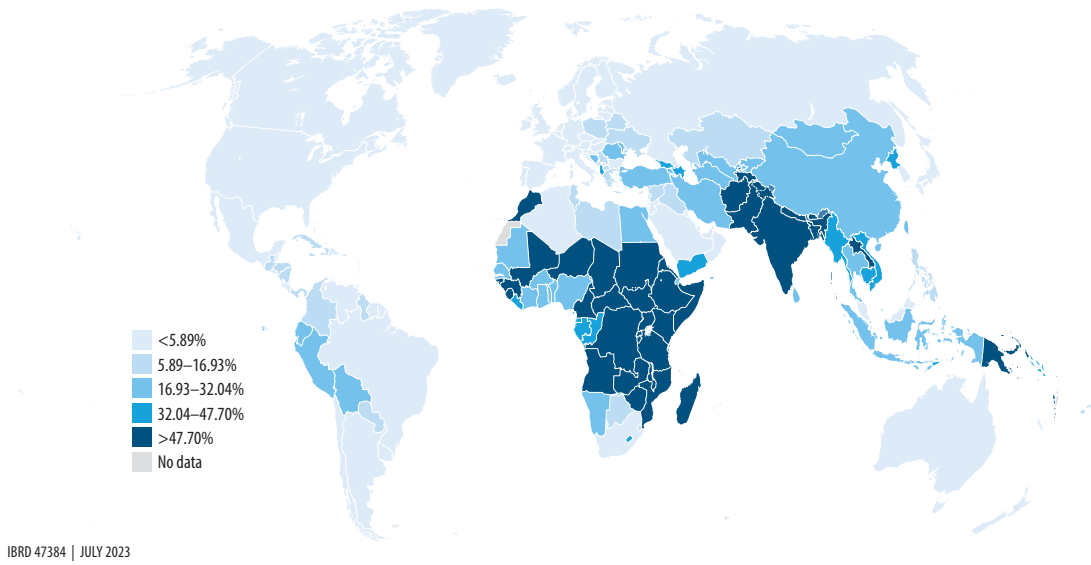
- Increased food diversity and crop productivity for farm families (through improved farming practices such as rotational, relay, and intercropping and family gardens to grow nutritious vegetables); development of new nutrition-focused products (biofortified seeds, micronutrient fertilizers); and potential for manufacturing, processing, and marketing fortified and nutritious foods
- Increased income for farm families that economically lifts the surrounding communities due to the increase in purchasing power, which creates demand on local markets, which in turn is good to fuel economic growth in LMICs

- Enhanced local food security because smallholder farmers can produce nutritious crops and foods for nearby markets
- Increased farm family loyalty to agribusiness companies as a result of the support these companies provide on improving nutrition

Improving the Nutrition of Women

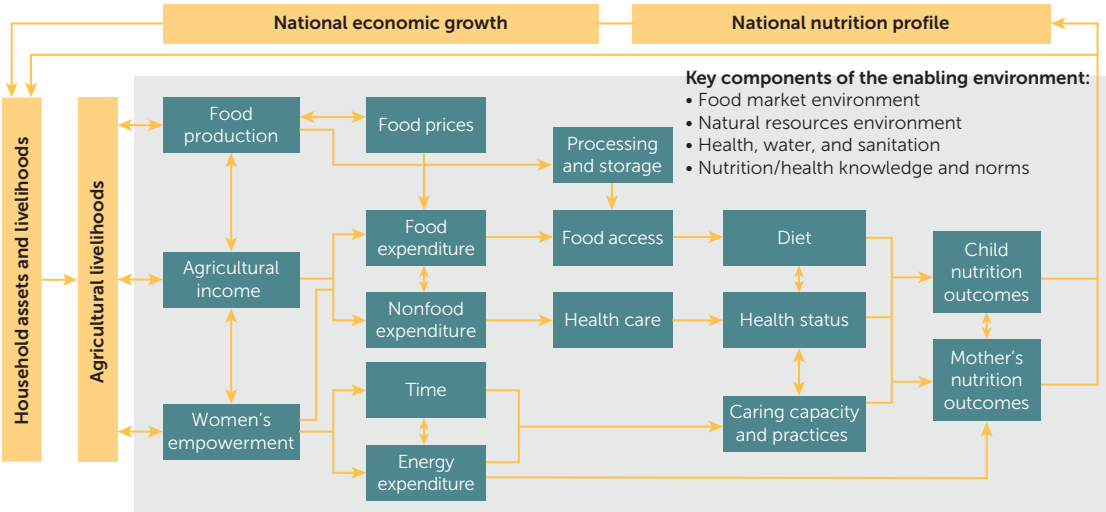
As noted in chapter 11, "Women's Participation," women often compose a large part of the agricultural workforce (map 9.1) and are often more susceptible to malnutrition. Access to healthy food, clean water, and a safe place for pregnancy or lactation can improve the nutritional status of women and their children (figure 9.2). Studies have shown that this type of support can reduce absenteeism and protect production levels, while at the same time building loyalty across a company's female workforce (box 9.8).

MAP 9.1 Female Employment in Agriculture (Percent)



Source: ILO-Modelled Estimates Database (ILOSTAT database), International Labour Organization (accessed January 29, 2021), https://data.worldbank.org/indicator/SL.AGR.EMPL.FE.ZS?end=2019&start=2019&type=shaded&view=map&year=2019.

FIGURE 9.2 Agriculture to Nutrition Impact Pathways



Source: USAID 2018.

BOX 9.8

Investing in Women's Nutrition Is a Smart Business Decision

Women are often the gatekeepers of their family's nutritional well-being because of their multiple roles as child caretakers, home providers, farmers, and income earners. Finding ways to ensure that women can benefit from and contribute to nutrition is likely to lead to multiple benefits such as improved health for themselves and their families and increased productivity for the agribusiness companies that engage with them.

Improving the nutrition of women not only supports their health and productivity, but also is key to breaking the intergenerational cycle of malnutrition between a mother and her child. This is because women who are undernourished tend to give birth to small, undernourished babies who in turn grow into undernourished adults with the cycle continuing from one generation to the next. The cycle can be broken by investing in improving the nutrition of women so that they are more

likely to give birth to healthy babies who thrive, grow, and become healthy adults and a stronger workforce for tomorrow.

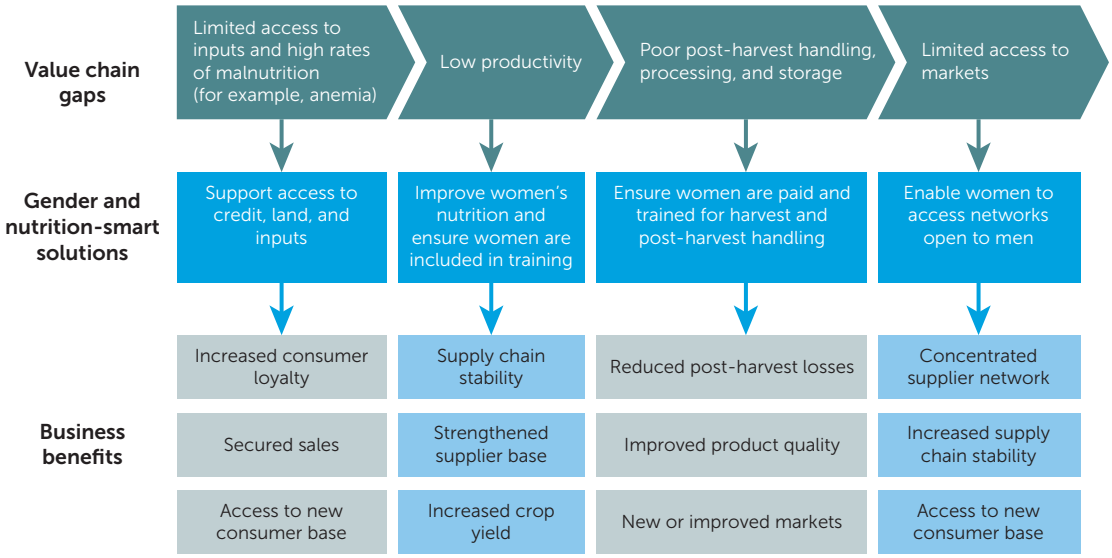
Poor nutrition not only limits the productivity of women but also puts them at greater risk for increased illness and mortality. Two key nutrition areas offer an opportunity for targeted activities by the private sector in coordination with local health care programs and resources:

1. *Maternal nutrition:* Pregnancy and the prenatal and postnatal periods are when women are particularly vulnerable to malnutrition due to their higher nutritional requirements at these times. As women frequently continue to work during pregnancy, companies should contribute to women's good health by linking their female workforce to improved care and nutritious diets, which are crucial for the well-being of both mothers and their infants and young children. Strong maternal nutrition is essential to improving women's workforce performance, productivity, and career advancement.
2. *Anemia:* Anemia in women is a serious problem and is often related to iron deficiency due to poor diets with low iron availability, high rates of infections, and blood loss (for example, due to childbirth or menses). As a result, up to 39 percent of women in sub-Saharan Africa and 50 percent in South Asia are anemic. With the dramatic effect that iron deficiency anemia can have on worker productivity, reducing anemia in women is key to not only lowering maternal deaths but also to increasing labor force productivity and outputs across the agribusiness supply chain.

The private sector can also contribute directly to addressing key commercial challenges faced by women (figure 9.3) in a number of ways, such as:

- Improving access to productive inputs for farming
- Improving women's access to capacity building opportunities
- Reducing income gaps by directing payments to women
- Empowering decision making by women in agriculture
- Complying with national legislation to support maternity rights and breastfeeding for working mothers

FIGURE 9.3 Benefits of Improving Women's Nutrition in Agribusiness Value Chains



Source: IFC 2020.

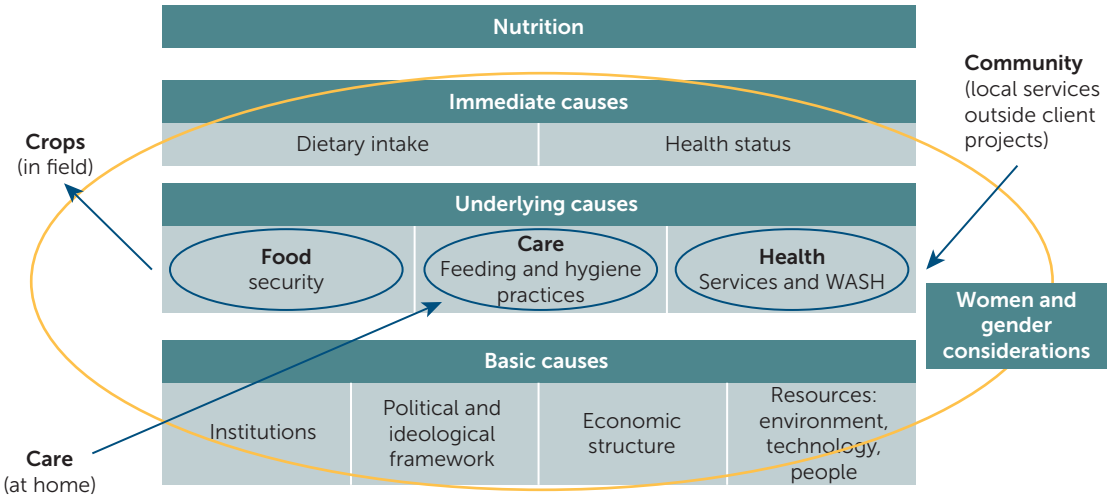
Food, Care, Health

The United Nations Children's Fund (UNICEF) (UNICEF 1993), has identified a framework that focuses on the three major clusters of underlying determinants of nutrition, namely (1) food (that is, quality and quantity of diet), (2) care (that is, feeding and hygiene practices), and (3) health (that is, health and hygiene services) (figure 9.4). These three clusters of underlying determinants can help direct where future actions should be focused to improve nutrition outcomes. That said, it is important to first assess and analyze the local food and health care to ensure that any actions taken are relevant to farm families and their communities.

Crops, Care, Community

The International Finance Corporation (IFC) adopted and adjusted the Food-Care-Health framework described above into its crop-centric work. The Crops-Care-Community (CCC or Triple C) framework emphasizes the importance of crops as a source of good nutrition for farming families (table 9.1) while also recognizing the importance of animal-source foods.

FIGURE 9.4 Framework to Improve the Nutrition of Women and Children



Source: USAID 2022.
Note: USAID = United States Agency for International Development; WASH = water, sanitation, and hygiene.

TABLE 9.1 The Crops-Care-Community Framework to Improve Nutrition: Client and Value Chain—Smallholder Farm Families

	Crops	Care	Community
Locus	Field	Home	Locally available services
Focus	Promote family cultivation and consumption of nutritious crops through various approaches. • Support biofortified crops; for example, iron beans, vitamin A maize, zinc maize, iron pearl millet, zinc wheat, vitamin A cassava, vitamin A sweet potato, zinc rice. • Encourage micronutrient-rich rotational, relay, and intercropping approaches. • Encourage establishment of family gardens to grow nutritious crops year round • Encourage efficient irrigation, improved agronomy, and stronger soil health for high-value nutritious crops.	Support relevant nutrition education activities for farm families aiming at long-term behavior change, such as adopting improved feeding, health, and hygiene practices, especially for pregnant or lactating women and children under two years.	Forge links with existing health services and development projects including water, sanitation, and hygiene and community development. Encourage smallholder farm families to utilize these existing services that are relevant to nutrition.

Source: World Bank.

- *Crops:* Work in this focus area occurs primarily in the farmers' fields. It aims to improve food security and nutrition by helping participating farmers cultivate nutrient-dense crops that are already adapted and culturally accepted in that agroclimatic zone through rotational, relay, or intercropping methods, as well as the use of kitchen gardens. Selection of nutrient-dense crops may allow several interconnected benefits:
  - Improved dietary diversity by increasing family access to nutrient-dense fruits and vegetables high in vitamins and minerals as well as protein-rich pulses; contribution to soil health and fertility, which improves the productivity of cash crops (for example, legumes colonized by bacteria that convert atmospheric nitrogen into plant-available nitrogen, thus improving soil's nitrogen content)
  - Protection of shade-grown crops (for example, improved coffee productivity when intercropped with fruit trees)
- *Care:* Nutritional support may extend into the home, community or a classroom setting and be combined with business skills training such as the Agribusiness Leadership Program or other capacity-building activities. Increasing the knowledge of options and reinforcing good nutritional decision-making can be achieved by designing and delivering contextually relevant nutrition education. This education provides behavior change support to farm families to make healthy dietary decisions, covering topics such as the types of nutritious food crops to grow or purchase; how to prepare these crops and combine them with other nutritious foods especially nutrient-rich animal-source foods necessary for good growth, brain development, and overall health; how to ensure that women and children get the variety of foods they need for good health; when to seek advice or nutrition supplies from local health workers; and how to keep food safe during processing, preparation, and storage.
- *Community:* Farming families in the clients' supply chains may also be linked with existing external support such as health and nutrition services that are frequently operating in surrounding areas, but not yet fully leveraged. Among such services may be distribution of iron tablets or deworming medicines, preventative malaria supplies, care for malnourished children, and so on.

Guiding Principles

IFC uses a set of guiding principles in its approach to improving nutrition with agribusiness investment clients where profitability is a key driver, but long-term nutrition outcomes provide significant development impact (World Bank 2023; Hawkes and Ruel 2008). The following actions are recommended:

- Assess and analyze the local context related to nutrition challenges facing farm families in order to inform relevant actions to improve nutrition.
- Identify clearly defined nutrition objectives and associated ROI indicators into agricultural project designs.
- Invest in farmers to provide the greatest ROI against chronic challenges that impact profits and development.
- Reduce and manage the impact of nutrition-focused work on farmers' time burden (especially for women farmers) to ensure that the ROI at the individual level is accounted for.
- Increase access to high-nutrient-content food through support to promote cultivation and consumption of locally grown crops or animal-source foods high in nutrients, thus leveraging lower cost and sustainable options.
- Improve nutrition knowledge of farm families to enhance dietary diversity and maximize the uptake and benefits from other activities.
- Build on existing resources (for example, tap into nutrition programs of nearby health facilities) to the extent possible.

A Successful Example in Indonesia

Since 2016, IFC has supported and implemented project activities that improve the nutritional status of smallholder farm families, for example, in the Musim Mas (MM) Indonesian Palm Oil Development Scheme for Smallholders (IPODS) project. Project has focused on improving the productivity of crops through better access to inputs, finance, and markets as well as training farmers on topics related to diet diversification and better nutritional outcomes (box 9.9).

BOX 9.9

Case Study: Health and Nutrition Program for Women from Oil Palm–Growing Smallholder Households

Musim Mas (MM) Group is one of the world's largest palm oil corporations, with operations spanning the entire value chain in 13 countries across Europe, Asia, and the Americas. Its operations entail large commercial farms as well as smallholder farmers in Indonesia.

Indonesia is the world's largest producer of palm oil, with 2.67 million smallholder farmers managing a combined 40 percent of the country's total oil palm area and accounting for 35 percent of the nation's palm oil output. But smallholder farmers face several productivity, profitability, and sustainability challenges. These challenges include land tenure issues, poor agricultural practices, and lack of access to markets and finance for replanting and certification. Recognizing this, MM continuously invests in communities to improve productivity, overall production, and the standards of living for the suppliers.

In 2015, MM partnered with the International Finance Corporation (IFC) on the Indonesian Palm Oil Development Scheme for Smallholders (IPODS) project (Musim Mas and IFC n.d.), seeking to integrate 1,500 farmer groups with over 30,000 smallholders (9,000 women) into the company's palm oil supply chain. One of the project's five intervention components was the Health and Nutrition (HNT) Program for women from oil palm–growing families.

Women have key roles in providing nutritious food and maintaining the health of the family, but they often have less access to resources and have lower decision-making power than men. Women also have limited understanding, time, and resources to select nutritious foods for their family. Recognizing this, the project offered a series of HNT programs through 70 women community leaders who were trained on health and nutrition issues. These leaders then worked with 50–70 women each to increase their knowledge on health and nutrition, and to encourage home gardening or animal rearing (alternative livelihoods) as a way of improving food accessibility and nutritional intake. A total of 975 women were reached this way.

The HNT Program emphasized the important role of women in family health, and the strong commitment and motivation of women leaders was essential to the program. Mentors also played an important role in maintaining the commitment of the leaders. Small group meetings were the most effective for reaching participants, but undertaking HNT programs during a pandemic was challenging; WhatsApp groups were used to maintain engagement during this period. Nonetheless, participation was limited due to internet connectivity problems. Overall, the increased access to training improved the capacity and knowledge of women, as well as contributing to the community's long-term health and nutrition improvements.

Results from the HNT intervention showed that participants' scores on the food insecurity experience scale was better than the baseline and the control group. In addition, the average food

box continued

BOX 9.9

Case Study: Health and Nutrition Program for Women from Oil Palm–Growing Smallholder Households *(Continued)*

consumption score indicates higher dietary diversity and food frequency for HNT participants. This result also shows better diet quantity and quality for the participants as compared to the control group. Overall, the solid results from the HNT Program encourage scaling of the approach to enhance nutrition and food security in smallholder communities.

Key Steps for Companies to Start a Farmer Nutrition Program

***Step 1.* Establish *whether* and *why* nutrition is a challenge in the communities where your company is active.**

- Collect relevant reports and survey data on nutrition in the given geographic area. Some data to examine include the following:
  - Child stunting and wasting (data source: UNICEF, https://data.unicef.org/resources/resource-type/datasets)
  - Women's malnutrition, including anemia and overweight/obesity (data sources: UNICEF and Demographic Health Surveys, https://data.unicef.org/wp-content/uploads/2021/09/UNICEF_Expanded_Global_Databases_Diets_6_23months_2022.xlsx, and https://dhsprogram.com)
  - Minimum dietary diversity score for women (data source: Demographic Health Surveys, https://dhsprogram.com)
  - Minimum acceptable diet for children (data source: UNICEF, https://data.unicef.org/resources/resource-type/datasets)
  - Food Insecurity Experience Scale and Food Consumption Score (data sources: Food and Agriculture Organization (FAO), https://www.fao.org/faostat/en/#data/FS)
- Analyze the data to identify major nutrition challenges.
- Validate the conclusions with local nutrition experts.

Step 2. **Understand *who* is already working in nutrition in your areas.**

- Map out entities working on nutrition or related activities in the given areas. These groups may include the ministry of health, ministry of agriculture, civil society organizations, and international development organizations. These entities represent potential partners with which to coordinate or cofund nutrition support.
- Reach out to these groups to learn more and ascertain the feasibility of collaborating.

Step 3. **Think through *what* could be done to address nutritional challenges and narrow down interventions to the most relevant—those that are in line with your business objectives and the existing nutrition challenges and activities in the area.**

- Food
  - Promote production and consumption of locally available nutrient-dense crops or animal-source foods through integrating in the supply chains, homestead or family gardens, farmer field days, field demonstrations, and so on.
  - Identify potential for rotational, relay, or intercropping using nutrient-dense crops (for example, legumes) that also enrich soils and contribute to the productivity of the major commercial crops.
  - Incorporate relevant nutritional content on how to produce and use nutrient-dense crops and/or rear livestock and poultry and why they are important for the farm family's health in the agricultural training curriculum for farmers.
  - Work with agri-retailers to ensure that farmers have access to relevant inputs (for example, improved seeds, appropriate fertilizers, animal feed, and vaccines).
- Care and Health
  - Partner with the entities that are already working in the target communities to support nutrition behavior change interventions that focus on small, doable actions that will improve consumption of diverse and nutritious foods among all family members.

- Raise awareness of existing nutrition services in the community (for example, health facilities) from which farm families may access needed knowledge and supplies (for example, iron folic acid pills to treat anemia in women of reproductive age).
- Focus on women as key agents and beneficiaries of nutrition interventions.

***Step 4.* Identify *how* to deliver nutrition education and support. Potential entry points and delivery channels may include the following:**

- Company's own agri-extension staff
- Producer organizations
- Agri-retailers
- Village-based agents
- Government extension agents
- Savings groups (for example, a village savings and loan association)
- Local health facility–led community nutrition activities

***Step 5.* Track your success to see *which* nutritional interventions were successful and which were not. Several indicators at output, outcome, and impact levels can show how successful nutrition interventions are; some of them are directly linked to ROIs in nutrition:**

- Improvements in farmer health and physical capacity[2] (See chapter 8, "Measuring Results," for the importance of attribution links between activities and results.)
- Increased volumes for off-taking
- Improved dietary diversity using the indicator "minimum dietary diversity score for women," which has been shown to reflect dietary quality, especially vitamin and mineral sufficiency, in a family
- Decreased absenteeism from farmer training due to illness; this is relevant for the supply chains where training farmers is a part of the business model; this is also relevant for school-aged children whose absenteeism from school may decrease as well
- Improved brand image

Notes

1. The definitions of and information about food security and insecurity used here are from the UN's Food and Agriculture Organization (FAO n.d.). Those for hunger, undernutrition, and malnutrition are from the International Food Policy Research Institute's Global Hunger Index (von Grebmer et al. 2016; IFPRI 2016). https://www.globalhungerindex.org.
2. Changes in crop productivity can be caused by multiple factors: for example, weather conditions in the given season. It is important to structure data collection such that it allows attributing improvements in productivity to a particular intervention or set of interventions.

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CHAPTER 10
YOUTH PARTICIPATION

Namita Datta and Sunamika Singh

KEY MESSAGES

- Contrary to popular belief, youth are not suddenly exiting the agriculture sector; in fact, the absolute number of African youth in agriculture is expected to rise in the coming years.
- Given that young people are generally more agile, educated, and adaptive to changing conditions, they are likely to play a pivotal role in the transformation of agriculture.
- The private sector can support youth to engage meaningfully in agricultural activities, leading to a mutually beneficial relationship. This can be done through rural youth profiling (to identify their needs and address gaps), peer-to-peer learning, awareness campaigns, and undertaking activities in close proximity to youths.

Business Case for Increasing Youth Participation in Smallholder Supply Chains

It is mostly through youth that structural transformation occurs.[1]

Generally, as countries develop, agriculture's role as an employer declines, and the average farmer becomes older and more wage oriented (Christiaensen, Rutledge, and Taylor 2020). In parallel, the

broader agrifood system expands, and the scope for agriculture-related job creation shifts beyond the farm to include jobs in the agrifood value chain including production, processing, preservation, and other handling processes, as well as packaging and marketing. This process of *structural transformation* shifts more people from agriculture to nonagriculture jobs. Recent studies have found that postfarm opportunities can create positive spillovers by developing economic links, infrastructure, and local market integration.

There is a perception that youth in emerging markets may no longer be interested in agriculture and are fleeing agriculture to seek opportunities in urban centers (IFAD 2019). However, it has been shown that there is no sudden accelerated exit of youth from the sector (Christiaensen, Rutledge, and Taylor 2020). Mabiso and Benfica (2019) have shown that the absolute number of young African farmers is expected to rise in the coming decades. In fact, many youths remain in agriculture and, with the right support, are likely to take the lead in modernizing the sector, increasing its productivity and the range of products—which is also a key part of the structural transformation process. Young people, on average, are more agile, educated, and adaptive to changing labor market conditions. Others might move into jobs in agribusiness services, which form an increasingly important part of the agrifood chain (Christiaensen, Rutledge, and Taylor 2020).

Companies can benefit in a number of ways from investing in youth across smallholder supply chains.

Empowering young farmers could help support sustainable agriculture supply chains and create win-win opportunities for both young farmers and the private sector. Although few companies have structured initiatives for engaging youth as suppliers, there are many examples of their supporting youth entrepreneurship programs as an alternative pathway to economic independence (MCI 2019). Some companies, such as Cargill and Nestlé, are actively engaging with youth, helping them gain access to land, skills, and microloans, while revitalizing their own supply chains. Young farmers benefit from easier access to finance, stronger market links, and higher incomes, while the private sector benefits from better quality yields, increased trade volumes, and a stable supply, which is important for agribusiness, since farmer suppliers are often older. Since this approach helps youth access economic opportunities, it also contributes to Sustainable Development Goal (SDG) 8 (UN 2023). Empowering young people can lead to a number of benefits:

- *Youth as a human resource:* For an employer in any sector, human capital creates value, growth, and prosperity. Companies recognize

the importance of young people's career choices, and they engage with potential job seekers during their education, school-to-work transition, and beyond. Many agribusinesses are addressing youth jobs and skills indirectly through platforms in which they participate. For example, Barry Callebaut, Cargill, and Olam are all partners in Mondelēz's Cocoa Life program,[2] which focuses on five areas of transformation in cocoa farming, including making cocoa farming a more attractive profession for young people, who are a critical source of innovation, creativity, and forward thinking.

- *Youth as consumers:* Youth represent a significant customer segment for the private sector, both as individual consumers and as future purchasing decision-makers for their organizations. Engaging with youth as potential buyers demands deep understanding of their preferences, tastes, and habits, which can be developed by engaging them as suppliers. Such investments in engaging youth as suppliers creates shared value because the company gains commercially or competitively while social value is also created.
- *Social cohesion:* Above all, businesses thrive in peaceful, cohesive, and inclusive societies. When young people feel safe and valued as citizens, and when they have access to education and good economic opportunities, they become builders of the future in their communities. The private sector has a crucial contribution to make toward advancing the well-being of young people as partners in stable, prosperous communities.

Good Practices for Increasing Youth Participation in Smallholder Supply Chains

According to the Organisation for Economic Co-Operation and Development's report *The Future of Rural Youth in Developing Countries: Tapping the Potential of Local Value Chains* (OECD 2018), general success factors for integrating youth into any agricultural value chains include the following:

- *Rural youth profiling:* Understanding the nature and conditions under which the different youth groups are engaged or excluded, and the generational and power dynamics along the value chains, will help identify the bottlenecks to be addressed when designing a youth-sensitive agricultural value chain project.

- *Peer-to-peer learning:* Peer-to-peer learning has proven effective when providing agricultural extension services. For example, an increasing number of young people with higher education have begun starting agrifood businesses, and peers can act as role models for other young people and play an important role in creating and investing in small industries in rural areas, building networks, and generating employment.
- *Awareness campaigns:* Young people in rural areas need to be informed about the different activities possible along the value chain if their minds are to be changed about potential jobs in agriculture and or agriculture-related activities. Campaigns should include information about market requirements, product standards, knowledge, innovative tools, and new production methods.
- *Physical proximity:* Activities must take place close to young people's homes. This is especially relevant for young women who cannot travel far to attend training or take a job.

There are numerous examples of good practices used by the private sector for increasing youth participation in smallholder supply chains. For example, Starbucks Coffee Company, Kraft Foods, Mars Inc., The Hershey Company, Olam International Ltd., and other companies support the Empowering Cocoa Households with Opportunities and Education Solutions (ECHOES) project, a public-private partnership initiative supported by the United States Agency for International Development (USAID). It focuses on improving opportunities for youth and young adults in cocoa-producing communities in Côte d'Ivoire and Ghana through provision of vocational training and other relevant education (World Cocoa Foundation 2015).

The private sector can promote youth groups or associations so that youth are able to access agricultural extension and advisory services, financial services, and agricultural inputs such as improved seeds and fertilizers. The groups also ease the marketing of produce. The USAID-funded Kenya Horticulture Competitiveness Project (KHCP) worked with agribusinesses Canken and Mace Foods to incorporate youth into their supply chains (USAID 2013). KHCP, through a local business service provider, organized young people into groups to serve as suppliers to Canken, an exporter of fruits and vegetables to the United Arab Emirates and Europe; 15–20 percent of their supply chain is now composed of youth. Mace, which sells mostly to domestic markets, offers

embedded finance and technical training to young people, who in turn deliver picking, drying, and transport services to Mace.

Initiatives can also take the form of nongovernmental organization (NGO) or organizational assistance to farmers or farmer organizations (Christiaensen 2020), for example, by providing agricultural extension and credit and/or linking them with upstream and downstream actors. (For examples, see the case studies in boxes 10.1 through 10.3).

Many young farmers do not have up-to-date knowledge and skills on farming best practices. Programs that provide apprenticeship and on-the-job training opportunities for rural youth can increase their employability (see box 10.2).

BOX 10.1

Case Study: Linking Rural Youth in the Informal Sector to the Poultry and Aquaculture Value Chains in Mali

Inclusion of Rural Youth in Poultry and Aquaculture Value Chains in Mali is a pilot project that aims to increase rural youth employment and improve nutrition.[a] The project works through producer organizations to train rural youth—18- to 30-year-olds and 50 percent women—in poultry and aquaculture production and processing, such as fish smoking, to supply local villages and larger regional markets. The project also provides financial support.

The first step in the process is to establish demonstration units for poultry and fish farming and smokehouses near the locations of producer organizations.

Subsequently, lead farmers in producer organizations are identified and trained, followed by identification and training of about 1,000 rural youth, with those who have a family member guarantor also receiving a start-up loan. Funds also support a childcare center, so more women can attend trainings. In a second phase, the program will strengthen the capacity of local producer organizations and establish value chain platforms between poultry and fish organizations and upstream and downstream actors for better coordination and integration.

Source: Christiaensen 2020.

a. The project is funded under the Missing Middle Initiative (MMI) flagship program, established in 2016 under the Public Sector Window of the Global Agriculture and Food Security Program (GAFSP). MMI funds support smallholder farmers, their organizations, and partnerships between them and the private sector. MMI had awarded $13.2 million to the Mali project up to the end of 2019. The implementation partners in the Mali project are the Association of Professional Farmers' Organizations (AOPP), the National Federation of Rural Youth (FENAJER), and the National Federation of Rural Women (FENAFER), together with the National Coordination Agency for Farmers' Organizations of Mali (CNOP).

BOX 10.2

Case Study: Providing Structured Apprenticeships to Young High-Potential Farmers

The Future Farmers Foundation partners with agricultural buyers like Bayer and the Sernick Group in South Africa to run an apprenticeship program that includes youth from disadvantaged backgrounds who were unable to attend tertiary institutions, as well as tertiary graduates between the ages of 18 and 30 who are struggling to find placements on farms. Future Farmers offers an entry point into the agriculture sector for young men and women. Their model provides opportunities for youth by placing apprentices on local farms to develop farming skills and expertise through practical training by expert farmers supported by mentors. After a couple of years of practical experience, the best apprentices are selected to do an overseas internship. Upon their return, the interns have gained so much knowledge and experience that they invariably become farm managers or farm owners and work closely with local and international suppliers.

Source: Future Farmers Foundation website, https://futurefarmersfoundation.com/.

BOX 10.3

Case Study: Using an In-Grower Incubation Model

Agridev, in Nhamatanda, Mozambique, is creating and developing businesses through an in-grower model. It has a structured value chain, guaranteed market, and profitable margins. Agridev partners with technical agrarian institutions to select and train graduating youth on basic technical knowledge of agricultural practices. The youth receive three days of induction training on the business model to introduce them to the business. There are clear expectations about the resources to be provided and percentage of profits to be received at the end of the production cycle. Youth are given training on financial management and on either one or two production cycles, depending on the produce, for about 12 months. They remain "incorporated" in the business, which means they work on the land that is owned by the firm. Youth receive technical assistance and all the inputs they need so they don't need to invest anything. At the end of the paid internship cycle, they receive guidance on whether to continue working with Agridev or use the money they've earned to establish their own businesses.

Source: Based on consultations with the German Agency for International Cooperation (GIZ).
Note: More information is available at Agridev, "Services," http://agridev.org/services.

Mentoring can happen through incubator approaches, where young farmers learn how to operate a business. Young people need role models to look up to and follow. Firm leaders and other youth farmers can help to develop youth into suppliers through mentoring and coaching (box 10.3).

Notes

1. *Structural transformation* is defined here as transformation from a low-income economy in which low-productivity agriculture employs most workers and generates most output to a higher-income, more industrialized, service-oriented, and diversified economy with a far more productive, but relatively much smaller, agricultural sector. During this transformation, agriculture releases labor to work in other sectors and provides plentiful raw materials for secondary processing and manufacturing, and farmer income growth stimulates demand for nonfood goods. This pattern is strongly associated with economic growth, poverty reduction, urbanization, and increasingly efficient spatial integration of factor (for example, financial and labor) and output (for example, food) markets. See Barrett et al. (2019).
2. For more on the Cocoa Life program, see Mondelēz International's website, https://www.cocoalife.org/.

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CHAPTER 11
WOMEN'S PARTICIPATION

Andi Wahyuni, Sofiyanti Baso, Jyoti Dar, Patricia Biermayr-Jenzano, Sanola Alexia Daley, and Lydia Mbevi

KEY MESSAGES

- Women farmers represent at least 40 percent of the agricultural labor force, but they have less access to land, finance, training, extension service, and inputs than their male counterparts.
- Women farmers play various roles in different agricultural value chains, and the tasks they perform are often key to productivity, quality, and income generation.
- Improving women's access to training, finance, markets, and other resources will directly address challenges and help improve overall productivity and quality, while improving financial, social, and economic outcomes for farmers, their families, and communities.

Business Case for Increasing Women's Participation in Smallholder Value Chains

Closing the global gender gap in agriculture will lead to an increase in yields by approximately 20 to 30 percent while raising the total agricultural output by 2.5 to 4.0 percent. For companies with agricultural supply chains, closing the gender gap can contribute significantly to their business outcomes (box 11.1). Sixty-one percent of enterprises

in the agricultural, forestry, and fishing sectors reported that gender-diverse policies contributed to increased profits and productivity (IDH 2020).

While women play key roles in production and post-harvest handling, these roles are often informal, unacknowledged, and underresourced (IFC 2021a). To boost access to affordable agricultural inputs and advisory services, one firm in Liberia examined their client base for Liberian agrodealers and found a large untapped market of female customers. Their subsequent strategy to move sales outlets from urban centers to weekly markets where more women participate saw an increase in annual sales by 77 percent and doubled the customer base to 17,000 farmers (Garbarino and Beevers 2022). This showcases the importance of intentionally targeting female customers as well as the importance of analyzing sex-disaggregated data and using that information for business strategy and growth. Women control 64 percent of consumer spending (UNDP 2019), and establishing gender equality in supply chains entails seeing women not only as producers but also as customers/buyers, investors, and leaders in sustainability.

Investing in women as farmers, producers, employees, and customers can generate business growth, profitability, and sustainability in agricultural supply chains. As more companies and consumers focus on sustainability and traceability in supply chains, opportunities for gender inclusion emerge in sourcing:

BOX 11.1

Positive Outcomes of IDH Initiative of Women Farmers

By changing business practices to address unequal working conditions that disadvantage women, companies can increase their market share and reduce costs. Positive outcomes include the following:

- 131 percent increased coffee supply through female farmer training approach
- €1.3million higher revenue and €150k company savings through comprehensive gender package in fish processing facility
- 367 leadership circles in factories where employees voice their ideas and concerns to management

Source: IDH 2020.
Note: IDH = Sustainable Trade Initiative (Dutch).

- *Smallholders:* Women farmers' and producers' access to leadership and decision-making, technical capacity, and access to quality inputs
- *Larger farms:* Working conditions for women laborers, sourcing from and supplying to women-led small and medium enterprises (SMEs) suppliers and distributors

Increasing women's participation in smallholder-based supply chains and improving their technical capacity can help maintain and grow production volumes, improve productivity, and reduce management costs. Increasing women's participation can also help improve product quality and enhance a company's credentials as it targets premium markets (Chan 2010).

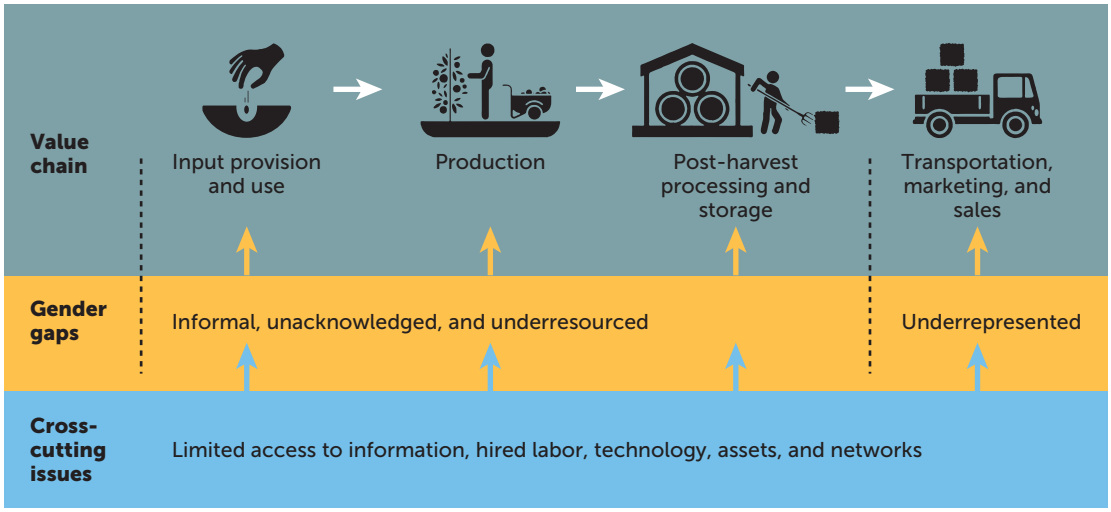
Women Farmers and Producers in Value Chains

Women and men play different but complementary roles in agriculture, agribusiness, and food systems. Men play a primary role in the preparation of the land, plowing, and managing heavy equipment and large livestock. Women engage in planting, weeding, cultivating, and harvesting the crops and tending small animals (chickens, fish, goats, and so forth). They also work in the processing of primary products and selling them at market. Often, their involvement in the production and the processing stage takes place in agro-industries that hire the women on a temporary basis or as seasonal agricultural work, leading to financial instability. Figure 11.1 provides an overview of gender gaps in agribusiness value chains. Although there are some cross-cutting issues that apply to both men and women, there are very specific gaps that women face as they participate in agricultural value chains.

Challenges for Women's Participation

In 2017, the World Bank found that in Sub-Saharan Africa, women represented 40 percent of the agricultural labor force, and in other regions, their contributions exceeded 50 percent. Their lack of land ownership, however, reduces their available collateral and negatively affects women's ability to obtain credit from financial institutions or access other services. Women farmers have reduced access to technical knowledge and training; only an estimated 15 percent of women farmers worldwide have access to advisory services. Reduced access to extension services or

FIGURE 11.1 Gender Gaps in Agribusiness Value Chains



Source: IFC 2016.

adult education opportunities negatively affects the quality of their products for the market. Women farmers also receive lower wages: in Latin America, women earn 80 percent of men's wages in the Ecuadorian and Mexican flower industry, and in Pakistan and other places in Asia, they receive 50 percent of men's wages in sugarcane production. Similar patterns are reported in Kenya, where women farmers are engaged in 80 percent of the vegetable and fruit export business, participating in the harvesting, processing, packaging, labeling, and bar-coding of those products; this work is not mechanized and therefore is considered—and paid—as unskilled labor.

Other important challenges include lack of transport, low access to the internet and cell phones, unsafe locations at markets facilities, and lack of access to childcare at their work site, which reduces the time to participate in paid activities and training. A summary of these challenges is included in table 11.1.

Childcare and Gender-Based Violence

Women and girls are tasked with the unpaid responsibility of childcare. For most women, childcare costs up to 40 percent of their income. Childcare and related responsibilities also account for absenteeism for

TABLE 11.1 Challenges Women Smallholder Farmers Face in Agribusiness Value Chains

Land	Inequality in access to land and titles is further exacerbated by restrictive laws and customs affecting women's inheritance.
Finance	Women's reduced access to land and other resources results in a lack of collateral needed to access financial services, such as bank accounts, credit, and crop insurance.
Inputs	Lack of access to agricultural inputs, technical assistance, and extension services restricts their ability to increase their productivity and yields.
Information	Women farmers and producers often receive lower and more volatile prices of the commodities they produce because they lack market information.
Training and technology	Women face a lack of training in areas of business administration, financial literacy, technical innovations, and other crucial topics needed to access markets through information and communication technology (ICT) services.
Safety and transportation	Lack of safe transportation and infrastructure such as sanitary facilities, including bathrooms and changing areas at markets sites and companies, may exacerbate vulnerabilities to gender-based violence and harassment.
Childcare and responsibilities	Women have few options to access childcare, lactation facilities, or other domestic support that would facilitate access to training and work and the time needed to process, store, and sell their products.
Markets	Women face a lack of certifications (organic, fair-trade, and so forth) needed to access higher prices.
Youth	There are fewer opportunities for young women and girls to perform in current business schemes due to the lack of collateral and knowledge.
Membership in farmer associations and cooperatives	Women experience lower participation and leadership in farmer cooperatives and associations, which are essential to access opportunities and benefits available to formal and organized business-oriented groups (associations, cooperatives, small retailers, and so forth).
Decision-making and leadership	Women often lack access to leadership positions in companies and farmer associations and have difficulty making leadership decisions in associations and in the household. In cases where women are in leadership positions, they sometimes lack the empowerment or confidence to exercise leadership skills or make decisions.
Farm ownership and contracts	Women farmers and producers may not have formal ownership in family farms or occupy key decision-making roles, but they make up the majority of the labor performed. This lack of formal ownership impedes their ability to access training, credit, and other services needed to obtain contracts or other business opportunities.

Source: World Bank.

many women working on farms. This has major repercussions, as it affects the quality of produce when a trained female staff member is absent and must be replaced with an untrained female staff member. Agriculture is unique in that production has seasonal demands with periods of high intensity work. It is also a sector with low margins, making volumes key, and labor shortages in rural areas is a growing business concern. There are huge risks for farm owners when children are brought to the fields or worksite due to safety concerns, distraction for parents, and potential child labor violations.

For the private sector, childcare becomes a business risk when its absence inhibits mothers from dedicating their hours to focused and quality work. More women would be available to work additional days and hours if there were options for childcare services, as demonstrated in box 11.2. A study done in Rwanda's tea sector found that worker loyalty and retention improved when companies provided childcare (Salmaso et al. 2021). There was also a marked increase in productivity for workers with access to employer-supported childcare.

Unfortunately, gender-based violence (GBV) is widespread, affecting women's ability to benefit from income-generating activities and contribute to economic growth. Research indicates that the cost of violence against women amounts to around 2 percent of the global gross domestic product (UN Women 2016). The economic costs of GBV are huge, and any prevention and mitigation efforts also cost money. The costs to the private sector include absenteeism, loss of productivity, time spent outside of work at court, employee assistance costs, relocation or pay benefits. Research finds high incidences of GBV within agribusinesses and their supply chains (Agrilinks 2019).

BOX 11.2

Findings from a Farm in Washington State, United States

- Seventy-three percent of women interviewed who work on the farm said childcare would result in workers being available to work more hours.
- Sixty-eight percent said it would result in more workers.
- Fifty-seven percent said it would mean a more stable workforce.
- Thirty percent said it would decrease the possibility of child labor.

Source: Miller, Gempler, and Lee 2016.

There are various types of GBV in agriculture and market systems (Eckman et al. 2022), and these include participation in private sector activities that may inadvertently exacerbate women's time poverty. Male partners or relatives may view female participation in private sector activities as conflicting with household duties, which may trigger GBV. Types of GBV that may be found in agriculture and markets include the following:

- *Economic violence* in agricultural value chains manifests as male partners taking over the negotiation and sale of and income from agriculture and making decisions about how that income is used.
- *Emotional and psychological violence* happens when women sales agents, traders, or agrodealers experience harassment, intimidation, and aggression.
- *Honor-based violence* can be triggered if the company places women in situations that are predominantly male-dominated spaces; situations in which women must stay out late or travel long distances to and from company activities; and situations in which women's access to and use of resources provided by the client violates social norms that are seen as bringing dishonor to the family (for example, providing extension or advisory services to and having interactions with men who are not relatives, as these may be perceived as infidelity).
- *Risks of sexual exploitation* in the agricultural value chain may include sexual exploitation itself, abuse, and harassment by input providers and land holders as a condition of access to resources. Women may also be forced to engage in quid pro quo activities in exchange for water, food, fish, and other resources. Women may also be vulnerable to exploitation if they cannot make their credit payments or need post-harvest handling services. Casual workers may be at risk of sexual exploitation and abuse in the absence of employment contracts.

Access to Markets

Finally, many women leaders in the agribusiness SME sectors are in joint family businesses, owned with their spouses, fathers, or other male family members. Research from the Food and Agriculture Organization (of the United Nations) (FAO) and others demonstrate that men are more likely to sign supplier contracts to buyers, but women were the ones conducting the majority of the work (FAO 2011, 2013; Smalley 2013).

In Kenya, one study showed that women made up fewer than 10 percent of farmers in contract farming programs in the country's export business for fruits and vegetables (Brewin and Murphy 2019). A list of constraints and main reasons why women do not reap the benefits from business and support programs are presented in box 11.3.

Strategies and Tools for Developing Gender-Smart Solutions

To address the identified gender challenges and successfully integrate gender meaningfully throughout a project, it is important for project teams to understand the issues throughout each stage of program design and implementation (see figure 11.2). It is extremely important that project teams identify a *realistic and comprehensive budget for gender activities* that can cover the costs of gender analysis, implementation, and tool development; monitoring and evaluation; and communications and knowledge management.

To successfully develop a gender plan, three solutions and strategies are recommended. They are covered in the following subsections.

Step 1: Conduct a Gender Mapping or Gender Analysis

The International Finance Corporation (IFC) has developed and implemented a gender mapping tool that helps identify where men and

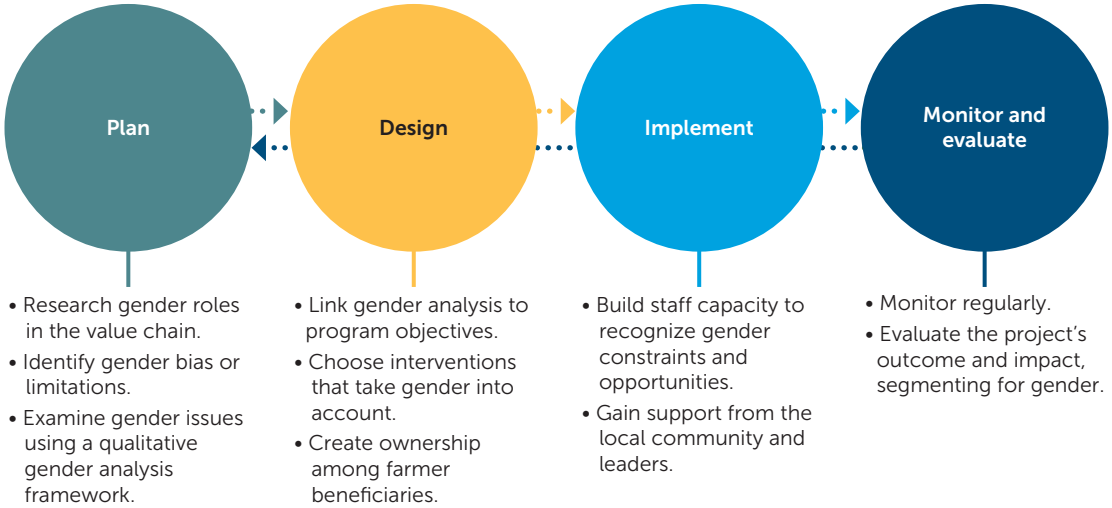
BOX 11.3

Why Women Benefit Less from Companies' Smallholder Sourcing and Support Programs

- Fewer women than men are members of company contract farming schemes.
- Many companies source from established producer groups, and women are typically underrepresented in both membership and governance of these groups.
- On male-owned farms, female family members do much of the work yet receive little of the income from crop sales and have little say in how that income is spent.
- Women are less likely than men to be reached by technical training and extension services.
- Women are underrepresented in certification schemes such as Fairtrade.

Source: Chan 2010.

FIGURE 11.2 Gender Is an Important Consideration at Each Step of Program Design and Implementation



Source: IFC 2019b.

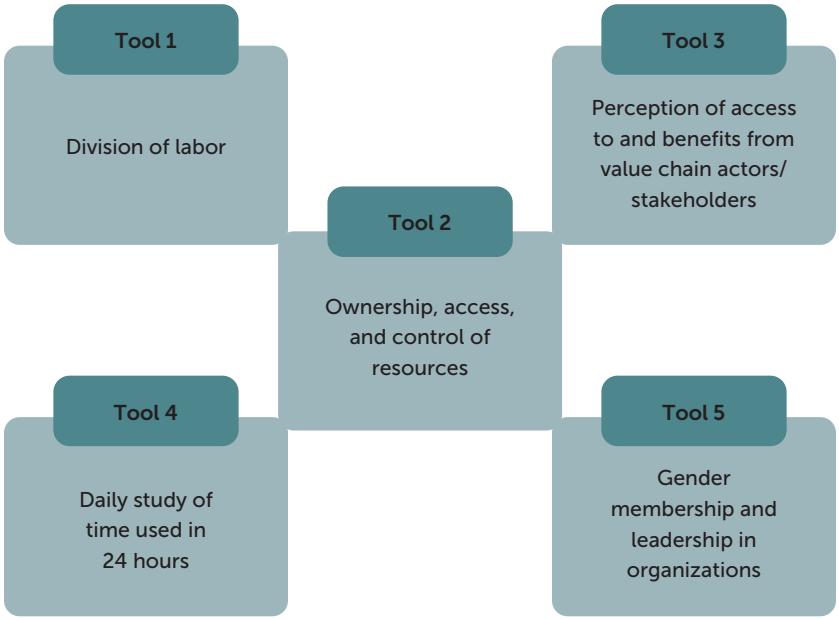
women are located in the supply chain, the roles they play and why, and their biggest constraints to participation (IFC 2020). The gender mapping is centered around five modules (see figure 11.3). The data collection process includes male and female smallholder farmers and producers, as well as large farmers and family-run supplier farms in the topical areas of intervention. Consultations are also undertaken with other beneficiaries and stakeholders, such as local financial intermediaries, village-based agents, relevant representatives of local nongovernmental organizations, ministries, social services, and others. The mapping analysis digs deeper into the underlying issues that traditionally serve as constraints for women's participation as well as their availability to participate in activities or access advisory services.

The understanding of women's and men's roles will provide insights and inform design questions regarding the following:

- The social and cultural context in which the farmers are operating
- How project interventions may be a driver of change for women beneficiaries
- How the expected results could affect men and women differently

This gender mapping is useful in designing gender-smart solutions based on industry best practice and ensuring that these gender-smart

FIGURE 11.3 IFC's Gender Mapping Assessment



Source: IFC 2020.

interventions align with a company's objectives. The tool also provides guidance on how to implement these gender-smart solutions and how to evaluate the impact of these proposed solutions.

Step 2: Implement Appropriate Gender-Smart Solutions

Improve Access to Training and Extension Services

It is estimated that only 15 percent of extension workers globally are women (FAO 2018), and approximately 7 percent of extension services are directed toward women smallholder farmers (Mercy Corps 2018). To address this, the following are recommended:

- Ensure a strong baseline, as well as an ambitious—but realistic—target for women farmers and producers to participate in training and receive extension services.
- Design outreach solutions and leverage local partnerships and communications channels to identify the right stakeholders and ensure they are able to participate in the training and extension services.

- Where necessary, adapt training methodologies, materials, and resources to the literacy level of the women farmers.
- Provide specialized agricultural training tailored to their needs and the roles women play in production, designed to reduce their workload and save their energy.
- Identify innovative ways and methods—such as videos and mobile technology (for example, WhatsApp)—to ensure training and information can be received and utilized by the women farmers.
- Include women farmers and producers in technical trainings and certification programs such as Good Agricultural Practices and Fairtrade so they do not lose important access to market opportunities and increased earning potential.
- Where possible, recruit female extension agents. Ensure all extension agents—male and female—have gender-sensitization training to support the inclusion, voice, and agency of women farmers while respecting cultural norms and engaging male farmers and stakeholders.
- For larger farms, ensure women employees and laborers have access to skills training and career development opportunities.
- Where feasible, provide childcare services during the trainings to ensure that women with children can fully participate and benefit from the training.

Improve Access to Financial Services and Literacy

Rural women face inherent gender bias when accessing credit; cultural norms and requests for collateral prevent them from borrowing money. For example, only 4 percent of rural women in Peru have access to credit, and only 2 percent of rural women save in the formal banking system (TechnoServe 2021). Another pervasive problem that prevents women from full participation in business is the lack of collateral to apply for loans, even though women's records show better repayment performance than their male counterparts. These challenges help demonstrate that women farmers are unable to cope during crises such as climate change, the pandemic, and other economic shocks. Possible solutions include the following:

- Leverage microfinance and microlending schemes.
- Utilize digital financial services, including mobile payments.

- Utilize village savings and loans associations (VSLAs), cooperatives, and self-help groups (lending circles, rotating savings and credit associations [ROSCAs]).
- Identify innovative insurance solutions around crop insurance, particularly given challenges for women's access to collateral.
- Train women in bookkeeping skills to increase their financial literacy and record-keeping.
- Provide links to inclusive financial service providers during farmer field days, exhibitions, or other relevant events.

Improve Women's Access to Leadership and Decision-Making Positions

Addressing gender imbalances in leadership is not simply about gender parity in numbers. For inclusive leadership to be meaningful, impactful, and beneficial, appropriate and targeted training must be conducted to provide the knowledge, skills, and solutions necessary to implement successful strategies and solutions to benefit all cooperative members.

- Set targets for women's participation in company, cooperative, or farmer association leadership and help identify appropriate and motivated candidates for those leadership positions.
- Provide technical and soft-skills training to women leaders to strengthen their business skills. Stronger technical knowledge will facilitate greater confidence, willingness to use voice and agency, and participation in decision-making.
- Where necessary, provide gender-sensitization training to all cooperative members and leaders to help address unconscious biases and support gender inclusion, including in the household.

Improve Access to Technology and Inputs

Constant innovations in technology, the increase in information accessible through digital devices, and the COVID-19 pandemic have increased the need to better leverage digital solutions, devices, and adapted solutions (such as global positioning systems and drip irrigation) to improve farming techniques. Other solutions to consider include the following:

- Map and understand how men and women use technology and which services, devices, and programs they utilize and who owns the technology solutions.

- Design around preferences on types of content media (for example, written, oral, and video) and how to leverage these to provide training and information or organize farmer groups.
- Identify and provide improved tools that reduce the amount of labor needed on the farm.
- As improvements continue, facilitate women farmers' access to good quality seed, fertilizer, and other inputs.

Psychological Safety: Address Childcare and Gender-Based Violence

Understanding and supporting women's care responsibilities and offering protective measures against GBV are integral to ensuring women's participation in agricultural value chains. Solutions include the following:

- Conduct a childcare needs assessment and GBV assessment to identify and address needs and risks.
- Facilitate access to childcare services during trainings, extension services, and at the workplace or farm facilities by providing onsite childcare, partnering with childcare facilities, or subsidizing costs associated with childcare access.
- Provide safe transportation to trainings and farming activities, as well as well-lit and accessible restrooms and other facilities for women farmers and producers.
- Where possible, provide a lactation room or lactation facilities.
- Provide appropriate training on GBV to all stakeholders and beneficiaries, male and female, that defines GBV and provides skills, solutions, and resources to address incidents.
- Support companies and stakeholders in the development of appropriate GBV policies, procedures, and mechanisms and communicating this information to all stakeholders.

Step 3: Monitor and Evaluate

The third step in gender-integrative project design is continuous monitoring and evaluation of the project interventions to understand their immediate, midline, and endline impacts. This will help ensure that efforts comply with IFC's "do no harm" policy and ensures continued

added value and achievement of development impact objectives. It also helps track growth and progress, which is useful for scaling up good practices. Companies can develop gender-related key performance indicators (KPIs) based on their priority areas for gender equality and their objectives. Some examples are provided in box 11.4 based on the IFC results measurement framework for agribusinesses.

Finally, one additional tool to measure women farmers' economic empowerment is the Women's Empowerment in Agriculture Index (WEAI) (IFPRI, OPHI, and USAID 2012). See box 11.5.

In Practice: Case Studies

Women's participation in agribusiness is varied and deeply engrained in the social fabric of their communities and the products they tend to produce and bring to the market. The following case studies have been selected from IFC projects across regions. They present opportunities to leverage women's participation while enhancing economic empowerment and exponentially improving households' well-being. This is done

BOX 11.4

Gender-Related Performance Indicators

1. Number of female farmers reached (directly and indirectly)
2. Number of female smallholder farmers reached
3. Number of employees participating in training (disaggregated by sex)
4. Number of extension agents recruited (disaggregated by sex)
5. Number of suppliers and distributors in the company's value chain (disaggregated by sex)
6. Number of agreements signed between farmers and off-takers per year (disaggregated by sex)
7. Number of women participants in workshops, training events, seminars, conferences, and so forth
8. Amount of savings achieved for women farmers or cooperatives
9. Number of participants in gender-based violence and harassment training (disaggregated by sex)
10. Number of gender-based violence policies or procedures implemented
11. Number of persons accessing childcare services (disaggregated by sex)
12. Percentage of group leadership positions held by women
13. Number and/or percentage of women farmers using fertilizer and other inputs

BOX 11.5

The Women's Empowerment in Agriculture Index (WEAI), a Groundbreaking Tool

The WEAI was developed in collaboration with the United States Agency for International Development (USAID), the International Food Policy Research Institute (IFPRI), and the Oxford Poverty and Human Development Initiative (OPHI) at the University of Oxford to track the change in women's empowerment levels that occurs as a direct or indirect result of interventions of the Feed the Future initiative, the US government's global hunger and food security initiative. The WEAI measures the empowerment, agency, and inclusion of women in the agricultural sector and measures five domains of empowerment: (1) production, (2) resources, (3) income, (4) leadership, and (5) time, adopting 10 indicators. It measures the percentage of women whose achievements are at least as high as men in their households as well.

The WEAI is also useful for tracking progress toward gender equality, and it was used initially in Bangladesh, Guatemala, and Uganda. Recently, the use of the WEAI has been enhanced, with new indicators adapted to different agricultural activities, such as the pro-WEAI (Malapit et al. 2019) to measure women's empowerment at the project level, the WE-LI (Galiè et al. 2019) to measure women's empowerment in livestock production, and the A-WEAI (Malapit et al. 2014), an easy-to-use version to collect information in the field. The adoption of these indexes can facilitate the design of interventions that are most beneficial in the implementation of projects and programs to enhance women's leadership and participation.

through entrepreneurial strategies and access to financial literacy, among other strategies.

The success story in box 11.6 depends on a strong partnership between IFC and DCM Shriram, guided by a gender assessment conducted to identify and quantify challenges the company faced to reach women smallholder farmers. Support was also provided for the development of an action plan aimed at building the women's capacity through training in good agricultural practices and gender sensitization for extension trainers and farmers. The project applied the Women's Empowerment Agriculture Index (IFPRI, OPHI, and USAID 2012) and the plan is being implemented from 2017 to 2024.

Box 11.7 illustrates how gender-smart solutions were used in an IFC and ECOM coffee project to improve crop yields and quality while increasing farmer revenue. The project created an innovative strategy to involve women farmers in sustainable coffee farming practices in rural areas to achieve better and longer-term development impact. The project developed

BOX 11.6

Case Study: DCM Shiram's Sugarcane Value Chain in India

Women sugarcane producers in Hardee district, located in India's north-central state of Uttar Pradesh (one of the largest low-income states of India), have been farming for generations, engaged in planting, growing, and harvesting—performing demanding manual labor with little access to improved technology that would enable higher yields. Most women are de facto heads of households due to the men migrating in search of profitable jobs, leaving the women in charge of the plantation. The women oversee most of the hard work, but they are not able to apply for credit or to access advisory services because they do not legally own the land, which is generally registered under their husband's or male family member's name. More than 40 percent of women farmers and laborers are involved in the growing of sugarcane, yet they represent only 6 percent of the farmland owners. Furthermore, social norms restrict their mobility to go outside the village and to attend training events; hence, women lag in farming skills, and their contributions to farming activities are not acknowledged.

On the business side, agricompanies are affected because of uncertain levels of productivity and therefore uncertainty about reaching the quantity and quality of raw material they need. With support from the International Finance Corporation (IFC), DCM Shriram engaged in the Meetha Sona Climate-Smart Sustainable Sugarcane Production Project. The project was extended to more than 20,000 women farmers, supporting them in the adoption of sugarcane and complementary farming activities such as dairy production (also nurturing them as first-generation entrepreneurs in sugarcane and dairy value chains). The objectives were to increase agricultural yield and to conserve water and soil health while improving local smallholder farmers' livelihoods, particularly women producers.

DCM Shriram Sugar Mills runs four sugar mills located in Hardoi, Uttar Pradesh, one of the poorest and most disadvantaged districts in the country. It covers more than 100,000 hectares and employs 200,000 farmers. Dairy was a new intervention for the project, and it was supported through gender mapping, extensive training, and capacity building for creating important revenue-earning opportunities for the women and enhancing the overall rural economy where the company operates. Women also received training in technical farming skills, soil health, water efficiency, and mechanization. Women contributed to significantly improved company results, with an overall yield increase of 20 percent, and around 43 women entrepreneurs are now trained to manage the company's seed nursery, providing quality plantings in an initiative to improve sugarcane material across the state. An increase in sugarcane yield from 40 tons per hectare to more than 70 tons per hectare in two years was recorded, along with improvement of the local ecosystem. Finally, it is expected that the new dairy project intervention will train approximately 20,000 women dairy farmers in order to increase milk yield and income by 10 percent and improve cattle breeds, quality of milk, and synergy with sugarcane farming (IFC 2019a).

BOX 11.7

Case Study: Integrating Women into the Coffee Supply Chains in Indonesia and Vietnam

Indonesia and Vietnam are among the world's largest coffee producers, with millions of people relying on coffee for their livelihoods. To meet an increasing demand for high-quality, sustainably produced coffee beans, the two countries must strengthen the supply chains of their respective coffee industries.

The International Finance Corporation (IFC) worked with global coffee trader ECOM in these countries to establish farmer training centers (FTCs) to promote quality awareness and best practices for sustainable coffee cultivation. The training centers helped men and women farmers improve their productivity and the quality of their coffee, while reducing costs. Following the training, farmers received internationally recognized certification for sustainable production.

Women make up 80 percent of coffee farm workers in North Sumatra, Indonesia, and about 50 percent in Lam Dong, Vietnam, which were the project locations. Although they play key roles in coffee cultivation, pruning, harvesting, processing, and marketing, they are often excluded from training and other development opportunities.

When women farmers have better access to technical training and productive input, they are more likely to adopt good agricultural practices. And when they are included in agricultural development opportunities, they receive critical knowledge, skills, and assets that help them improve their household productivity. In Indonesia, ECOM was training men but without much impact. A gender analysis was conducted to identify the roles of women and men in coffee supply chains to help ECOM target its training more effectively.

To increase women farmers' skills and improve overall coffee productivity and quality, IFC implemented a gender-smart approach, including deploying women trainers and volunteers; engaging leaders of women's unions, farmers' associations, and village heads; adjusting the training schedules to accommodate women's needs; developing gender-specific training materials; and providing ECOM staff and local communities with training for trainers. It introduced visual aids such as videos and pictures to accompany traditional training materials and also introduced a simple financial management tool to help women farmers document and analyze household and farm expenditures, since women traditionally manage household incomes in these countries.

The project was successful in its approach to involve more women in coffee farm supply chains and improve the coffee productivity. In Vietnam, about 4,000 farmers who received project certification increased their total income by about US$6.6 million. In Vietnam, more than 2,300 women were trained, or about 25 percent of the total number of farmers trained. By comparison, in 2010 only 10 percent of the trained farmers were women. In North Sumatra, Indonesia, nearly 1,600 women were trained. The share of women who receive training increased from 4 percent to 27 percent between 2009 and 2012. A survey of coffee farmers showed that training groups consisting of both men and women farmers reported a 92 percent increase in productivity. Farmers not trained by the ECOM–IFC supported program reported only a 37 percent increase in productivity.

the extension-training design based on an extensive gender assessment and analysis, which mapped the value chain activities by gender, origin, and social economic status. Women farmers were put on the map, and roles, needs, and constraints were identified along the value chain.

The World Food Programme (WFP) and IFC projects on women's leadership (box 11.8) and the Farm to Market Alliance (box 11.9) increased farmers' participation among both men and women. At the same time, farmer organizations improved their production and risk management by supporting better long-term planning among cooperatives, as measured by the production of annual cooperative business plans.

One of the most common production schemes women farmers engage in is poultry production. They first engage in the local history by raising poultry in their own backyards, and their roles tending animals provide them with additional income. While many development interventions and businesses emphasize the production of large livestock for meat processing, there are additional products that women could bring

BOX 11.8

World Food Programme (WFP) Rwanda Project: Women Farmers and Leadership Roles in Cooperatives

Rwanda, once a patriarchal society, today ranks fifth in the world for closing the gender gap, even ahead of the United States (Jessee 2020; Thomson 2017). After the genocide in the early 1990s, women have been at the forefront of reconstruction, and women make up more than 60 percent of the country's national Parliament. Rwanda has one of the highest rates of female labor force participation in the world at 86 percent. Aspects such as land tenure, ownership of assets, and access to and control of resources present a different and positive light in comparison with the situation of women in other African countries.

Despite these good points, women farmers in rural Rwanda still face challenges regarding lack of access to information that could maximize their productive potential and improve their achievements. They still find it challenging to become cooperative members, given the time they must invest and the number of requirements to fulfill. Even though women are well represented at leadership levels, women farmers tend to lack the confidence to participate and to make decisions. They need training in leadership and other technical areas such as financial management. The International Finance Corporation, the WFP, and an alliance of business partners (including Rabo Bank, Yara, Bayer Crop Sciences, AGRA, and Syngenta) known as the Patient Procurement Platform (WFP 2016) signed a memorandum of understanding to work with a focus on provision of finance to the farmer cooperatives while supporting women's participation.

BOX 11.9

Case Study: World Food Programme (WFP) Farm-to-Market Alliance—Rwanda

The objective of the agreement between the International Finance Corporation (IFC) and the WFP Patient Procurement Platform in Rwanda was to increase the sourcing of commercially available food (mainly maize and beans) from smallholder farmers; to secure market access via off-take contracts from buyers; and to align a variety of services, including preharvest financing, access to improved inputs, and technical assistance at the cooperative level. Initially, 47 cooperatives with 17,160 members covering 8,125 hectare of cropping area have been selected for participation. A total of 75 smallholder farmer cooperatives were able to enhance their professional performance by functioning more effectively and providing better services to their members.

Nearly 75 percent of women members of those cooperatives did not have access to loans to invest in farming inputs, which jeopardized their participation in associations. Few women were represented in committees overseeing the work of cooperative management, and it was clear that they needed to improve their technical and soft skills such as confidence, communication, and assertiveness to boost their leadership. In 2018, IFC conducted a gender assessment to inform programming and guide potential actions to improve women's active engagement. This gender intervention focused on the following activities: (1) train women on financial literacy and formation of savings groups, (2) coach potential women leaders on governance and financial management, and (3) provide gender awareness facilitation while targeting all cooperative board members to drive the recruitment of new members.

These interventions had an extensive impact, reaching 39,462 new female farmers from 145 cooperatives; 800 women's saving groups were created with more than US$114,070 cumulative savings mobilized. Women are using these savings to procure inputs for increased production and productivity; 50 percent of the women in the cooperatives were elected to leadership roles after completing the training/coaching and 77 percent of women reported improved capacity to express their views in cooperative governance. Later, the women invested their savings and acquired inputs for improving productivity. The knowledge they acquired increased their level of confidence to assume leadership roles and representation in several cooperative committees. Among other gains, new crops were adopted, such as bananas and vegetables, with the potential to generate income for the farming communities and to enhance diet diversification and nutrition outcomes.

Source: IFC 2021b.

to the market, including wool, fibers, eggs, and chicks, which would enhance their presence in the value chain. The case study from Ethiopia presented in box 11.10 presents a different perspective from the previous case studies, as it directly aims to support women engaged in animal production in several regions in that country.

BOX 11.10

Case Study: EthioChicken and Women's Participation in the Poultry Industry—Ethiopia

EthioChicken is the leading producer of day-old chicks and poultry feed in Ethiopia. The company sells poultry input products to rural farmers. Ethiopia's diet has deficiencies, especially in the low levels of animal protein consumption, leading to stunting, particularly, in young children. Another issue that the poultry industry must deal with is the low quality of chicken breeds that most smallholders are raising that produce few eggs, yield low meat volume, and are highly susceptible to diseases.[a] Furthermore, there is a widespread lack of quality feed offerings at the local markets. Since 2018, the International Finance Corporation (IFC) and EthioChicken have engaged in the implementation of a four-year project to increase the availability of affordable and high-quality poultry products into the rural market by professionalizing the distribution system of improved poultry breeds and feed to smallholder farmers in four main regions of the country. The advisory project has a target of reaching 200 women poultry agents. More than 1,070 people have joined this effort in poultry production, and one of the highlights is the emphasis on adopting gender-smart agri-interventions with support for women off-takers, last-mile retailers, and entrepreneurs.

The initial assessment found that women in poultry underperform in their businesses compared to male counterparts. Most female poultry agents have a lower level of education than their male counterparts. Only 46 percent of women noted having good access to poultry markets compared to 52 percent for male poultry agents. Close to 69 percent of women do not have access to the formal finance sector, that is, banks and microfinance institutions. Usually, their financing comes from family and friends, which is not sustainable or scalable. Sales (turnover) and net profits of women poultry agents are much lower than for men. Women have relatively less access to formal markets. In addition, the women contend with low liquidity and business management skills with few opportunities for training due to distances, lack of information, and cultural barriers.

A series of coordinated efforts to reach out to women included dedicated training programs for women-only operators to improve their marketing, record keeping, and decision-making processes and helping them to access timely information about purchasing the right input when required. The project targets only 1,000 agents and 70 feed dealers; the company currently has more than 8,000 poultry agents and 450 feed dealers throughout the country. Through IFC's advisory support, about 900 EthioChicken agents and 63 feed dealers are undergoing training and coaching, and at least 20 percent of them are women. It is expected that the number of agents will increase steadily, and they will be fully engaged, supplying 300,000 smallholder farmers with healthy chicks to enhance the company operations as well as access

box continued

BOX 11.10

Case Study: EthioChicken and Women's Participation in the Poultry Industry—Ethiopia *(Continued)*

to improved breed across the country. This is a win-win situation for women farmers and young women who plan to become entrepreneurs. Women will continue playing a pivotal role, increasing their household income while participating in the business sector. EthioChicken in Ethiopia's partnership with IFC is a positive example, giving women the opportunity to engage in lucrative value chains while improving their business management skills and supporting their presence in small livestock agrimarkets.

a. The introduction of the SASSO (Sélection Avicole de la Sarthe et du Sud Ouest) chicken, a French hybrid, has been a success, producing more eggs and growing faster, which is an improvement over the local breeds that are highly susceptible to diseases.

The projects described in these case studies demonstrate that women can perform as important contributors across different business models, integrating their small or midsize businesses into the local and regional supply chains while successfully engaging in local and regional supply chains of agricultural products. A conscious effort to adopt business models and strategies that are inclusive to women entrepreneurs will open avenues for them to participate and perform in both traditional and newly developed markets, bringing more diversity and better opportunities for the business and consumers.

Important Takeaways

Despite the challenges women face in participating in value chains, female entrepreneurship in rural settings has increased, representing about 8 million to 10 million formal small and medium enterprises with at least one female owner (World Bank 2021). Companies and organizations like IFC are advocating for an increasing female presence as integral partners in different value chains as farmers, entrepreneurs, and business owners. This has been underlined by IFC agreements with agribusinesses worldwide through a conscious effort to enhance women's participation to reach untapped new markets. Measures can be adopted not only from larger organizations but also by small and

local or regional businesses alike, boosting women's participation in value chains. Enterprises big and small will benefit by implementing actionable strategies to engage women smallholder farmers, encouraging diversity and innovation to engage with the private sector. Nonetheless, challenges remain. The following takeaways should be considered when developing initiatives to facilitate inclusion and women's participation and to bring agribusiness operations to a higher level of performance:

- Gender-smart targeted solutions can help identify innovative opportunities and address gender imbalances in order to facilitate women's access to advisory services, finance, education, training (particularly financial skills), and capacity development to increase their productivity, access to markets, and income.
- Women may need additional support with the logistical costs and other enabling factors to attend trainings and coaching. The training venues and facilities should be comfortable for women with children.
- Providing access to childcare, safe transportation, safe warehouses, safe packaging facilities, and safe market sites, as well as resources and trainings to combat GBV, can facilitate women's access to training and economic opportunity.
- Women's access to information and communication technology (ICT) and connectivity using cell phones is essential to their receiving timely information regarding price and product availability and access to digital financial services solutions, and gaining ability to make timely decisions on market opportunities.
- Sex-disaggregated indicators and gender-inclusive indices should be used to measure women's economic empowerment (WEAI, for example; see box 11.5). Tracking and evaluating metrics will facilitate the design of interventions that are most beneficial in the implementation of projects and programs, thus enhancing women's leadership and participation in economic opportunities.

These types of interventions, if adopted in a timely manner, can contribute to enhancing business performance through women's integral participation. When presented with entry points and an enabling business environment, women smallholder farmers will engage in positive trends, improving their livelihoods while furthering the integration of women smallholder farmers and suppliers in the agribusiness sector.

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CHAPTER 12
PARTNERSHIP STRATEGIES

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KEY MESSAGES

- Multistakeholder partnerships (MSPs), comprising various combinations of public and private sector entities, are an increasingly common approach to address shared, complex, system-level issues that are beyond the scope or control of any single group.
- Sustainability is now the main driving force behind MSPs in agriculture, often catalyzed by regulation, although unlocking market access, managing changing consumer preferences, and risk management are also significant drivers.
- Governance, financing, and accountability remain key challenges limiting the longevity and effectiveness of MSPs.
- Good practices in MSPs include undertaking meaningful and sustained stakeholder engagement, setting clear and realistic goals, ensuring that interests and incentives are aligned among the stakeholders, establishing effective governing and financing structures, and monitoring progress in a transparent way that allows stakeholders to be accountable for their contributions.

Introduction

Multistakeholder partnerships have proliferated in recent years. According to the Global Development Incubator, the number of MSPs more than quadrupled from 2000 to 2015, with agriculture sector examples focused primarily on (1) smallholder capacity development, market access, income diversification, and commercialization; (2) climate and biodiversity issues, especially around land pressures and deforestation risks; and (3) labor standards and supply chain equity and inclusion (GDI n.d.).

These multistakeholder collaborations are distinguished by the breadth and depth of the shared system-level issues they seek to tackle, the wide range of stakeholders resolved to act in concert, and the use of structured formats and governance mechanisms to achieve enduring change in market systems (Winter, Bijker, and Carson 2017). Stakeholder groups brought together under MSPs typically include some combination of the following: (1) private sector entities (agribusinesses, financial services providers, and retailers); (2) farmers and producer organizations; (3) civil society organizations (nongovernmental organizations [NGOs], academia, and consumer groups); and (4) governments, donors, and multilateral organizations.

This chapter opens with a survey of the main categories of agribusiness partnership that companies can draw on to guide the design of new MSPs or to assess the suitability of joining existing MSPs. These range from commercial partnerships, precompetitive partnerships, and public-private partnerships (PPPs) to productive alliances (PAs), landscape partnerships, and partnerships with financial institutions focused on private capital mobilization. Key risks, lessons, and success factors for each model are highlighted through case studies.

In the concluding section, we ask: What motivates an ever-increasing number of food and agriculture companies around the world to set up, or sign up with, ambitious MSPs? Regulatory and consumer preference trends play a role, as do systemic risks, such as commodity market volatility and the growing frequency of global supply chain shocks. However, one factor—sustainability—generates more traction for MSPs than any other driver. As company chief executive officers feel ever more urgent pressure to tackle complex sustainability issues, there is growing recognition that such challenges are addressable only through the collective action enabled by MSPs.

Agribusiness Partnerships

Commercial Partnerships

Commercial partnerships—broadly defined as contracts or agreements with other single entities—are the most intuitive and straightforward example on the menu of available partnership options. They are common in most agricultural commodity value chains and industries, including, among other things, cocoa, cashews, cotton, tea, coffee, and raw materials sourced for food and drink production. If such partnerships involve smallholder produce, the business partners may be producer organizations, traders, or other intermediaries.

In addition to commercial partnerships between individual producers and off-takers, contractual agreements between other players along the value chain are common—for example, processor-manufacturer, manufacturer-retailer, and trader-manufacturer commercial partnerships are relatively standard in the cocoa industry. The most structured and developed agricultural value chains around the world—for example, cash crops sold in high volumes to a diversified set of global end-markets—typically feature the greatest number and variety of commercial partnerships. In well-structured supply chains, commercial partnerships can be both *vertical* (for example, between smallholders and processors) and *horizontal* (for example, between different private sector processors, distributors, or retailers). Moreover, as the examples profiled in box 12.1 and box 12.2 demonstrate, commercial partnerships can serve as the anchor for deeper and broader engagement over time.

BOX 12.1

Case Study: Nestlé's Partnerships with Cocoa Producers

Investments by the multinational food and beverage conglomerate Nestlé into its cocoa supply chain provide an illustrative example of producer-level partnerships. The Nestlé Cocoa Plan offers farmers training and resources to help increase their cocoa yields, leveraging the company's global team of 1,000 agronomists to optimize production and reduce costs through techniques such as pruning and fertilizer optimization. Over 16 million higher-yielding cocoa plants have been distributed to replace aging, less productive plants. The Cocoa Plan has, in addition, helped farmers access basic financial services through the creation of 270 village savings and loans associations. In

box continued

BOX 12.1

Case Study: Nestlé's Partnerships with Cocoa Producers *(Continued)*

total, more than 150,000 cocoa farmers have benefited under the plan, accounting for 198,000 metric tons of cocoa sourced annually.

The Nestlé Cocoa Plan also demonstrates the potential for multidimensional producer partnerships. Cocoa farmers that sell to Nestlé have additionally been supported to develop alternative income sources and proactively protect the environment in cocoa-growing zones, with 2.8 million shade trees planted by 2022, for example. Meanwhile, in Ghana, Nestlé partnered with the International Federation of Red Cross and Red Crescent Societies to bring safe water and sanitation facilities to about 38,000 people in cocoa-producing areas between 2019 and 2021. As these examples show, commercial partnerships between off-takers and farmers can extend far beyond agronomic advice. As Nestlé's Sustainability Report for 2021 concluded, "Keeping children in school and supporting the human rights of farming communities are equally crucial to improving livelihoods in the cocoa sector and form part of our initiatives" (Nestlé 2021b, 41). By broadening partnerships in this way, integrated global companies not only boost the resilience and security of their supply, but they also get to know their farmer-suppliers better—thereby generating the transparency and data required to demonstrate traceability, which in turn may strengthen market access or command premium prices for end-products.

Sources: Nestlé 2021a, 2021b.

BOX 12.2

Case Study: Olam's Partnerships with Producer Cooperatives in the Cashew Sector

Olam Group's involvement in the Côte d'Ivoire provides a further example of a commercial partnership with producer organizations. Olam has worked with the government of the Côte d'Ivoire and small and medium enterprises (SMEs) to expand the supply chain for cashews and cocoa and to increase supply chain efficiencies. The company assisted in the formation of producer cooperatives that provide training in how to hand-shell cashews, thereby increasing the quality and value of the product as well as creating new rural jobs. (Machine shelling is done on a larger scale, but the process mechanically damages a significant percentage of the nuts, and the end-product receives

box continued

BOX 12.2

Case Study: Olam's Partnerships with Producer Cooperatives in the Cashew Sector *(Continued)*

a lower price.) Additionally, Olam was assisted by IDH (the Sustainable Trade Initiative) to develop a network of traders, processors, roasters, and retailers to provide a completely transparent, traceable supply chain for cashews. The availability of a larger supply of higher-quality cashews allowed Olam to expand sales, increasing the price paid to the producer cooperatives or processors for the hand-shelled product.

Building on these successes, Olam launched its Cashew Trail strategy in 2021. This strategy aims to increase average yields by 50 percent and support 250,000 cashew households improving their livelihoods through investments not only in cashew production but also more broadly in health, education, income diversification, and climate resilience. In Ghana, for example, Olam has distributed beehives, personal protective equipment, and honey presses and provided training to women in cashew-farming communities in partnership with the German development agency GIZ. These hives increase pollination and cashew yields while creating jobs and alternative income from the sale of honey and wax for over 2,000 women.

Thanks to these multifaceted partnerships, Olam is better able to market differentiated end-products to consumers: The group's product range in Singapore includes, for example, cashew butter and cashew nut offerings whose major ingredients are sourced directly from Olam's sustainable supply chains and can be traced back to origin, connecting the consumer to the farmer. Olam has initiated similar models in other African and Asian countries to expand and increase the transparency of their supply of specialized commodities.

Sources: World Bank 2018a; Olam 2021.

Precompetitive Partnerships

Some agribusiness partnerships have an explicit focus on resolving precompetitive bottlenecks in agricultural value chains such as low levels of productivity or supply chain organization. These precompetitive partnerships usually involve two or more companies operating in the same industry and working together on a common issue limiting the growth of the industry (Kennedy, Girard, and Olson 2022). These private sector partners share their resources, expertise, knowledge, and reach in a precompetitive space to attain their objectives.

The Sustainable Agriculture Initiative (SAI) Platform, launched by Danone, Unilever, and Nestlé, provides an illustrative example. The SAI Platform was designed to accelerate precompetitive collaboration across the food and beverage industry. Currently, it has more than 150 members globally—including farmer cooperatives, manufacturers, processors, retailers, and traders—working toward advancing sustainable agricultural practices.

In Pakistan, the platform seeks collective efforts from its members to address systemic issues such as introducing regenerative practices, investing in women's economic empowerment, and reducing greenhouse gas emissions. The aim of the project is to work with local farmers to help them adapt to changes and shift practices that contribute to securing supply and the development of the sector (SAI Platform 2022.)

Public-Private Partnerships

PPPs bring together government and nongovernment stakeholders (including civil society and businesses) toward the achievement of a common goal. PPPs typically involve co-investment from public institutions given the expected public good benefits and/or fiscal pressures to mobilize private finance. In agribusiness, such partnerships have the potential to contribute toward both sustainable agricultural practices and inclusive, smallholder-focused market development (Rankin et al. 2016). They enable different stakeholders in a sector, including women and youth, to become organized and equipped and gain access to markets, financing, and training.

Often, the defined goals of a PPP will focus on addressing value chain bottlenecks that no individual stakeholder can resolve alone—for example, through the development and operationalization of previously absent hard and soft market infrastructures that require a combination of enabling policies, technical assistance, long-term financing, public and private insurances or guarantees, and multistakeholder participation.

Examples of agribusiness PPPs include, but are not limited to, investments to build modernized irrigation infrastructure, input distribution platforms, digitized market integration platforms, commodity exchanges, and post-harvest storage networks. At their most effective, agriculture PPPs create and sustain cross-party traction by meeting three broad design criteria, the first of which ensures that the challenges being addressed are precompetitive, allowing for incentives to align.

Secondly, the defined goal(s) are equally high priority for all the key participants, with a clear and measurable targeted return on investment (ROI) for all involved.[1] This requires, among other things, that the PPP is "demand-led" and has confirmed support from key partners at the level of chief executive, board, and/or ministerial or head of state, as appropriate. Finally, the potential implementation risks—in terms of management time committed, funds invested, and reputational impacts—are shared equitably by all partners.

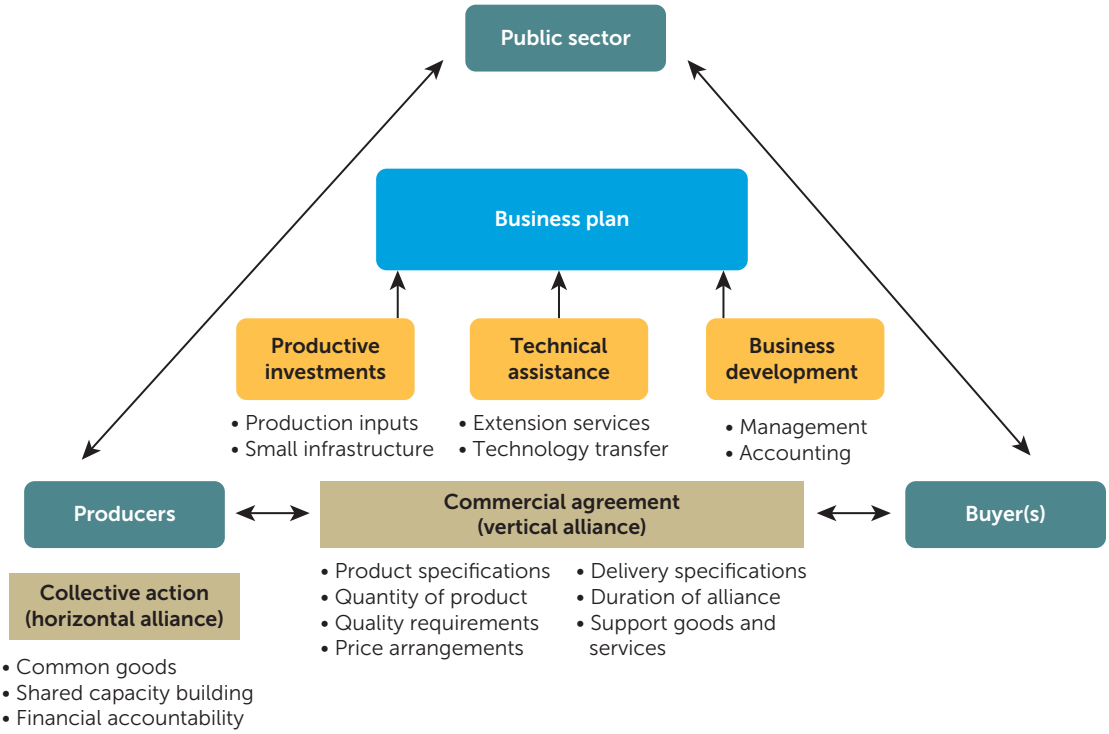
Productive Alliances

One of the greatest development challenges in agriculture is linking smallholder farmers to markets. PAs are an effective approach to counter this challenge as they strengthen links among producers, buyers, and the public sector within agricultural value chains. The three parties are connected through a business proposition that identifies the capital and service needs of the producers and proposes upgrades to their production capacities and skills in order to strengthen links with markets or buyers (figure 12.1). Financial support to PA projects often comes in the form of matching grants. The World Bank has played an active role in catalyzing PAs (World Bank 2016).

A previous assessment of the World Bank's experience of PA projects in Latin America observed the following achievements (World Bank 2016):

- *Scope:* Almost all PA projects exceeded their appraisal targets.
- *Social inclusion:* There has been greater inclusion of women and other disadvantaged groups such as indigenous groups or smallholder producers in postconflict zones.
- *Socioeconomic impacts:* Production, sales, income, and employment have grown—specifically, sales increased by 20–60 percent while average net income of producers increased by 30 percent.
- *Efficiency:* Most PA projects generated satisfactory average rates of return at the commonly assumed discount rate of 12 percent, using a 10-year estimation period.
- *Sustainability:* Longer-term vertical alliances were promoted between smallholder producers and buyers—even after project support came to an end.

FIGURE 12.1 Core Elements of a Productive Alliance



Source: World Bank 2016.

As this assessment shows, PAs can strengthen links between producers and buyers, providing mutually beneficial arrangements by "tightening" value chain links. Producers benefit from direct access to buyers, guaranteed volumes of purchases, technical assistance, and financial support. Buyers benefit from securing a set quantity and quality of agricultural produce required for their business and achieving greater visibility of their supply chain. See box 12.3 for examples.

Potential Challenges and Limitations

Structuring and operationalizing PAs is often time-consuming and costly, and in certain contexts, such partnerships may prove to be less flexible than alternatives. The downside risks tend be more significant in commodity value chains that exhibit minimal end-product price differentiation on quality grounds and where off-takers investing in PAs are

BOX 12.3

Case Study: Examples of Productive Alliance Projects in Latin America and Guatemala

The World Bank and the Inter-American Development Bank (IADB) cofinanced the Rural Economic Development Program, implemented between November 2007 and December 2014. The project's objectives were twofold:

- Improve the competitiveness of rural productive supply chains with strong indigenous participation
- Strengthen the institutional capacity of the public entities participating in the program for the adoption of a territorial management model with indigenous participation

The project costs amounted to US$45 million, of which US$29 million was funded by the World Bank and US$16 million by IADB. In addition, the beneficiary producers contributed US$1.04 million in cash.

Results: At completion, 174 Productive Alliance business plans were successfully implemented. In addition, the project had financed 27 business-strengthening plans. In total, 18,115 direct beneficiaries were reached by the Rural Economic Development Program.

required to compete to secure the same scarce supply against buyers who do not invest in such producer partnerships.

Hence, for processors and off-takers considering playing an anchor role in a PA, development of a quantified and risk-adjusted business case is a necessary first step. (See the checklist at the end of this chapter for details.) Risks may be further mitigated during implementation by the following:

- *Coimplementing with a selected NGO* that has proven technical skills and, crucially, the credibility that comes from a successful track record of operating within the local socioeconomic, linguistic, and cultural context
- *Adopting a graduated "escalator" approach* to strengthening producer partnerships, whereby fresh phases of investment by an agribusiness into its farmer-suppliers—in the form of capacity building, enhanced market access, or financial support—are triggered only on completion of agreed key performance indicators (KPIs) under the previous phase, creating a performance-based positive feedback loop for all parties

Landscape Partnerships

With rising global demand for agricultural land on a collision path with environmental goals, companies involved in the production and sourcing of agricultural commodities are increasingly working beyond their own supply chains to ensure sustainability. In recent years, landscape partnerships have increased in popularity as an effective way for different stakeholders (government, local communities, producers, civil society, and supply chain companies) to work together to address challenges relating to land pressures—such as sustainable farmer incomes, child labor issues, land conflict risks, deforestation, and water management. The essential features of this partnership model are the primary focus on sustainable land use and the extension of scope—for participating agribusinesses—beyond the narrow lens of the company's direct supply chain. See box 12.4, box 12.5, box 12.6, and figure 12.2 for examples.

Guidance for Engagement with Landscape Initiatives

The following guidance outlines how agricultural supply chain companies can engage most effectively with landscape-scale initiatives—where to engage, which type of initiative to support, and how to identify entry points to commence work with existing landscape initiatives (Proforest 2022). This guidance may be used in conjunction with the more expansive checklist provided at the end of the chapter covering all categories of MSPs.

BOX 12.4

Case Study: Proforest's Production Landscape Programme (PLP) in West and Central Africa

Proforest's PLP is an example of a landscape partnership initiative. It is supporting supply chain companies in Cameroon, Ghana, and Liberia to work effectively by aligning their actions and commitments on deforestation and other sustainability issues with government policy processes and civil society initiatives. This synergy is being achieved through awareness creation, capacity building, and the development of national guidance for engagement through multistakeholder processes. PLP focuses on four commodities—oil palm, cocoa, rubber, and timber—and seeks to address issues including deforestation, child and forced labor, insecurity of land rights or tenure, and the need for greater smallholder inclusion and gender inequality.

BOX 12.5

Case Study: SourceUp Platform

The SourceUp platform serves as a connection between companies and landscape initiatives. It works with compacts, which are coalitions of local stakeholders in the producing region (such as producers, local government, and civil society). These coalitions jointly set, act, and report on sustainability targets for the entire area, such as increasing forest cover or improving working conditions. Companies can support a compact through preferential sourcing, project funding, and technical assistance, and then claim sustainability results based on those criteria. A good example is a compact in the Central Highlands of Vietnam that has successfully reduced the carbon footprint of coffee by 60 percent while increasing the income of smallholder farmers by 20 percent, supported by the coffee brand JDE Peet's.

For investors looking to finance companies working with smallholders, the SourceUp platform provides a way to identify opportunities for stronger supply chain connections, reduced risk, and improved delivery on environmental, social, and governance objectives. Investors can initiate the development of a compact locally by using support from SourceUp, engaging a local development partner, and then monitoring progress on the platform.

SourceUp ensures credibility and transparency of collaboration. It validates and verifies locally reported sustainability data and analyzes this information against other data sets—for instance, on deforestation. The platform was initiated by the Sustainable Trade Initiative and jointly developed by major global companies, nongovernmental organizations, and other partners including the World Bank.

Source: Sustainable Trade Initiative (IDH), SourceUp, https://www.idhsustainabletrade.com/approach/sourceup/.

BOX 12.6

Case Study: FACT Dialogue

The United Kingdom launched the Forest, Agriculture and Commodity Trade (FACT) Dialogue with Indonesia during the 2021 26th United Nations Climate Change Conference of the Parties (COP26). The FACT Dialogue brings together the largest producers and consumers of internationally traded agricultural commodities (such as palm oil, soya, cocoa, beef, and timber) to protect forests and other ecosystems while promoting trade and development. So far, 30 countries have participated and 25 have endorsed the joint principles for collaborative action, committing to working together to protect the world's precious forests while also promoting sustainable trade.

box continued

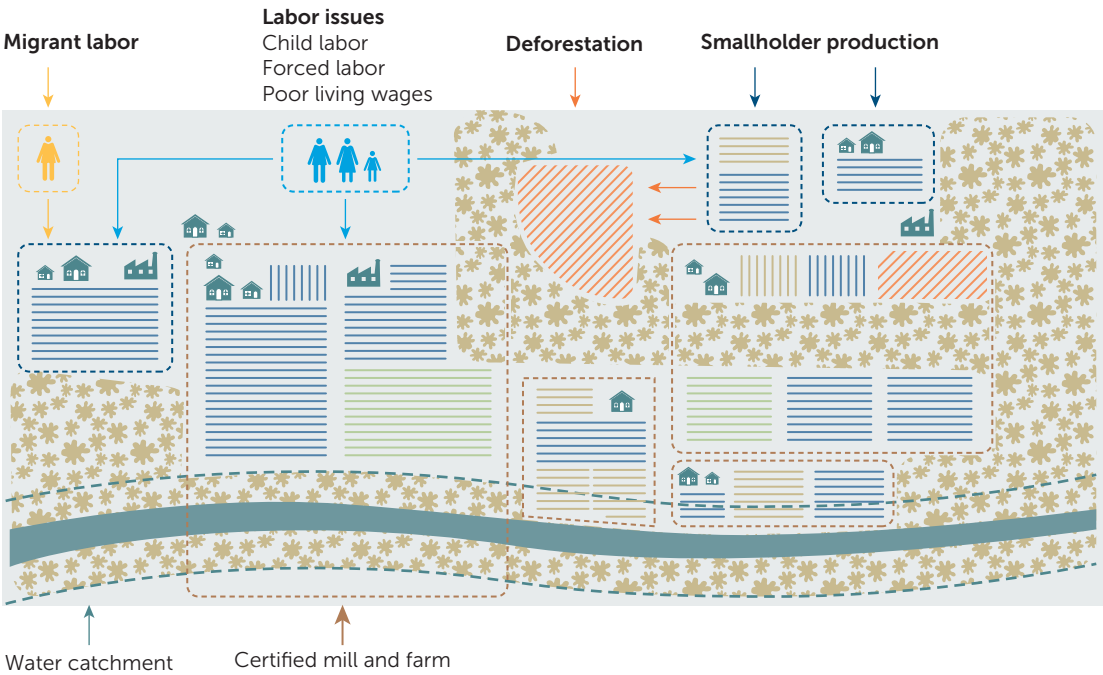
BOX 12.6

Case Study: FACT Dialogue *(Continued)*

The dialogue includes other multistakeholder consultations facilitated by the Tropical Forest Alliance. These collaborations are motivated by the urgent need to decouple deforestation from viable smallholder livelihoods. To support this mission, the dialogue will support smallholder farmers in the following ways: (1) improve access to affordable services, for example, agronomic services, technical assistance, and farmer registration and aggregation; (2) improve access to affordable financing (in the form of payments for environmental service, carbon finance, input and replanting finance, or grants, for example); and (3) enable a jurisdictional approach through national engagement—focusing, for example, on land rights and titling, forest governance, institutional capacity building, and agricultural extension services.

Source: FACT Dialogue 2021.

FIGURE 12.2 Examples of Landscape-Level Issues



Source: Proforest 2022.

Before engaging in the production landscape, work through the following four steps:

1. Understand the supply base through supply chain mapping.
2. Identify priority landscapes for engagement, considering their importance for procurement, level and materiality of risk, existing leverage, and success factors.
3. Determine what kind of overall approach is appropriate.
4. Identify and assess initiatives in the selected landscape.

Subsequently, when engaging in a landscape, work through the following:

1. Understand local motivations, expectations, and decision-making in the partnership.
2. Clarify resources available, scope, expected time frame, and delivery of results for the engagement.
3. Understand governance structures and mechanisms for private sector involvement, and build trust by supporting existing and developing governance structures.
4. Plan and implement interventions.
5. Coordinate and align communications with partners.
6. Develop a contingency plan to deal with miscommunication or adverse publicity.
7. Monitor and evaluate—including alignment with existing landscape-monitoring frameworks, where possible.
8. Set clear rules for remedial action if the initiative threatens to underdeliver on expected results.

Key Drivers of Multistakeholder Partnerships

Sustainability issues are increasingly taking center stage in the global food and agriculture industry. For agribusinesses, sustainability credentials are becoming a pivotal determinant of market access and commercial success. This, in turn, necessitates collaboration from multiple actors and stakeholder groups, given that few of the complex sustainability

challenges linked to how we produce and consume agrifood products can be overcome by individual firms alone.

Of all the examples explored in this handbook, the prevalence of deforestation in or near to zones of agricultural production is perhaps the most striking. Deforestation represents a key driver behind the 60 percent global decline in natural capital recorded over the last 45 years (WWF 2020), and in several value chains—especially cocoa, palm oil, coffee, and soy—proactive steps are required to mitigate direct and indirect deforestation risks. Cocoa and coffee are smallholder crops; soy and palm oil are mostly plantation and large farm crops. The composition of the sector has implications for the structure and functioning of these partnerships. The issue is discussed in more depth in chapter 13. "Multistakeholder Roundtables and Voluntary Standards." Several multistakeholder initiatives are now working on tackling this challenge with the recognition that collective action is paramount. Examples include the Global Coffee Platform, Cocoa & Forests Initiative, Collaborative Soy Initiative and the Food Systems, and Land Use and Restoration Impact Program, among others.

Sustainability and the Sustainable Development Goals (SDGs)

The United Nations' SDGs provide a wider lens for agribusinesses grappling with urgent questions relating to the creation of a more sustainable (economic, social, and environmental) food future. Numerous firms operating in agrifood supply chains have made commitments related to the SDGs and to MSPs that advance them by mobilizing and sharing knowledge, expertise, technology, and financial resources. The following actions and statements by Mars, Nestlé, Unilever, and Olam provide an illustrative cross section:

- *No Poverty* (related to SDG 1): "Through the Farmer Income Lab, which MARS launched in 2017, we work with partners AB InBev, Danone, Oxfam, the UN Development Program, and others to advance research and procurement practices that benefit rural communities and agricultural supply chains" (Mars 2020; see also Mars n.d.).
- *Responsible Consumption and Production* (related to SDG 12): "To drive collective action, we [Nestlé] participate in a number of industry and multistakeholder platforms, such as the Consumer Goods Forum's Forest Positive and Human Rights Coalitions of Action or the Institute for Human Rights and Business's Leadership Group for Responsible Recruitment" (Nestlé n.d.).

- *Climate Action and Life on Land* (related to SDG 13 and SDG 15): "We [Unilever] are working within our business and with external partners to eliminate deforestation from our supply chain, support human rights and tackle climate change" (Unilever n.d.).
- *Partnership for the Goals* (related to SDG 17): "We [Olam] must collaborate at a sector level if we are to achieve the UN Sustainable Development Goals by 2030. We share knowledge and learn from others. Working in partnership also gives greater access to financial and non-financial resources" (Olam 2020).

Publicity around this kind of private sector–led sustainability commitment has driven increased scrutiny of companies' performance on the SDGs, creating pressure to tighten the link been commitments, actions, and measurable outcomes. In response to this need, a number of organizations and partnerships have developed tools and facilities to help companies to achieve and measure sustainability impact. For example, the World Benchmarking Alliance (WBA), a multistakeholder alliance, has developed benchmarks to credibly assess and measure this performance and impact. Meanwhile, the Banking for Impact on Climate in Agriculture (B4ICA) partnership announced during the 2021 26th United Nations Climate Change Conference of the Parties (COP26) will bring together agrifocused lenders to support food, agriculture, and land-use sector clients with tools that enable the transition to net-zero and Paris Agreement goals.

The Imperative for Systemic Change

A further driver for the formation and expansion of MSPs is the growing frequency of multidimensional global shocks impacting agrifood supply chains. Notably, the food price crisis of 2008 brought the development and implementation of principles for responsible agricultural investment (RAI) to the top of the global agenda. High food prices, high energy prices, a growing biofuel sector, and the need for a near doubling of food production to meet longer-term demands led to a rapid upsurge of foreign investments in land. This created a profound tension between the need for investment in agriculture to improve productivity and realize its economic development potential, and the need to ensure that the poorest and most vulnerable people would not be displaced from their lands and natural resources would be protected (see box 12.7). More recently, in 2022, as the Russian Federation's invasion of Ukraine became protracted, the Russian Federation's blockade of Black Sea ports—alongside

BOX 12.7

Case Study: Food Innovation Hubs

In 2020, the World Economic Forum (WEF), in partnership with private firms, public institutions, and civil society, introduced the Food Innovation Hubs initiative to support sustainability innovations designed to improve how we produce and consume food through an ecosystems approach.

An impressive range of innovations already exist with the potential to transform our food systems to become more sustainable, inclusive, and efficient. However, they need to be widely adopted and scaled up through collaborations. Food Innovation Hubs are multistakeholder, precompetitive, and market-based. The hubs aim to achieve food systems' transformation at scale by strengthening local innovation ecosystems.

The hubs foster partnerships and networks that unlock investments, stimulate innovation, and collectively work to remove barriers. The first Food Innovation Hubs are being developed in Colombia, Europe, and India, while scoping work is under way in several African markets and Vietnam. The hubs focus primarily on subnational, national, or regional opportunities and are guided by the following principles:

- *Multistakeholder and inclusive,* engaging governments, the private sector, innovators, farmer organizations, civil society, international organizations, and others
- *Locally driven and owned,* aligned with national and regional goals, strategies, and plans, and supporting the SDGs
- *Market-based,* focusing on catalyzing sustainable and inclusive investments and market-based activities
- *Organized by a neutral facilitator* playing the role of catalyst and honest broker

Source: WEF 2020.

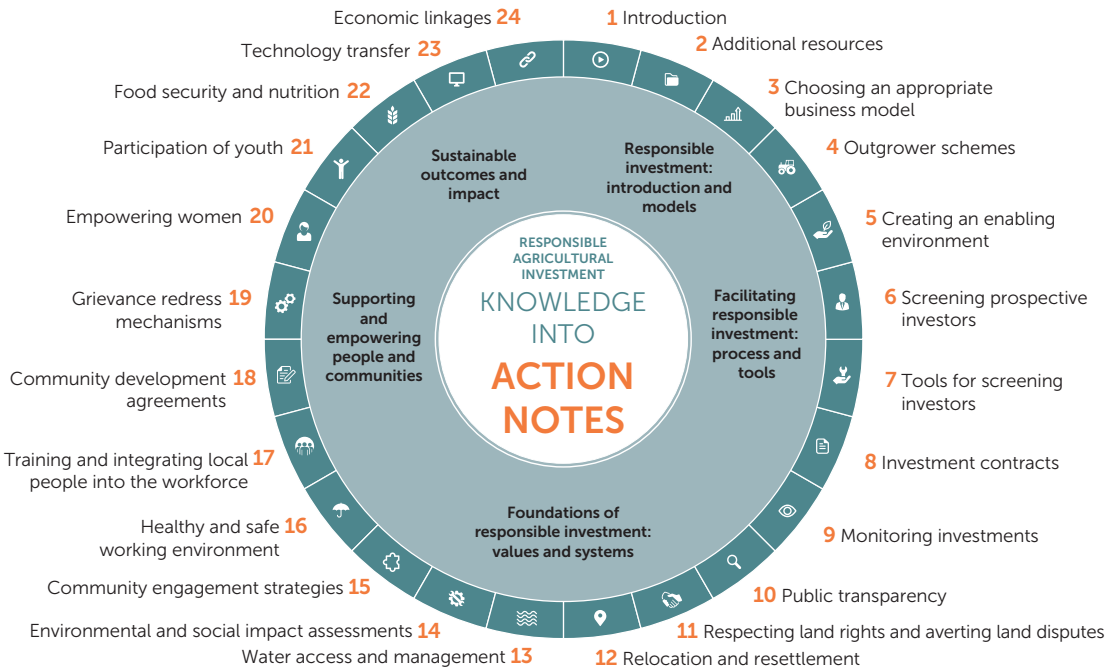
the introduction of wheat export bans by producers such as India—saw global wheat prices spike again, this time to levels higher than at the peak of the 2008 crisis (Financial Times 2022).

Several MSPs provide platforms for addressing these systemic-volatility and land-pressure risks. Based on a multistakeholder process, the Principles for Responsible Investment in Agriculture and Food Systems (CFS-RAI) were developed to promote responsible investments in agriculture and food systems, for example (Committee on World Food Security 2014). RAI's Inter-Agency Working Group generates empirical knowledge on responsible agricultural investment to

strengthen the capacities of governments, investors, companies, finance providers, communities, civil societies, and other stakeholders. First created in 2009 by the Food and Agriculture Organization (of the United Nations) (FAO), the International Fund for Agricultural Development (IFAD), the United Nations Conference on Trade and Development (UNCTAD), and the World Bank, its activities are supported by the UN General Assembly, the G-7, the G-20, and the government of Japan (World Bank 2018b).

The UNCTAD–World Bank *RAI: Knowledge into Action Notes* series provides evidence-based advice on the implementation of responsible agricultural investment (UNCTAD and World Bank 2018a). The series aims to provide balanced, informed, and practical guidance on key aspects of RAI. It is unique in its systematic coverage of a wide range of interconnected issues, most of which can be best addressed by partnerships and collaborations (figure 12.3).

FIGURE 12.3 RAI Knowledge into Action Notes Series



Source: UNCTAD and World Bank 2018b.
Note: RAI = responsible agricultural investment.

Global Food Security and Private Sector Solutions Using Blended Finance

The Global Agriculture and Food Security Program (GAFSP), which was created in response to the food price crises of 2007–08, supports both public and private initiatives and is a leading global financing instrument dedicated to fighting hunger, malnutrition, and poverty in low-income countries. GAFSP supports resilient and sustainable agriculture systems by channeling additional financing through existing multilateral agencies.

The GAFSP Private Sector Window (PrSW) is supported by the governments of Australia, Canada, Japan, the Netherlands, the United Kingdom, and the United States. It offers blended finance solutions with the International Finance Corporation's (IFC's) investments and expertise to support projects in the agriculture sector that may not attract commercial funding. It supports agribusiness and agrifinance projects across the entire food supply chain, including farm inputs, logistics, storage, processing, and retailing. Together, the GAFSP PrSW and IFC invest either directly in agribusiness companies or indirectly through financial intermediaries such as banks or microfinance institutions (see box 12.8). GAFSP PrSW's concessional terms are combined with commercial terms from IFC in a blended finance solution that covers short- and

BOX 12.8

Case Study: Financing for Cargill Cocoa Farmers in Côte d'Ivoire

With support from IFC and the Private Sector Window of the Global Agriculture and Food Security Program (GAFSP), the leading cocoa company Cargill launched the Cargill Coop Academy, an educational program for cocoa cooperative managers that attendees describe as a cross between a mini-MBA and an organizational boot camp. Since it was launched in 2013, it has reached an estimated 130,000 farmers across Côte d'Ivoire, training more than 700 cooperative leaders in digital finance, sustainability, and navigating commercial credit systems, while also increasing traceability and security. The programs are also tailored to train and coach women leaders in the cocoa sector and boost professionalism and traceability. A pilot launched as part of the program—which has since been rolled out—also enables farmers to receive cocoa premium payments digitally, removing cash from the process and providing safety to thousands of cooperative staff and members. "In just a few years, the cooperatives we've trained have become more profitable and more

box continued

BOX 12.8

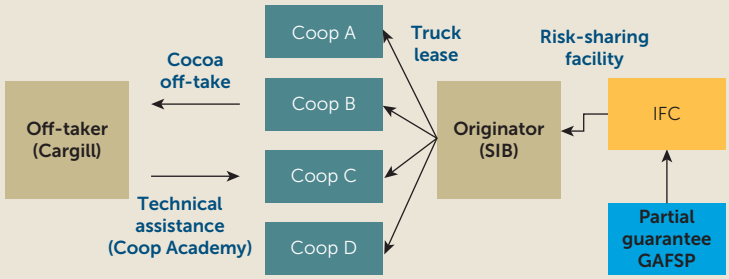
Case Study: Financing for Cargill Cocoa Farmers in Côte d'Ivoire *(Continued)*

sustainable, which has helped farmers, changed lives, and created positive impacts on dozens of rural communities," said Lionel Soulard, Cargill Cocoa & Chocolate's managing director for West Africa. "We're creating a virtuous cycle: cooperatives have become more professional and so farmers have put more trust in them. As a result, the cooperatives play an increasingly important role in the community."

Kouassi Yao Hervey, a Cargill Coop graduate, says that the training "compelled us to build a structure, which not only changed our lives, but also the lives of the farmers." Another graduate, Kouassi Kra, a cocoa farmer and cooperative leader who graduated from Cargill Academy in 2017, says that the changes he instituted following the training were "measurable immediately." Because of his participation in the program, Kra's cooperative became eligible to acquire new trucks through a three-year leasing deal, structured through a facility supported by the Private Sector Window of GAFSP, in which lending risks are jointly shared by Cargill, IFC, and the Société Ivoirienne de Banque (SIB), one of the country's largest banks.

The program, called Doni Doni ("step by step" in the Dioula language) provides affordable interest rates and has helped ease the logistical nightmare that had plagued many smallholder farmers as they struggled to get their cocoa beans to market. Close to 90 cooperatives have leased 268 new vehicles, which has meant fewer breakdowns and lower fuel costs. The academy is expected to reach an estimated 140 cooperatives and 140,000 farmers in total, while the digital payment component has already benefited 25,000 farmers from over 120 cooperatives enrolled in digital payments. See figure B.12.8.1 for a graphical representation of these sorts of relationships.

FIGURE B12.8.1 Blended Finance Deal Structure for West African Cocoa Cooperatives



Source: IFC 2019.
Note: IFC = International Finance Corporation; GAFSP = Global Agriculture and Food Security Program; SIB = Société Ivoirienne de Banque.

longer-term loans, guarantees, first- or second-loss cover and equity capital. In addition, GAFSP PrSW offers funding support to IFC Advisory Services (AS) projects that complement the investment projects. To date, GAFSP has approved US$446 million in 84 agribusiness investment projects in 29 countries and US$47 million in 95 advisory projects in 33 countries, aimed at improving the lives of more than 1 million smallholder farmers.

Regulatory and Policy Changes

Regulatory approaches are also driving the formation of sectorwide MSPs. For example, the European Union announced a mandatory due diligence law in March 2021 to encourage companies to take action to uphold human rights and reduce environmental impacts in their supply chains (CBI 2021). This legislation is already pushing different stakeholders to forge partnerships and collaborations to ensure compliance along all parts of the supply chain from farm to fork.

In June 2021, a coalition of cocoa sector actors, including Mondelēz, Tony's Chocolonely, Ferrero, Rainforest Alliance, and the International Cocoa Initiative, recommended establishment of partnership agreements with cocoa-producing countries and relevant stakeholders, such as farmers, civil society, community representatives, and industry to ensure effective implementation of the legislation (Fairtrade International et al. 2021). These partnerships and collaborations are expected to address issues such as deforestation, forced labor, children's rights, traceability, supply management, and living incomes, among others.

For companies in the agrisupply chain, extensive scrutiny and tracing will be required to ascertain that there are no issues involving human or environmental hazards anywhere along the value chain. Going forward, agricompanies will be required to invest more time and resources to ensure that they are sourcing their commodities responsibly, for example, through sourcing from certified producers, investing in traceability and monitoring systems, and supporting smallholder farmers in meeting international and/or local sustainability standards.

Effective Strategies and Best Practices for Building Strong Partnerships

Building successful MSPs takes significant time and resources. Therefore, adequate planning, dedication, and alignment of all actors are vital, and

companies need to take time to reflect before venturing into them (see case study in box 12.9 as an example). Most companies do not have a formal overarching strategy for choosing, creating, or exiting collaborations. Companies could therefore benefit from developing a high-level collaboration strategy, built around consideration of the following fundamental areas (Volkman, Petroy, and Lee 2021):

- *Vision:* Set out a high-level ambition for the company's collaborations.
- *Breadth versus depth:* Outline whether the company will focus on a few initiatives or spread itself across many.
- *Business strategy alignment:* Lay out how the collaboration strategy supports the overall business goals and drives business value.
- *Sustainability strategy alignment:* Ensure focus on material issues and support of company goals.

BOX 12.9

Case Study: Lessons from the Farm to Market Alliance in Rwanda and Tanzania

Background

Based on the successes of the World Food Programme (WFP) Purchase for Progress (P4P) scheme, through which locally produced food commodities are purchased for regional distribution, WFP decided to expand the initiative, leveraging the collective purchasing power of a range of market players providing smallholder farmers with access to markets and finance. In addition, the expanded initiative would provide an integrated value chain solution by bringing in input providers as well as financiers. The result was the Farm to Market Alliance (FtMA), formalized in 2016 with the signing of a global memorandum of understanding by eight partners: WFP, the International Finance Corporation (IFC), Yara International, Syngenta, Bayer CropScience, Alliance for a Green Revolution in Africa (AGRA), Grow Africa, and Rabobank Group. FtMA aimed to reach 1.5 million farmers through US$750 million of aggregated purchasing demand and related supply chain solutions.

Pilots were started in Kenya, Rwanda, Tanzania, and Zambia. In Tanzania, FtMA facilitated off-take contracts for 16,000 metric tons of maize between four partner buyers and 15,000 farmers from 69 farmer organizations. In all, 7,300 farmers accessed inputs through credit with a total loan

box continued

BOX 12.9

Case Study: Lessons from the Farm to Market Alliance in Rwanda and Tanzania *(Continued)*

value of US$2.7 million. In Rwanda, FtMA worked with five aggregators, engaging 40,500 farmers through 120 cooperatives with contracts for 9,900 metric tons of maize with an estimated value of US$2.5 million.

Results and Lessons

Overall there were mixed results. In Tanzania, there were a number of operational difficulties with program execution, but a large "shock" caused great difficulties for the program and led to an early termination. In late 2018 the maize price in Tanzania fell to 50 percent below the off-take price that had been specified in off-take contracts with farmer organizations, resulting in off-takers (buyers), such as local maize millers, reneging on their earlier contract commitments. The price crash was due to several factors, including a bumper harvest in the entire region and an export ban that considerably lowered interest in maize among buyers in Tanzania. The buyer defaults had a knock-on effect leading to borrower defaults with the participating banks. Twenty-four of the 26 farmer organizations went into arrears. The program loan guarantee was called upon, which disqualified the 24 farmer organizations from any further financing under the existing scheme.

The experience in Rwanda was different: The coops were stronger and had government support. The government set the price floor and had a strong commitment to develop the smallholder value chain and farmer financing as it stepped in to repay the farmers' debts. The buyers in Rwanda were also relatively large value-adding businesses or processors with clear business cases to source quality maize at fixed prices and build strong long-term relationships with coops.

The main lessons learned from the FtMA experience are to ensure that the following actions are taken:

- *Establish sufficient risk mitigation measures.* There were some limited weather insurance plans in place, but these were not adequate.
- *Establish clear program governance and relative roles of each of the alliance partners.* In the Tanzania case there were overlaps and duplication leading to poor operational outcomes. Once the problems were apparent there were no clear mechanisms for course correction.
- *Ensure that project-supported products have a solid buyer or off-taker.* Ideally this requires a large reliable off-taker, not multiple local smaller-scale off-takers or traders who are unwilling to honor contracts.
- *Avoid overreliance on a single commodity.* Maize alone, for example, has a loose value chain with a history of political interference, which brings additional risks. In retrospect FtMA should have included higher amounts of additional crops such as oilseeds, sorghum, and legumes (such as soy beans).

Undertake Stakeholder Engagement

Partnerships usually start with ambitions or ideas that require innovation and leadership to accomplish. Engaging the appropriate leaders to drive and champion such an effort is crucial to success. In the initial planning stages of a program, it may be useful to conduct a stakeholder analysis, particularly if the firm does not know the area or actors well. The company should systematically gather and analyze information to determine whose interests should be considered when developing or operationalizing the partnership. This can help identify potential partners and highlight areas of alignment or conflicting interests. At this stage, key activities include the following:

- Mapping the interests and motivations of all potential partners
- Conducting a detailed and thorough needs assessment of all potential partners
- Determining the value addition, strengths, and weaknesses of collaborating with each preidentified potential partner
- Prioritizing key stakeholders—including not just direct implementation partners but also regulators, beneficiaries, financial services providers, civil society, and so on—based on a combination of their assessed level of support (high to low) and assessed level of direct/indirect influence over the future success of the partnership (high to low)
    - We recommend an 80–20 approach, whereby 80 percent of the total engagement effort should focus on the top 20 percent of highly supportive, highly influential stakeholders.
- Planning on how to approach and engage the identified partners, including development of the following:
    - A *calendar of engagemen*t, sequenced in a way that builds momentum through early engagement with key influencers and opinion formers who are willing and able to use their own communication channels to build broader constituencies of support for the partnership
    - *Key messaging* (both headline messages and tailored messaging for each potential partner aligned to their individual priorities or concerns) to ensure that all stakeholders are aligned in their communications and avoid over- or underpromising

Develop Common Goals

After identifying the right partners, it is critical to develop a shared partnership agenda, including goals and priority areas. This planning is aimed at ensuring a proper alignment of interests, which is what most unsuccessful partnerships lack. At this stage, it is good for the key actors to identify potential areas of concern and seek to address them from the outset. Building trust and alleviating tensions are vital.

A shared partnership agenda should include the following:

- A vision statement that clearly outlines the partnership's goals (Preferably, the vision should be compatible or complementary to other global goals—for example, SDGs, Paris Accords, and so on.)
- Realistic, aspirational, and time-bound targets and actionable plans to achieve them
- Agreement on quantified KPIs and metrics for impact measurement and management, including agreed-upon result thresholds that will determine go/no-go decision gates during each phase of the rollout
- Shared priorities for the partnership, including the partnership's scope and areas of highest potential or impact: for example, crop or commodity value chain, geographic region, and cross-cutting issues, among others

When drafting the roadmap and actionable plans, it is necessary to clearly define the roles and responsibilities of each partner and agree on accountability. A framework should be established for regular meetings and reporting to track progress toward achievement of goals, including easy-to-use digital interfaces and data storage or data analytics. It is also beneficial for the partners to discuss and agree how costs and risks will be shared and mitigated.

Establish Governing Structures

Strong management and collaboration are a prerequisite to driving progress toward the shared goals among different stakeholders. Appropriate structures should be put in place to help formalize the partnership's mandate for action and build ownership and commitment to the agenda. The partners should draft a governance agreement and establish management bodies such as steering committees, a secretariat, and/or project teams.

At this stage, key activities include the following:

- Engage qualified staff with managerial experience to occupy leadership positions.
- Provide channels for effective communication between the steering committees and partners.
- Establish clear and transparent roles and duties for the staff, including fundraising, recruitment, and decision-making, among others.
- Create a clear, fair, and transparent dispute resolution mechanism in cases of conflict.
- Acknowledge and address any power disparities.

Often, senior staff representing constituent members in an MSP have multiple competing commitments and roles outside of the partnership. Therefore, it is critical that the core secretariat includes individuals with strong management and implementation expertise who are committed on a full-time and exclusive basis to advancing the partnership's goals.

Implement the Action Plans

As the partnership transitions from visioning, it should focus on how to implement the agreed action plans. Implementation usually involves engagement of other parties outside the partnership agreement such as producer organizations, consumers, government, civil society, and private contractors. Activities involving such a diverse range of parties will inevitably yield a wide range of results: the partnership should therefore build in flexibility to "fail fast," adapting each area of activity rapidly on≈the basis of fast feedback loops and lesson learning. In addition to this flexible "test and learn" model, the following guidelines are recommended:

- Ensure that the day-to-day operations are aligned with the short-, medium-, and long-term goals of the MSP.
- Hold regular meetings with key stakeholders to update them on progress and obtain guidance on critical issues.
- Allocate appropriate resources to the execution of the MSP's strategic plan, and communicate any issues related to capacity or financial constraints to the partners in a timely manner.

- Set up contingency plans to deal with new and unanticipated challenges and developments (for example, changes in legal or regulatory policies).

Conduct Monitoring and Evaluation (M&E)

Partners are advised to regularly conduct M&E. In this context, M&E entails collecting and analyzing information on performance measured against the set goals and KPIs of the MSP—either internally or through external evaluations, or via a combination of both. Monitoring is usually ongoing, while more substantial evaluations are conducted at set intervals (for example, every two years) and after implementation has been completed. Regular monitoring of performance can help identify unanticipated challenges or opportunities for affirmative or remedial action.

While partners and practitioners usually undertake monitoring themselves, external institutions, such as consultancies, NGOs, and academic institutions, can carry out evaluations. M&E results, positive or negative, can be shared externally to show good practices for future partnerships. Ideally, the results should be the basis for either continuing or discontinuing the partnership arrangement. Key M&E activities include the following:

- Developing procedures for undertaking both internal and external evaluations
- Maintaining transparency in communicating successes and failures from the results of the evaluations
- Establishing appropriate mechanisms to address the findings and recommendations in a timely manner
- Assessing whether the overall objectives are being met or not, and if the MSP is to continue or discontinue based on M&E results

Conclusion

MSPs have become a conduit for advancing complex global SDGs that individual actors are often powerless to achieve alone. The prominence of MSPs has been increasing in recent years, and their credibility is steadily increasing as successful track records and case studies reach wider audiences in the global agribusiness marketplace and lesson learning takes place.

Large-scale, integrated food and agriculture companies have embraced MSPs, with smallholder farmers being the beneficiaries in several flagship partnerships. These MSPs are increasingly setting ambitious targets on supply chain sustainability, with a growing number of landscape-scale partnerships emerging (see case study in box 12.10).

BOX 12.10

Case Study: Multistakeholder Collaboration to Integrate Smallholders into Uganda's Maize Supply Chain

Background

Over 70 percent of Uganda's population makes a living from growing crops, mainly low-quality maize on tiny plots. Farmers have in the past often dried their maize on bare ground shared with domestic animals—thus losing 30–40 percent of the harvest with the rest failing to meet minimum commercial requirements and safety standards. As a result, companies such as Nile Breweries used to source almost all of their grain products from overseas suppliers.

Household incomes in the country averaged US$307 per annum (87 cents a day) in 2010. Eleven million people (30 percent of the population) were severely undernourished, and 40 percent of children were stunted in part due to eating contaminated food.

Establishment of the MSP

In 2010, a project aimed at creating an inclusive supply chain that could engage and integrate local smallholder maize farmers into the regional economy was initiated by Carana, a global economic development consultancy. This initiative entailed extensive engagement with numerous players, including Nile Breweries, grain traders, and smallholder farmers. Significant investments went into the purchase of new assets and improvement of capabilities for traders and farmers. Maize demonstration plots to showcase good agricultural practices and proper post-harvest handling techniques were also created. An off-take agreement, Nile Breweries facilitated farmers' access to credit and attracted input suppliers that could help farmers finance the purchase of improved seeds, equipment, and fertilizers along with access to irrigation and pest- and fungus-control solutions.

Results

The following results were reported within five years:

- About 27,000 farmers—women accounted for more than half—were included in the supply chain.

box continued

BOX 12.10

Case Study: Multistakeholder Collaboration to Integrate Smallholders into Uganda's Maize Supply Chain *(Continued)*

- Median crop yields had risen by 65 percent, and the median price per metric ton had increased from US$139 to US$179.
- Annual household incomes more than doubled to US$688, and participating farmers' gross margins increased by 50 percent.
- Farmers' families had a more diversified and nutritious diet that included vegetables, nuts, fruits, and occasionally meat, fish, and eggs.
- Improved access to better inputs (drought-resistant seeds), crop insurance, and financing via mobile-phone payment systems.
- Annual sales of maize grits from the lead grain trader, AgroWays, to Nile Breweries increased from 480 to 12,000 metric tons. Improved quality and processing resulted in higher prices.

Source: Kaplan, Serafeim, and Tugendhat 2018.

Consumer-facing companies in the sector have been at the forefront of establishing multistakeholder initiatives, especially those with vertically integrated supply chains reaching back to primary agricultural production. With mounting pressures to meet global sustainability standards, and the resulting corporate commitments related to the SDGs, MSPs are seen as an attractive route to achieve these objectives. Traditional corporate approaches that utilized only in-house capabilities are giving way to ecosystem approaches as they provide better pooling of resources, expertise, and reach, and they are more effective at resolving precompetitive market-building challenges.

Firms working in the agriculture and food supply chain should readily embrace and engage in MSPs, wherever such partnerships are tightly aligned to core commercial goals and geographic and product focus areas. This chapter has outlined best practices for building successful and effective MSPs, and the checklist at chapter's end provides guidance on the highest priority action points before and after engaging in MSPs.

While MSPs can soak-up significant management bandwidth and budget, they offer potential solutions to a growing number of challenges. These challenges might otherwise prove intractable in a global agrifood economy where market access and product differentiation increasingly rests, not only on price or quality competitiveness, but also on a company's sustainability credentials and to supply chain traceability and equity.

Checklist

The checklist can help to guide a company through the process of identifying or selecting a robust partnership model.

Evaluating a Partnership: Internal Considerations

Imperative: Is there a clear imperative for a partnership approach to this challenge?

- What partnership activities are already in place in your areas of interest? One good source of information would be the local World Bank office. ☐
- What capacities and resources will be leveraged that are not available internally? ☐
- Which costs or risks would be shared by addressing the identified problem(s) collectively? ☐
  - Consider the full spectrum of options. Conduct a quantified cost-benefit analysis for participating in the MSP in relation to identified alternatives that could potentially achieve the same objective(s). ☐
  - Prepare a business case for participation in the MSP, analyzing both the costs of participation and the anticipated return on investment—in both financial and nonfinancial terms—that will accrue if the MSP's goals are met (for example, access to new markets, higher levels of supplier capacity, improved traceability, and so on). ☐
  - Proceed with participation in the MSP only if this business case receives full support from the company's top management positions, board, and relevant in-country management teams. ☐
- Which innovations could be identified or piloted more effectively by working with other organizations, value chain actors, and/or competitors? ☐
- How will the partnership and its activities be integrated into the company's operations? ☐
- Are the targeted goals measurable and realistic? ☐

Alignment: Does this partnership align with the company's mandate, objectives, geographic focus, and competitive advantages?

- Does the partnership help to deliver strategic priorities? ☐
- How does the partnership fit with current programs or initiatives? ☐
- Does the partnership align with the company's core business objectives? ☐
- Is there any risk that changing market dynamics (for example, shifting global agrocommodity prices, changes to product or go-to-market strategies, or country-level market entry/exit decisions) could decouple the partnership's activities from the company's core commercial goals? Has a forward-looking, scenario-based risk assessment been conducted? ☐

- Determine the interests and contributions of potential partners. What will their interests be? Do they align or conflict with yours? Do they have a strong and proven implementation track record? ☐

Value addition: Will the partnership add value?

- Does the partnership address key challenges or constraints that exist in the company's current or planned smallholder supply chain? ☐
- Does the partnership provide any additional benefits (for example, market entry, market creation, new networks, lower costs through improved market infrastructure, improved reputation, or enhanced government or community relations)? ☐

Partner relations: Can your company work with the partnership organizations or members through a formal mechanism? ☐

- Are the partnership's interests directly aligned with your business model? Are their values aligned with yours? ☐
- Are there any risks (commercial or reputational) presented by working with the partnership members? ☐
- Do the potential partners have the capacity to fulfill their commitments under the planned MSP and the ability to do so according to agreed timelines? ☐

Risks: Have the risks been considered and appropriate mitigation measures accepted?

- Which risks are presented by the partnership, what is the assessed likelihood and level of impact of each key risk, and how can these be mitigated? Has a risk register been created to track risk issues dynamically rather than as a one-off exercise? ☐
- Is there any potential negative effect stemming from the MSP on other company relationships or reputation? ☐
- In mapping the risks, have unintended consequences been considered? ☐
- Are the reporting requirements acceptable? Does the information shared with partners and/or the public present any concerns (for example, relating to commercial confidentiality or compliance with data privacy rules)? ☐
- Have risks associated with the partnership been accounted for in the firm's crisis communications plan? ☐
- Is the local regulatory and policy environment and its impact on the MSP's activities well understood? ☐
- Conduct appropriate political economy analysis to assess whether key government agencies and ministries are genuinely supportive of the planned MSP and to identify the likely winners and losers from any changes to the market system that are likely to result from the MSP's activities. This analysis can then inform "politically smart" stakeholder engagement, messaging, and coalition building. ☐

Costs: Are the transaction and implementation costs and the required resources acceptable and approved?

- Do decision-makers understand the resources required to manage or participate in the partnership? ☐
- Have funding sources for participation or implementation been secured? ☐
- Has staff time been allocated and budgeted for the life of the partnership? ☐

Capacity and commitment: Is there sufficient internal capacity and commitment to participate?

- Do relevant staff members have the sufficient skills and competencies to participate and deliver value for the partnership? ☐
- Who would represent the company in the partnership in a leadership capacity? ☐
- Is there sufficient buy-in from relevant management, staff, and other divisions? ☐
- Are decision-makers who are not directly involved in the partnership aware of and committed to the engagement (for example, key company shareholders, board members, or function leads)? ☐

Evaluating a Partnership: External Considerations

Common vision: Does the partnership have a clearly articulated definition of the challenge and vision for the future that informs its strategy?

- Has the partnership clarified common interest goals for participation? ☐
- Does the partnership have a clear strategy and set of activities that show how each partner contributes to solving the challenge at hand? ☐

Governance: Is the governance structure balanced, legitimate, and credible?

- Was the governance structure set up with the aid of a third party and/or based on best practices? ☐
- Is there an independent and documented due diligence process conducted before partners join? ☐
- Does the governance structure reflect a balance of needs from each partner? ☐
- Is each partner recognized equally in decision-making at a board or steering committee level? ☐
- Is there a clear process for conflict resolution? ☐
- Is there a mechanism to revisit the governance structure periodically to refine based on experience? ☐

Accountability: Is there a mechanism to ensure partner accountability?

- Are the partners committed with explicit leadership buy-in and realistic expectations? ☐
- What is the penalty for nonparticipation? ☐

- Is progress shared publicly? If so, are the activities disaggregated by partner? ☐
- Is there a dependency on the timing of partner funding contributions to the MSP—and if so, are partner funds secured? ☐

Measuring impact: Does the partnership collect and share data regularly on progress?

Supporting institution: Is the partnership supported by a strong "backbone" institution?

Communications: Does the partnership leverage regular communications and channels to share news and connect with partners and a wider stakeholder group?

- Does the partnership have a communications protocol? ☐

After ascertaining that a MSP is the best option and determining that there is a strong fit among the partners, the following should be considered:

- Jointly develop a clear and concise strategy for the MSP. What would the MSP ideally achieve and under what timeframe? ☐
- Allocate adequate resources in terms of staff, time, and money. ☐
- Establish an appropriate governance and management structure. Attend to any power dynamics and conflicting motivations from the outset. ☐
- Draft an accountability map and strategy. ☐
- Set up the rules of engagement between the MSP partners and intended beneficiaries of the MSP. ☐
- Develop appropriate communication and reporting lines. ☐
- Develop an M&E strategy. Regular impact assessments should also be considered in order to adapt and improve the initiative according to outcomes. ☐
- Develop an exit strategy. When will your firm consider the MSP to have fulfilled its objectives or to be underperforming or failing? ☐

Note

1. This RoI can be explicitly financial or nonfinancial (for example, improved social, environmental, or market access outcomes) or a combination of both.

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CHAPTER 13
MULTISTAKEHOLDER ROUNDTABLES AND VOLUNTARY STANDARDS

Kate Bottriell

KEY MESSAGES

- Roundtables are initiatives that bring together different types of stakeholders around a voluntary sustainability standards system, usually focused on a specific crop, commodity, or product. Standards developed through roundtables have an emphasis on stakeholder participation, balanced representation, and open membership.
- Key roundtables for smallholder farmers include those in the palm oil, soy, rice, beef, sugarcane, and cotton sectors. The cocoa and coffee sectors, however, have a number of sustainability standards systems that have not followed the same development trajectory as the abovementioned roundtables.
- Fair trade and organic labels share some similarities with standards systems but with some important differences. For this reason, these labels are often used alongside other certification systems.
- The challenges for smallholders to adopt and implement sustainability standards mean that support programs are needed for farmers to meet the requirements of the standard, operated either by firms or by other external organizations such as nongovernmental organizations (NGOs).

- Ensuring buy-in from a wide range of stakeholders leads to greater uptake and creates opportunities for efficiencies. Smallholders and producers can benefit from needing to meet only one set of requirements, as well as accessing shared resources such as training materials. Firms can benefit through fungibility between buyer demand and may also benefit from data efficiency (particularly where information technology [IT] systems for sharing data exist in the chain).

What Are Roundtables, and Why Are They Useful?

In the context of this handbook, the term *roundtable* refers to a specific type of multistakeholder initiative that includes the grouping of different types of stakeholders combined with a voluntary (as opposed to regulatory) sustainability standards system and that is focused on a specific crop, commodity, or product. These standards systems have historically also been called *voluntary sustainability standards* or *sustainability certification schemes*.

The stakeholders involved in the roundtable drive the development of the standards (that is, the social, environmental, and governance requirements that must be met); in the case of industry participants, they also adopt and implement the standards in their operations. Bringing together producers, supply chain actors, retailers, financiers, and civil society creates an opportunity to develop a set of requirements that reflects the reality of the particular industry, consumer demands, and the aspirations of civil society. Roundtables can also bring together stakeholders to work on wider social and environmental issues that affect the sector. Participating in a roundtable can provide firms with insight into developing trends from a range of perspectives, which can support their strategic decision-making.

Adopting and implementing the requirements of a voluntary sustainability standard can help firms structure their environmental and social compliance by providing a framework of key issues to focus on in their operations. Through roundtables, buy-in from key stakeholders across interest groups can create efficiencies in the market, as downstream buyers (such as branded manufacturers and retailers) are aligned on what they are asking suppliers for and need only to ask for compliance with an existing standard. Firms can respond to civil society demands without needing to develop their own set of sustainability requirements for each supplier and without the need to develop and implement verification

approaches. This is particularly important for smallholders, as well as small and medium-sized enterprises that may not have the resources to develop their own systems.

Furthermore, financiers use the same approach with investment screening; for example, the International Finance Corporation (IFC) accepts certain voluntary standards as evidence of fulfilment of its Performance Standard 1 (Social and Environmental Assessment and Management Systems).[1]

In some cases, voluntary sustainability standards systems can also be used by firms to demonstrate compliance with government regulations. For example, supply chain due diligence and/or modern slavery legislation has been adopted in Australia, France, the Netherlands, and the United Kingdom and has been proposed for the European Union (EU) as a whole (EC 2022). The standards systems are still considered voluntary in this context because there are typically several options that firms can use to demonstrate compliance.

What Makes a Credible Roundtable?

Governance

What differentiates standards developed through roundtables from other standards is the emphasis on stakeholder participation, balanced representation, and open membership. Most roundtables are legally established as associations, which means they have publicly available statutes, annual general assemblies where members vote for the executive board and on key decisions, and transparent reporting of accounts and activities. The executive board is responsible for oversight and management of the roundtable, and the day-to-day activities are implemented by an executive secretariat (a team of employees of the roundtable). Membership typically requires an annual payment of dues and, in some cases, also a commitment to follow a code of conduct, which may include meeting certain targets for verification and/or annual reporting of progress.

Scope of Activities

Roundtables that take the form of an association have a general assembly to which all members are invited. (Many of the roundtables have been established under Swiss law, which requires an annual general assembly.)

Larger initiatives combine this with a conference that includes plenary presentations and side meetings. These events are critical opportunities for members and other stakeholders to share their work in side events as well as to interact through informal exchanges. The roundtable's executive board meets regularly during the year to make strategic decisions and guide the work of the secretariat. As in other multistakeholder initiatives, task forces and working groups can be set up to work on specific issues, bringing together a range of stakeholders to try to solve critical sustainability challenges of the sector.

What differentiates roundtables from other multistakeholder initiatives is the presence of a sustainability standards system. The work of the roundtable, therefore, also includes the development and management of the standard and its assurance system.

Good Practice for Sustainability Standards Systems

A standards system has three components: the set of requirements (the standard), the checking of the requirements (assurance), and management of the whole system (the governance). Since 2004, the International Social and Environmental Accreditation and Labeling Alliance (ISEAL), the global association for sustainability standards systems, has been providing guidance through good practice codes on standard setting, assurance, and impact. Key credibility practices for standards systems include the following, adapted from ISEAL (ISEAL n.d. (a)):

- *Sustainability:* Standards scheme owners clearly define and communicate their sustainability objectives and approach to achieving them. They make decisions that best advance these objectives.
- *Improvement:* Standards scheme owners seek to understand their impacts and measure and demonstrate progress toward their intended outcomes.
- *Relevance:* Standards address the most significant sustainability impacts of a product, process, business, or service.
- *Rigor:* Standards are set at a performance level that results in measurable progress toward the scheme's sustainability objectives, while assessments of compliance provide an accurate picture of whether an entity meets the standard's requirements.

- *Engagement:* Standard setters engage a balanced and representative group of stakeholders in standards development.
- *Transparency:* Standards systems make relevant information freely available about the development and content of the standard, how the system is governed, who is evaluated and under what process, impact information, and the various ways in which stakeholders can engage.
- *Accessibility:* Standards systems facilitate access to information about meeting the standard, training, and financial resources to build capacity throughout supply chains and for actors within the standards system.
- *Truthfulness:* Claims and communications are verifiable, not misleading, and enable an informed choice.

In addition to standard setting, ensuring the integrity of the assurance system (that is, verification and auditing) of the production and the chain of custody is a critical aspect of credibility. Depending on the level of independence during an assessment, organizations found to be compliant with the standard may be called "verified" or "certified." Developing monitoring and evaluation systems to understand the impact of the standards system and whether it is actually making a difference in the field is also an important part of credibility.

There are currently 34 sustainability standards systems worldwide that are members of ISEAL, including a number relevant to agriculture. For example, Better Cotton (formerly known as the Better Cotton Initiative, or BCI), Bonsucro, Fairtrade International, Linking Environment and Farming (LEAF), Roundtable on Sustainable Palm Oil (RSPO), and Rainforest Alliance are all ISEAL code compliant. The Roundtable on Responsible Soy (RTRS), Sustainable Rice Platform (SRP), and the Sustainable Agriculture Network (SAN) are members working toward compliance (referred to as "community members"). Not all of these systems would be considered roundtables, but they are all sustainability standards systems.

Why the Credibility of Roundtables Matters

When firms choose to invest time and money in the implementation of a sustainability standard, in order to secure and benefit from this investment, it is important they consider the robustness of the system. Firms should consider the objectives of the roundtable, the range of stakeholders involved, the number of members, and how

decision-making works. Research by the Harvard Kennedy School has proposed that multistakeholder initiatives that are representative, deliberative, and collaborative are more likely to be worthwhile (Winter, Bijker, and Carson 2017).

Firms can refer to the list of ISEAL members and the status of their compliance with the good practice code (ISEAL n.d. (b)) and Standards Map (Standards Map n.d.), which is also a useful tool to compare various standards.

Firms should ensure that they have a good understanding of which standards systems are accepted by their buyers, the regulators in the countries they operate in or supply to, and their actual or potential financiers. Many of these assess both the content of the standard and the governance structure when determining which voluntary standards to approve as tools for demonstrating compliance.

A roundtable with clear governance and decision-making structures (even if it is still a small organization) is much more likely to be able to withstand the challenges it will inevitably face, compared with an ad hoc grouping.

By their nature of bringing together stakeholders from different interest groups, roundtables often find themselves the focal point of disagreements among stakeholders. Although it is not unusual for high-profile stakeholders to occasionally leave a roundtable, having balanced representation and clear decision-making processes makes this less likely to happen, and if it does, less disruptive to the functioning of the roundtable. Furthermore, a well-managed roundtable provides a structured negotiation platform for civil society (that is, social and environmental NGOs), industry (producers, supply chain actors, and retailers), and financiers to agree on the details of what sustainability means for the sector and how it can be practically implemented in fields, plantations, processing facilities, and offices. Similarly, having a board of elected representatives from different stakeholder groups can help resolve stakeholder conflicts, through both formal processes as well as the informal relationships that form through regular contact.

Attracting and keeping stakeholders at the table is important, because buy-in from a wide range of stakeholders leads to greater uptake, which, in turn, can create opportunities for efficiencies. When many buyers are asking for the same sustainability requirements, smallholders and producers can benefit from needing to meet only one set of requirements, as well as accessing shared resources, such as training materials.

Limitations and Criticisms

Perceptions of voluntary standards systems have fluctuated over the years. Campaigning NGOs have frequently targeted roundtables on the weaknesses in their standards and the need to increase requirements, particularly related to deforestation, labor rights, and human rights. As the requirements have increased over the years, these criticisms have shifted to focus on implementation and the extent to which the standard's requirements are implemented in the field. This is linked to the quality of auditing, and a number of standards systems have been investigated and found to have failures despite independent oversight systems in place. Some critics point to the commercial relationship between the auditors and the firm being assessed as a weak link (the firm hires the auditor directly). Although this is not specific to auditing voluntary sustainability standards, it is standard practice in the assurance sector. A report in 2020 from campaigning NGO Greenpeace identified weaknesses in governance and decision-making, strength of standards, transparency and traceability, audits, and implementation (Greenpeace 2021).

Because roundtables develop standards based on brokering an agreement between a wide range of stakeholders, the standards are a compromise. In practice, as roundtables mature and shift from development to operational mode, one result is that some stakeholders break away to establish other initiatives with lower or higher requirements. This process creates a complex proliferation of initiatives (particularly true for the palm oil sector). In addition, some large brands have created their own internal standards and assurance systems to align with their specific business practices. This reduces the efficiencies that roundtables might otherwise provide. However, some breakaway initiatives can be complementary, especially where endemic or sectorwide issues persist that cannot easily be addressed through individual producer certification.

Sustainability standards systems have also been challenged over the cost of implementation, often without a counterbalance of price premiums. The cost of implementation includes direct fees associated with membership; pre-audit, audit, and certification costs; as well as the indirect costs of changing or improving practices and implementing social and environmental management systems. Indirect costs can vary widely depending on the starting point of the production practices. For some markets, implementing sustainability standards is considered a core cost of doing business and the price of market access. However, this can

disproportionately impact smallholders, who are either excluded or end up bearing additional costs. There has been progress in addressing this by financing the direct costs of certification for smallholders and capacity building to increase productivity to offset costs.

The presence of limitations and criticisms does not mean that firms should not use voluntary standards systems, but it is important that they understand what these limitations are. Firms must remember that these systems are a tool rather than the end goal. Although there has been a trend to move away from certification toward new approaches, especially by firms with mature sustainability programs that have already spent many years implementing standards systems, roundtables remain an important part of transforming the sustainability landscape.

Roundtables and Agricultural Smallholders

How Roundtables Are Designed or Adapted to Support Smallholders

Many agricultural and horticultural crops and livestock are produced across a range of farm sizes, from smallholders through large-scale commercial operations. Looking at the historical development of roundtables and sustainability standards for crops such as oil palm, soy, and sugarcane, the initial industry-side participants in the roundtable discussions were large-scale producers. As a result, smallholders have been (and continue to be) excluded from supply chains as an unintended consequence of firms' sustainable sourcing commitments. It is therefore important for these sectors that firms explicitly consider smallholders in their sourcing commitments. For crops and agricultural commodities that have a significant global component of smallholder producers, however, such as cotton and rice, the standards systems have been designed around the smallholder context.

Challenges for smallholders to adopt and implement sustainability standards include insecure land tenure, insufficient access to inputs and finance, political disenfranchisement, poor access to markets and information, lack of economies of scale, and lack of training and support (AFI 2019). They may lack capacity to understand, interpret, and plan what needs to be done in practice on their farms to meet the requirements. This means support programs are needed for smallholders to meet the requirements of the standard, operated either by firms or other external organizations, such as NGOs. Sustainability standards also typically

require administrative and monitoring systems, record keeping, and developing and implementing policies that can be especially burdensome for smallholders. Some roundtables have adapted the standards to reduce the administrative burden for smallholders.

Assurance (also called *verification* or auditing) of smallholders can also pose challenges. Third-party assessments of every smallholder would be prohibitively expensive. In response to this, group certification systems have been introduced, which require a centrally administered system that is assessed, along with third-party sampling of some of the group members. However, even this system can be challenging, and some standards systems that work extensively with smallholders have introduced self-assessments and self-reporting as the starting point, supported by various levels of sampling, to reduce the burden.

There are often technical challenges and significant costs associated with tracing products to the level of individual smallholders; supply chain integrity ("chain of custody") systems have also been developed to allow aggregation through farmer groups or collection points, as well as credit systems where independent smallholders can directly sell an equivalent value of sustainable product to end users without supply chain traceability. This option also allows premiums to flow directly to smallholders.

Key Roundtables for Smallholders

Roundtable on Sustainable Palm Oil

The RSPO was officially established as a Swiss association in April 2004 by World Wildlife Fund (WWF), the Malaysian Palm Oil Association (MPOA), the Swiss supermarket Migros, Unilever, and the international vegetable oil processor AAK. This followed several years of informal cooperation dating to 2002, including a founding meeting in Malaysia in 2003 involving 200 participants from 16 countries. Today it continues to have the legal form of a nonprofit association, managed by a board of governors (composed of oil palm growers, NGOs, and representatives of other activities related to palm oil), and an executive secretariat (based in Malaysia). It currently has 5,294 members and is largely funded through membership fees. An annual members conference is normally held alongside the general assembly.

The RSPO operates a standards system that includes environmental and social requirements for oil palm producers and growers, as well as a chain-of-custody system to ensure the integrity of trade and the claims

made through the supply chain. Compliance is certified by independent third-party auditors. The standard is reviewed with public, multistakeholder participation every five years. Additionally, members of the association are bound by a code of conduct, which includes a commitment to a time-bound plan of working toward producing or buying certified sustainable palm oil and reporting annually on progress.

In 2022, globally there was 4.67 million hectares of RSPO-certified oil palm plantations (compared with the 28 million hectares of oil palm plantations worldwide), and 19.5 percent of palm oil globally is RSPO certified (RSPO n.d.).

Smallholders account for about 40 percent of total global palm oil production and are therefore an important part of the work of the roundtable. As of March 2022, there were 166,891 RSPO-certified smallholders covering 490,681 hectares. (See box 13.1 for a program example from Indonesia.) The RSPO has a formal Smallholder Strategy (approved in 2017), which sets out three objectives: to improve livelihoods, to increase market access, and to simplify the certification approach for smallholders. This strategy is implemented through the Smallholder Working Group (SHWG). Outcomes include the RSPO Independent Smallholder Standard, which was endorsed in 2019 and allows for a phased approach to compliance, and the RSPO Smallholder Support Fund (RSSF), which is available to independent smallholder groups to cover the costs of certification audits (funded from 10 percent of the revenue generated from the trade of certified sustainable palm oil). The PalmTrace chain-of-custody option can be particularly beneficial to smallholders, as it provides them with direct access to sell their credits to the market, and it distinguishes them so that downstream buyers can preferentially chose to buy independent smallholder credits.

BOX 13.1

Musim Mas and IFC Program, Indonesia

Through the largest palm oil independent smallholder program in Indonesia (which ran from 2015 to 2020), Musim Mas and the International Finance Corporation (IFC) engaged over 35,000 independent smallholders. Of these, 2,092 were certified under the RSPO (Roundtable on Sustainable Palm Oil) standards. Among those smallholders, 232 of them are female. This brings the total certified plantation area to 5,229.44 hectares. RSPO credits from these smallholders were sold to Nestlé, Unilever, and PepsiCo.

Round Table on Responsible Soy Association

The RTRS was officially established as a Swiss association in 2006 by WWF Switzerland, the Swiss retailers Coop and Migros, Amaggi, Solidaridad, Fetrauf-Sul, and Unilever. It was built on the Basel Criteria for Responsible Soy Production, which were developed in 2004 as a collaboration between WWF Switzerland and Coop, as well as the Responsible Soy Global Forum, also held in 2004.

RTRS is a nonprofit association, with an executive board (representing industry, trade and finance, and civil society) and a secretariat (based in Argentina and Switzerland). It currently has 188 members and is funded through membership fees and grants. An annual members conference is normally held alongside the general assembly.

The RTRS operates a standards system that includes environmental and social requirements for soy producers (with an optional genetically modified organism-free module) and a chain-of-custody system to ensure the integrity of trade and the claims made through the supply chain. Compliance is certified by independent third-party auditors. The standards are reviewed with public, multistakeholder participation at least every five years. Additionally, members of the association are bound by a code of conduct, which includes a commitment to a time-bound plan of working toward producing, purchasing, and promoting increasing quantities of RTRS soy and reporting annually on progress.

At the end of 2021, a total of 1,193,441 hectares had been RTRS certified, equivalent to 4,268,307 metric tons of certified soy, from 49,890 producers (of which all but 211 are smallholders in India). The RTRS Standard for Responsible Soy Production and accompanying certification was launched in 2011. With the exception of India, most of the RTRS certified soy is not produced by smallholders.

Although the RTRS does not have a specific standard for smallholders, the RTRS Standard for Responsible Soy Production does include smallholder guidance and additionally provides the option of group certification. Group certification is a type of auditing where a central group administrator is verified and the participating growers are sampled; it is therefore suitable for cooperatives and producer groups. In terms of support, the RTRS and NGO Solidaridad ran the Soy Producer Support Initiative (SOYPSI) from 2009 to 2012, with the aim of supporting small-scale farmers and farm workers and preparing them for certification in Argentina, Bolivia, Brazil, India, and

BOX 13.2

Soy Producer Support Initiative (SOYPSI) Program, India

As part of the SOYPSI program in India, approximately 30,000 soy farmers were involved from 13 different producer groups in 17 districts of Madhya Pradesh, with an average land holding of 2.2 hectares. The program successfully trained and prepared farmers for certification, resulting in increased productivity (up to 54 percent) and farm income.

Source: Solidaridad 2014.

Paraguay for certification (see box 13.2). In their "Beyond 2020" strategy, the RTRS identifies Asia (China, India, and Japan) as a growth driver for increasing certified soy, which because of the structure of the sector, will involve smallholders: soy (mainly smallholder-grown in China, 40 million soy smallholders) and India (8 million soy smallholders on up to 3 hectares).

Bonsucro (Sugarcane)

Bonsucro Limited was founded as a company in England and Wales in 2008. It was initially created under the name Better Sugarcane Initiative (BSI) in 2005 and, under this banner, began developing the first BSI standard. The initial multistakeholder group included industry representatives from the spirits industry, biofuels, cosmetics, sugar refiners and traders, UNICA (the Brazilian sugarcane industry association), as well as civil society organizations (Solidaridad and WWF).

As a limited company, it has a board of directors responsible for decision-making and a secretariat (based in London). It has a Members Council composed of up to 25 members, whose role is to represent the perspectives of the stakeholders to the board. It operates a network platform that currently has 284 members representing farmers, mills, industries, intermediaries, end users, and civil society. It has previously run an annual Bonsucro Week and technical weeks in various global locations.

Bonsucro operates a standard system that includes environmental and social requirements and performance-based indicators for sugarcane producers and a chain-of-custody system to ensure the integrity of trade and the claims made through the supply chain. Compliance is

certified by independent third-party auditors. The standard is reviewed with public, multistakeholder participation at least every five years. Additionally, members of the association are bound by the code of conduct, which includes a commitment to embed principles of continuous improvement and respect for human rights in sugarcane supply chains in their operations and business relationships and communicate their progress to stakeholders.

Over 1.2 million hectares of global sugarcane land is certified Bonsucro, which as of 2019, was equivalent to 5.8 percent of the global land planted in sugarcane. Furthermore, 67.7 million metric tons of certified sugarcane were produced in 2019–20, from a global production of 1.9 billion metric tons in the same period, or 3.6 percent. There are currently 10,814 Bonsucro-certified smallholders with 39,829 hectares of area, which is just over 3 percent of the global Bonsucro certified area.

Sugarcane is grown on both large- and small-scale farms. Brazil, the world's biggest sugarcane producer, has both. In other regions like India, Mexico, Pakistan, Thailand, and Sub-Saharan Africa, producers are mainly smallholder farmers. Bonsucro launched the Production Standard for Smallholder Farmers in 2018, which included the addition of requirements for organization of farmers, as well as "smallholder group calculator" for aggregating the performance-based indicators of the group. In terms of support, there is the Bonsucro Impact Fund (funded by the transaction fees on the credit platform), and one of its

BOX 13.3

Saraburi Sugar Company and Bonsucro Certification, Thailand

In Thailand, more than 300,000 smallholder farmers cultivate 100 million metric tons of sugarcane annually, providing 5.5 percent of the world's sugar supply. Thailand's Saraburi Sugar Company, a mill owned by sugar-producing giant Thai Ruang Roong (TRR) Group, was the first mill globally to help smallholders achieve Bonsucro certification to the new standard by promoting capacity building among small groups of farmers and encouraging more farmers to help accelerate the uptake of good practices.

Source: Bonsucro n.d.

first calls for grant proposals was for innovating sustainability in smallholder sugarcane farming (box 13.3).

Better Cotton

Better Cotton grew out of a roundtable discussion organized by WWF and IFC in 2004, including IKEA, clothing retailers, NGOs, the Interchurch Oganisation for Development Cooperation, and the International Federation of Agricultural Producers. After a preparatory phase, it was officially established in 2009 as a Swiss association.

Better Cotton is a nonprofit association, with a council (representing producers, suppliers and manufacturers, retailers and brands, and civil society) and a secretariat (with offices in offices in China, India, Pakistan, Switzerland, and the United Kingdom). It currently has 2,100 members and is funded through membership fees: users of the Better Cotton Platform pay a service fee, and brands and retailers pay fees according to how much Better Cotton they consume. An annual conference is normally held alongside the general assembly.

Better Cotton operates a standards system that includes environmental, social, quality, and management requirements for cotton farmers. Farms are assessed through a multilevel structure including regular self-assessments by producers, support visits by implementing partners, assessment by trained Better Cotton staff members, and a sample of assessments by approved third-party verifiers. For the supply chain, it operates the Better Cotton Platform, which is used by more than 10,000 ginners, traders, spinners, fabric mills, garment and end product manufacturers, sourcing agents, and retailers to electronically document volumes of cotton sourced as "Better Cotton" as they move through the supply chain. The Better Cotton Principles and Criteria is reviewed with public, multistakeholder participation at least every five years. Additionally, members of the association (producers, suppliers and manufacturers, retailers and brands, and civil society) are bound by a membership code of practice, which includes supporting the Better Cotton mission, meeting minimum environmental laws, and upholding worker and human rights in their own operations.

In the 2020–21 season, more than 2.2 million licensed farmers produced 4.7 million tonnes of Better Cotton (approximately 19 percent of global cotton production).

Smallholders make up over 95 percent of the farmers growing Better Cotton, and the Better Cotton Principles and Criteria have been

developed specifically for smallholders. As part of the standards system, a capacity-building program is delivered through local implementing partners (using a train-the-trainer approach) with training materials adapted to the farmers' environment and context. In the 2020–21 cotton season, Better Cotton worked with nearly 60 partners to deliver training to 2.9 million farmers in 26 countries (Better Cotton 2021). Furthermore, the way the assurance program is structured, field verification is cost neutral for small and medium-sized cotton farms. Additionally, the Better Cotton Growth and Innovation Fund, set up in 2016 and managed by the Dutch Sustainable Trade Initiative (IDH), identifies, supports, and invests in field-level programs and innovations. See box 13.4 for an example of Better Cotton's work.

Sustainable Rice Platform

The Sustainable Rice Platform e.V. (SRP) was originally convened in 2011 by the International Rice Research Institute (IRRI), the United Nations Environment Programme (UNEP), and German Agency for International Cooperation (GIZ) GmbH and subsequently hosted by UNEP. In early 2020, it was officially incorporated under German law as a nonprofit member-based international association.

The SRP has an executive board and a secretariat (based in Germany). It currently has 92 members and is funded through membership fees and in cooperation with international development organizations.

BOX 13.4

IKEA and Better Cotton

IKEA uses about 0.7 percent of all cotton produced globally and was one of the founding members of Better Cotton (BCI). More than 110,000 farmers have adopted more sustainable farming practices for IKEA projects, including over 45,000 farmers in India and Pakistan trained in Better Cotton techniques as part of a collaboration with the World Wildlife Fund (IKEA n.d.). An initial analysis identified that almost 60 percent of the IKEA cotton volume was sourced from a relatively small number of suppliers in the South Asia Trading Area, and therefore IKEA started its work there (Rai 2010). As of 2015, all cotton used by IKEA comes from "more sustainable sources" including from Better Cotton (as defined by BCI, including their equivalence in various geographies), cotton from farmers working toward the BCI standard, and e3 Sustainable Cotton from BASF.

Notably, it is part of a consortium delivering the Sustainable Rice Landscapes Initiative, a US$50 million project with funding from Global Environment Facility and other key donor organizations.

Historically, the SRP was focused on members delivering farmer training using the Sustainable Rice Standard as the framework. As of 2022, there are registered SRP Projects in the Americas, Africa, Asia, and Europe, reaching nearly 500,000 rice farmers.

In 2020, the SRP launched a standards system (called the "assurance scheme"), which includes the SRP Standard for Sustainable Rice Cultivation, covering good agricultural practices and climate-smart agriculture, as well as social and environmental requirements for rice farmers. This is accompanied by the SRP Performance Indicators for measurement of the impacts of adoption of sustainable practices at farm level, and a chain-of-custody system to ensure the integrity of trade and the claims made through the supply chain. These are scheduled for public, multistakeholder review in 2022. GLOBALG.A.P. (global good agricultural practices) is the assurance service provider for the scheme, and it manages implementation, including farmer registration, management and training of verification bodies and auditors, oversight of verification audits, shadow audits, and database management. Separately, data collectors collect registration data and self-assessment reports from producers and producer groups. Partners may choose from three levels of farm assurance: self-assessment, second-party verification, and third-party verification. On-pack labels are only permitted for third-party assessed products.

Smallholders are the focus of the SRP: approximately 90 percent of the world's rice is grown in Asia (GRiSP 2013), comprising 400 million people farming rice on 144 million smallholder farms, typically on less than 2 hectares. In 2020, there were already 21 projects using SRP tools to build capacity of farmers and farmer groups to shift to sustainable rice cultivation practices. In total, these projects aim to reach over 420,506 farmers during their implementation, toward SRP's goal to reach 1 million farmers adopting climate-smart, sustainable practices by 2023. One of SRP's stated purposes is proving technical assistance and capacity building to drive farm-level adoption of climate-smart best practices by rice smallholders. The SRP operates a training program, delivered through authorized training providers, to help scale up training efforts for local trainers, implementers, and farmers. In 2019–20, 78,407 farmers participated in capacity-building training. See box 13.5 for an example from Vietnam.

BOX 13.5

Loc Troi Group and IFC, Rice in Vietnam

Loc Troi Group (LTG), the leading provider of agricultural services and products in Vietnam, and the International Finance Corporation (IFC) partnered to roll out sustainable agricultural standards and practices throughout its rice-production value chain. IFC worked with about 4,000 farmers over a two-year period to help LTG conform to agricultural standards and practices developed by the Sustainable Rice Platform (SRP) to promote resource efficiency and sustainability, both on-farm and throughout the rice value chain.

Source: IFC 2016.

Global Roundtable for Sustainable Beef

The Global Roundtable for Sustainable Beef (GRSB) was formed in 2012 by representatives of the agriculture and livestock sector, industry, civil producers, and other organizations, building on the experience of the Brazilian Roundtable on Sustainable Livestock (GTPS), which began in 2007. In 2014, the GRSB was officially founded as a nonprofit public benefit corporation in the United States.

GRSB has a board of directors (representing producers, commerce and processing, retail, civil society organizations, and roundtables), an executive committee (composed of board members), and an administrative office (based in the United States). It currently has 87 members, of which 12 are regional beef roundtables, each with its own structure and membership. An annual Global Conference on Sustainable Beef is normally held alongside the general assembly.

The GRSB initially worked on the development of a standard, and in 2014 the GRSB Global Principles and Criteria for Defining Sustainable Beef was approved by the general assembly. At the time, GRSB agreed that the next steps would be the development of regional-specific indicators, but that no seal, certification, or comparable standard for sustainable beef would be developed centrally, so it technically doesn't meet the definition of a roundtable used in this publication. Regional roundtables have taken different approaches to implementation: GTPS operates a voluntary indicator reporting framework for producers; the Mesa Paraguaya de Carne Sostenible has the Self-Assessment System for Sustainable Livestock Production; the Canadian Roundtable on

Sustainable Beef operates a standards system with the Certified Sustainable Beef Framework, a chain-of-custody standard and third-party verification system; the Australian Beef Sustainability Framework monitors and reports on progress against indicators; the US Roundtable for Sustainable Beef assesses other industry programs against the US Beef Industry Sustainability Framework; and indicators are currently under development in Argentina. In 2019, the GRSB released its *2030 Strategic Plan Priorities*, including a shift to focus on three sustainability goals (animal health and welfare, climate, and nature positive), which build on the previous principles and criteria. Each of these goals has a working group. See table 13.1 for a roundup of beef roundtables.

TABLE 13.1 Key Crop and Livestock Roundtables

	Legal form	Multistakeholder membership categories	Members	Standard system	ISEAL status
RSPO	Nonprofit association, Switzerland	Oil palm growers, palm oil processors/traders, consumer goods manufacturers, retailers, banks and investors, environmental or nature conservation organizations, social or development organizations	5,294	Standard (principles and criteria) audited by third parties	ISEAL Code Compliant
Better Cotton	Nonprofit association, Switzerland	Civil society organizations, producer organizations, retailers and brands, suppliers, and manufacturers	2,482	Standard (principles and criteria) with self-assessment, second-party sampling within a farmer group, third-party random samples	ISEAL Code Compliant
RTRS	Nonprofit association, Switzerland	Civil society organizations, industries, trade and finance organizations, producers	188	Standard (principles and criteria) audited by third parties	ISEAL Community Member

table continued

TABLE 13.1 Key Crop and Livestock Roundtables *(Continued)*

	Legal form	Multistakeholder membership categories	Members	Standard system	ISEAL status
Bonsucro	Limited company in England and Wales	(Nonvoting) civil society organizations, end users, farmers, industrial organizations, mills, intermediaries, farmer associations, mill associations	284	Standard (principles and criteria) audited by third parties	ISEAL Code Compliant
SRP	Nonprofit association, Germany	No specific membership categories	92	Standard and performance indicators, choice of self-assessment, second-party assessment, or third-party verification	ISEAL Community Member
GRSB	Nonprofit public benefit corporation, United States	Producers and producer associations, allied services and industries, processing organizations, retail companies, civil society organizations, and national roundtables	87 global members, including 12 national roundtables	GRSB Beef Sustainability Goals; national roundtables take various approaches	Not a member

Source: World Bank.
Note: GRSB = Global Roundtable for Sustainable Beef; ISEAL = International Social and Environmental Accreditation and Labeling (Alliance); RSPO = Roundtable on Sustainable Palm Oil; RTRS = Round Table on Responsible Soy; SRP = Sustainable Rice Platform.

Smallholders have not been a focus for the GRSB, given that most of the regional roundtable members are countries whose farmers have large-scale cattle operations, and consequently the producer, processing, retail, and allied services and industry members are also associated with these regions. The exception is the Southern Africa Region Roundtable for Sustainable Beef (SARRSB); regionally over 80 percent of the cattle in sub-Saharan Africa are owned by communal or smallholder farmers. Solidaridad, the NGO that initiated the SARRSB, is working with smallholder cattle farmers in Tanzania

(Solidaridad 2020) and Zambia (Solidaridad 2020). The focus of the GRSB is in contrast to the global cattle production, where two of the largest cattle producers, China and India, have industries characterized by small cattle farmers.

Alternative Approaches to Assurance of Smallholder Sustainability

Evolution of Sustainability Standards in the Coffee Sector

An estimated 75 percent of coffee in Latin America is grown according to sustainable standards (Mistiaen 2012). Although the coffee sector has a number of sustainability standards systems, these have not followed the same development trajectory as the roundtables. Sustainable coffee standards systems are run independently, without multistakeholder membership structures. However the Global Coffee Platform (GCP) is emerging as the global precompetitive multistakeholder platform, with a number of independently run standards systems separately providing assurance for the coffee sector.

Historically, two of the largest coffee certification programs were run by the NGOs Rainforest Alliance (established 1987) and UTZ (established in 2002), which merged in 2018. As of 2021, the Rainforest Alliance was working with more than 400,000 certified coffee producers in Asia, East Africa, and Latin America (Rainforest Alliance 2021b). In 2018, more than 10 percent of the global coffee production was certified under the Rainforest Alliance programs (including UTZ) (Rainforest Alliance n.d.). Arabica makes up 94 percent of their global certified coffee sales (Rainforest Alliance 2021b), although arabica represents only about 60–70 percent of global production. According to the Coffee Barometer, about 55 percent of total global coffee production was certified in 2019, of which only 25 percent was purchased as certified by the industry (Panhuysen and Pierrot 2018, 2020).

The 4C Association was launched in 2006 as a multistakeholder membership organization with a standards system, based on an entry-level sustainability standard (the Common Code for the Coffee Community) and at one point was the world's largest coffee certification scheme. In 2016, the association split into the GCP, established as a Swiss association with 10 country platforms, and the 4C Certification system, which is run by a German company, 4C Services GmbH. Currently 4C has more

than 300,000 certified farmers in 20 countries. The GCP has developed a Coffee Sustainability Reference Code for benchmarking standards systems (and members report volumes): Rainforest Alliance, 4C, Coffee and Farmer Equity (C.A.F.E.) Practices, Nespresso AAA, and Olam's AtSource (among others) have been assessed as equivalent.

The Sustainable Coffee Challenge is a multistakeholder initiative conceived by Conservation International and Starbucks and launched during the 2015 Paris climate meetings with 18 founding partners. It is a multistakeholder initiative that has developed a collective framework to provide a vision for the sector and hosts a place for stakeholders to publicly state their commitments to sustainability and report on progress over time, although it does not operate a sustainability standards system.

Coffee companies have also launched private standards systems, including the Starbucks C.A.F.E. Practices sourcing from 400,000 farmers, of which 99 percent is "ethically" sourced (established in 2004 with the NGO Conservation International and the auditing company SCS Global Services), and the Nespresso AAA program including 120,000 farmers (initially developed with Rainforest Alliance in 2003). Another example is coffee trader Olam, which launched its AtSource platform in 2018 and which collects data based on sustainability indicators from farmers that can be accessed digitally throughout the supply chain.

There are a number of reasons why coffee standards systems did not follow the development of a sector roundtable the same way as other commodities have. Most of the roundtables developed in the early 2000s were supported by the WWF, which used an analysis of deforestation risk and agrochemical contamination as the key criteria for selecting which commodities to focus on. WWF did not consider coffee to be a major deforestation risk, and therefore coffee did not feature in the initiative. Furthermore, the Rainforest Alliance standards system had already been in place for a number of years at that point, and while it is not a roundtable per se, it did provide the market with an NGO-backed widely accepted label. Another factor is the structure of the coffee sector, which includes a highly consolidated retail industry: the world's top three coffee companies, Nestlé, Starbucks, and JAB, account for almost 50 percent of the retail market (2019 figures) (Rennie 2019), in contrast to the 25 million smallholder farmers (Acosta-Alba et al. 2020) who grow over 70 percent of global coffee production. Furthermore, beans undergo little transformation between harvest and purchase by the manufacturers and are used almost exclusively to produce drinks, compared to other commodities

such as palm oil, soy, and sugarcane, which are ingredients in a wide range of food and nonfood products. This means that there are comparatively fewer types of industry stakeholders, and bringing together a wide range of stakeholders has been a key factor for roundtables.

Evolution of Sustainability Standards in the Cocoa Sector

Cocoa is predominately a smallholder crop, with 5 million smallholder farms producing over 70 percent of the world's cocoa and providing revenue for 40 million to 50 million people. The sector is highly consolidated, with over 60 percent grown Côte d'Ivoire and Ghana; the top three trading and processing companies (Barry Callebaut, Cargill, and Olam) account for around 60 percent majority of the total global processing market (IMARC Group 2021). About 60 percent of the global chocolate market is controlled by 10 companies.

Over the past decade, the World Cocoa Foundation (WCF) has shaped the sustainability agenda in the sector, acting as a multistakeholder initiative. WCF is an industry association (legally, a nonstock corporation registered in the United States) with 100 member companies representing 80 percent of the global cocoa sector, established in 2000. Membership is limited to companies operating in the cocoa sector, and key decisions are made through the board of directors (composed of elected members) and with the advice from the membership assembly (WCF 1994). It is based in the United States, with offices in Côte d'Ivoire and Ghana.

Historically, chocolate companies have operated their own cocoa sourcing and farmer support programs. In 2014, WCF launched CocoaAction, an industrywide strategy aiming to coordinate and align the cocoa sustainability efforts of members to accelerate sustainability and improve the livelihoods of cocoa farmers. Each of the participating companies (ADM Cocoa, Barry Callebaut, Blommer, Cargill, ECOM Agrotrade Limited, Ferrero, The Hershey Company, Mars, Mondelēz International, Nestlé, and Olam) implemented this by aligning their existing programs to include at a minimum the interventions from the CocoaAction Productivity and Community Development Packages in their Côte d'Ivoire and Ghana supply chains, targeting 300,000 cocoa farmers. In addition to supporting coordination between companies' separate programs, WCF ran the Cocoa Livelihoods Program from 2009 to 2019, funded by the Bill & Melinda Gates Foundation (with a US$23 million grant) and including 16 WCF member companies focused on increasing productivity, improving marketing efficiency,

and strengthening farmers' business skills. Furthermore, the WCF's Cocoa and Forests Initiative (founded in 2017) is currently operational and seeks to end deforestation and restore forest areas. This initiative includes the governments of Côte d'Ivoire and Ghana and 35 cocoa and chocolate companies.

Another multistakeholder approach, the International Cocoa Initiative, was founded in 2002 and emerged from an international agreement aimed at ending the worst forms of child labor in the cocoa supply chain. It is a Swiss membership association, comprising civil society and industry members, and provides advice to standard setters and support for implementation.

Separately from the industry multistakeholder initiatives, the Rainforest Alliance operates a cocoa standards system (see the previous section for its history) in 20 countries, which include over 870,000 certified farmers on 2.7 million hectares (2020 data) (Rainforest Alliance 2021a). However, there have been challenges for cocoa certification, particularly as child labor has long been an endemic issue in the sector and, despite certification, continues to be found in practice. Regarding deforestation, in 2019, UTZ (part of Rainforest Alliance) was widely criticized when an investigation found 4,900 certified cocoa farmers inside the boundaries of nationally protected forests in Côte d'Ivoire. As a result, new cocoa certifications were paused in Côte d'Ivoire, as well as Cameroon, Ghana, and Nigeria, starting from 2019, while the Rainforest Alliance reviewed and developed a strategy to improve its cocoa certification program. Global chocolate companies including Nestlé, Ferrero, Mars, and Wrigley continue to source certified cocoa. However, some, such as Mondelēz, have in recent years chosen to focus on their own farmer support programs to communicate the sustainability of their products. Furthermore, because the supply of certified cocoa is limited, it is not possible for companies to source 100 percent certified cocoa. In 2019, after six years of development, the ISO 34101 Sustainable and Traceable Cocoa Standard was published, and in 2020 a draft African Regional Standard on Sustainable Cocoa (ARS 1000) (ARSO 2020) was put out for consultation. It was developed by regulators of Côte d'Ivoire and Ghana, who concluded that ISO 34101 does not fully address the concerns of cocoa-producing countries. The European Cocoa Association has called for "one solid, credible and recognized standard easily implementable and used as a benchmark for other cocoa sustainability programmes" (SCI 2021). These standards are likely to become important tools for meeting supply chain and modern slavery due

diligence regulations, although differences between European and West African needs and perspectives mean a single globally accepted standard is unlikely in the near future.

However, because child labor, poverty, and deforestation are endemic to the sector, coordinated private-sector support programs and engagement with governments are still needed, as is seen by the following case study on Barry Callebaut (box 13.6). While cocoa certification can be an effective framework for identifying gaps and communicating compliance, it is neither sufficient nor designed to address the root causes.

BOX 13.6

Case Study: IFC and Barry Callebaut Establish Partnership for Sustainable Financing Facility

In 2021, the International Finance Corporation (IFC) announced a partnership with world-leading chocolate and cocoa manufacturer Barry Callebaut to provide the company's suppliers with rewards for improving the social and environmental sustainability of their business practices. The initiative was launched among sugar suppliers in Mexico and would later expand to other countries and cover suppliers of a wider range of ingredients (for example, soy lecithin and dairy) used in Barry Callebaut products.

Barry Callebaut's suppliers in Mexico would be eligible for discounted rates on short-term working capital financing for meeting the company's sustainability standards related to labor, health, safety, and environmental performance. The higher the supplier's performance levels, the more it would save.

IFC and Barry Callebaut launched this initiative in partnership with Demica, a financial technology company that provides working capital solutions, including a broad range of payables and receivables finance products. An IFC-investee company, Demica's unique platform architecture automates the processing and reporting involved in payables and receivables financing transactions and allows participants to interact using real-time information.

The partnership is part of IFC's Global Trade Supplier Finance (GTSF) program, a US$500 million multicurrency investment and advisory program established in 2010. GTSF provides short-term financing to small- and medium-sized suppliers in emerging markets selling to large domestic buyers or exporting to international buyers, by discounting invoices once they are approved by the buyer. The financing rates can be linked to sustainability measures to minimize impacts on the environment and to promote climate-resilient agriculture practices.

Source: IFC 2021.

Fair Trade and Organic—Are They Roundtables?

Fair Trade

The fair trade movement comprises a number of different voluntary organizations, and its origins date back more than 60 years. Initially, fair trade products were sold through fair trade shops only, with the first fair trade label "Max Havelaar" introduced in 1988. The Max Havelaar name still exists today as national fair trade associations in France, the Netherlands, and Switzerland, providing multistakeholder dialogue and advice supporting the adoption of the standards system operated by the Fairtrade Labelling Organizations International (FLO).

FLO was established in 1992 and is a nonprofit member-based international association registered in Germany. Membership includes three continental producer networks (Africa, Asia, and Latin America), and 25 national fair trade organizations. Producers are represented with 50 percent of the voting weight in the highest decision-making body (general assembly) and can therefore shape the strategy. FLO is responsible for the strategic orientation of fair trade and for the development of standards. It has product-specific standards for small-scale producer organizations, including, for example, sugarcane, cocoa, coffee, oilseeds and oleaginous fruit, and fiber crops (including cotton). The standards focus on fair trade minimum prices and premiums but also include a limited number of social and environmental requirements. Compliance with the FLO standards is audited by independent third parties.

The second international association, the World Fair Trade Organization (WFTO), formerly called the International Federation of Alternative Trade (IFAT) and established in 1989, has more than 400 members in 76 countries that are social enterprises practicing fair trade. It is an association registered in the Netherlands and operates a standards system called the WFTO Guarantee System (GS), which is designed to assess the entirety of a business, not just a specific product, ingredient, or supply chain (WFTO 2020). The GS includes five major components: new membership admission procedure, self-assessment report, monitoring audit, peer visit, and the Fair Trade Accountability Watch (FTAW). The FTAW is a participative monitoring mechanism that allows the public to report compliance issues regarding fair trade organizations (WFTO n.d.). Enterprises with "Guaranteed Fair Trade Enterprise" status may use the WFTO label on their products.

While both FLO and WFTO operate standards systems, they do not have full multistakeholder membership structures (both limit

membership to firms, national associations, and producers), and the scope of their standards does not actively seek to address the full range of environmental and social impact of a specific industry. For this reason, fair trade labels are often used alongside other certification labels, especially for bananas, coffee, and cocoa-based products. Fair for Life (by IMO/Ecocert) and Fair Choice (by Control Union) are other fair trade certifications available to producers and other operators.

Organic

Organic certification is a widespread and geographically diverse set of standards systems, many of which are regulated by governments. The International Federation of Organic Agriculture Movements (IFOAM, or Organics International) is the worldwide umbrella organization, which represents close to 800 members ("affiliates") in 117 countries. IFOAM is a multistakeholder initiative and has developed a set of standard requirements that functions as an international reference to benchmark organic standards and regulations, but it does not operate a standards system. In Europe, the EU-organic production-regulation (EU-Eco) (approved in 1991 and updated in 2018) sets rules about the production of organic agricultural products and how to label them, and approved national certification bodies verify producers' compliance. Each EU country appoints "control bodies or authorities" to inspect operators in the organics food chain. Many private labels are still used widely in Europe, as they significantly exceed the requirements of the EU regulations (for example, Soil Association, Dameter, and BioSuisse). In the United States, the standards system was established as a result of the Organic Foods Production Act of 1990, and the United States Department of Agriculture (USDA) organic label is administered through the National Organic Program. In China, organic certification is administered by a government agency called the Certification and Accreditation Administration.

At their core, organic standards limit the use of synthetic substances in agriculture. The EU regulations have expanded on this to include environmental and climate action practices, biodiversity, the preservation of natural resources, and animal welfare standards (EU 2018). Private standards continue to exceed these requirements, for example, to include working conditions, though in general their scope is still limited compared to sector-specific standards developed by roundtables (see box 13.7). Organic certification is sometimes used alongside other product certification labels, particularly fair trade.

BOX 13.7

Committee on Sustainability Assessment

The Committee on Sustainability Assessment (COSA) is a nonprofit organization that has developed a set of sustainability indicators to evaluate and monitor sustainability. The indicators were developed by a wide range of experts. COSA is not a roundtable, but the metrics are designed to be used with foods, coffee, cocoa, cotton, and other crops and can therefore be combined to support implementation of roundtable standards systems. For example, in addition to being applied at the firm level, the Global Coffee Platform worked with COSA to develop a common set of science-based performance metrics, with input from industry experts and executives.

Source: COSA n.d.

Opportunities for Firms in Roundtables

A firm can implement the roundtable's sustainability standard in its own operations and also become involved in a roundtable through membership, active participation in working groups, sitting on the board, active participation in standard setting, and influencing standards content.

The sustainability standards systems developed by the roundtables can be important tools for firms to meet sustainability requirements of buyers and financiers, as well as regulatory requirements in some markets. By using a commonly accepted standard and certification system, firms can benefit through fungibility between buyer demand; they may also benefit from data efficiency. This is particularly true for systems that have IT systems for sharing data at each step in the chain.

To implement a sustainability standard, a firm will need to analyze the current state of its operations (including the supply chain) with respect to the requirements, develop an action plan, set targets for adoption, and actively implement the requirements. In the case of smallholders that supply the firm, this may also involve setting up a smallholder support program.

Involvement in a roundtable may also involve collaborating with other members on joint projects, and firms may choose to cofund joint activities such as working groups to advance progress on the sustainability issues that are most important to their business.

While smallholders are not the primary focus of the palm oil, soy, and sugarcane roundtables, each of these provide smallholder-specific tools and support to varying degrees; firms will also benefit from interaction with peers facing similar challenges with smallholders. The rice and cotton roundtables have been designed with smallholders specifically in mind, and firms will find plenty of resources and support in these. The beef "roundtable" remains a marginal space in terms of focus on smallholders, but firms working with smallholder cattle farmers may still benefit from the platform it provides to connect and engage with peers and sector stakeholders.

When determining whether to engage in a roundtable and implement its standards system, firms should consider the following:

- *Scope of standard:* Does it address the key sustainability issues in their sector?
- *Market demands:* Are their buyers or financiers asking for compliance and/or evidence that key sustainability issues have been addressed in the firm's operations? Are there national or regional regulations that the standard can be used to meet? Does it deliver the level of assurance the buyers, financiers, or regulators are asking for?
- *Firm's policy, values, and commitments:* Does the standards system align with what the firm has said it plans to do? Can it provide a useful framework for analyzing the firm's operations?
- *The extent to which the firm could benefit from active engagement:* Who are the stakeholders and what structures and processes are there in place to connect with them? What opportunities are there to shape the strategy and direction of the roundtable?
- *The credibility of the roundtable:* Is there reputational value or risk to members associated with the roundtable? Firms can look at the following, for example:
    - Balance of membership (stakeholder categories)
    - Number of members
    - Governance and transparency

A key resource to help firms better understand what roundtables and standards systems offer is the International Trade Center's (ITC's) online web tool and database Standards Map, which provides free,

comprehensive, verified, and transparent information on over 300 standards for environmental protection, worker and labor rights, economic development, quality and food safety, as well as business ethics. In terms of the standards systems, ISEAL provides information on which systems meet their codes of good practice for standard systems ("code compliant") and which are still in progress toward compliance ("community members"). Finally, all roundtables have their own websites, and those that are membership organizations typically publish annual reports and statistics that can help firms better understand what role they could play.[2]

Checklist for Firms

- Identify whether there is a roundtable and/or sustainability standards system for the agricultural and horticultural crops or livestock relevant to the firm's operations and supply chains. ITC's Standards Map is a good starting point. ☐
- Analyze the sustainability requirements of existing and potential buyers. ☐
- Analyze the sustainability requirements of existing and potential financiers. ☐
- Make a short list of potentially relevant roundtables and sustainability standards systems. ☐
- Review the list with compliance with the ISEAL codes of good practice. ☐
- Review the list in terms of balance of membership (stakeholder categories), number of members, and governance and transparency. ITC's Standards Map and the websites of each roundtable are valuable resources. ☐
- Read the statutes of the roundtable, the sustainability standard, and the assurance system documents. ☐
- Understand the current context of the roundtables under consideration—this may include internet research, discussions with peers, and direct discussion with the roundtable secretariat. ☐
- Determine which roundtables are relevant and credible for the firm's operations. ☐
- Create an action plan for implementation, taking into consideration how smallholders in the firm's supply chain can be supported to meet the requirements of the sustainability standard. ☐
- Create an initial direct cost estimate, including cost of membership, estimate cost per audit (multiplied by the number of potential audits), and cost of buying credits where applicable (in lieu of purchasing. ☐

- Create an initial indirect cost estimate, including the costs of setting up systems, training, and other financial or labor implications of implementing good social and environmental practices. ☐
- Engage in the collaboration and opportunities for exchange that the roundtables provide. ☐

Notes

1. Full information may be found on the "Performance Standards" page of the IFC website.
2. More about the International Trade Center (ITC) Standards Map database and toolkit can be found at its website, https://www.standardsmap.org/en/home. The International Social and Environmental Accreditation and Labeling (ISEAL) Alliance provides an enormous amount of resources on its website, www.isealalliance.org/.

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CHAPTER 14
FUTURE OUTLOOK

Ashley Elliot

Introduction

A series of linked shifts—from urbanization and changing patterns of consumption to technology disruption, land scarcity, and supply chain volatility—is triggering changes in the smallholder farming landscape, and agribusiness management teams need to monitor them. One trend, above all others, connects and propels many of these intersecting structural changes: climate change. Over the next decade, food production will be impacted by the changing climate; agriculture—the world's largest industry—must evolve to address, rather than contribute to, the challenge of climate risks.

For smallholders, conditions are set to evolve at a pace that will prove extremely hard to manage, as temperatures rise, weather changes, rainfall and seasonality become less predictable, and extreme weather events occur with higher frequency. By mid-century in Sub-Saharan Africa, for example, "The areas currently providing 70 percent of the value of crop production will be victim to severe or extreme aridity and heat stress" (Chikava 2021). Smallholder farmers are particularly vulnerable to these impacts, "due to their small farm sizes, limited access to capital and technical support and low adaptive capacity" (Catacutan et al. 2022).

Against this backdrop, we conclude this handbook with a forward-looking perspective on selected trends and innovations that are set to shape emerging market, smallholder supply chains over the coming decade. This selection (table 14.1) is not exhaustive. Instead, our aim

TABLE 14.1 Emerging Trends Shaping Opportunities and Threats in Smallholder Supply Chains

1	Smallholder participation in carbon projects increases as carbon markets approach takeoff.
2	Regenerative and low-input agriculture move toward the mainstream.
3	Global shocks highlight the need for flexibility and redundancy in agrifood supply chains.
4	Urbanization and value chain integration trigger expansion in city-based, peri-urban farming.
5	Increasing overall adoption of agricultural technology masks divergence between emerging markets.
6	Traceability emerges as a key requirement of firm-level competitiveness in agriculture.
7	Evolving preferences and technologies drive evolution in both traditional and alternative protein markets.

Source: World Bank.

is to highlight trends that are most likely to have direct and increasing relevance for operational managers responsible for integrating smallholder farmers into value chains—as suppliers, clients, or customers—during an era in which the climate crisis takes center stage. For agribusinesses around the world and across value chains, the overriding priority will be to scale sustainable and resilient farming practices by developing new sourcing models, enabling policies and funding mechanisms that spread the costs of the transition, and position sustainable agriculture as the best business decision for farmers.[1]

Key Trend 1: Smallholder Participation in Carbon Projects Increases as Carbon Markets Approach Takeoff

The 2021 26th United Nations Climate Change Conference of the Parties in Glasgow (COP26) agreement's most concrete outcome—finalization of the so-called Article 6 rules for a new global carbon market after a six-year negotiation process—paves the way for carbon itself to become the basis for a global commodity market (*Financial Times* 2021a). While the new global carbon-trading system envisaged under the COP26 agreement has drawbacks—millions of lower-quality credits created under the Kyoto Protocol have been allowed into the new system, for example—it is nevertheless clear that the Article 6 rules represent a turning point for carbon markets, allowing replacement of the fragmented and opaque emissions trading systems that predated it with a viable global marketplace. In particular, Article 6 enhances the potential for a clearly defined, United Nations (UN)–regulated architecture to emerge for sovereign-to-sovereign (bilateral) and sovereign-to-corporate carbon credit trading, even if the voluntary (corporate-to-corporate)

carbon market is likely to remain the most active space for trading of environmental assets in the near term.

Putting the Article 6 rules into practice at scale will require a formidable stakeholder coordination effort, including public and private investments in new market systems—from standardized carbon credit auditing and validation practices to carbon-rating agencies able to value carbon credits using broadly accepted methodologies. This process is likely to move forward gradually over the coming half-decade. Nevertheless, securing agreement over the basic rules for a global carbon-trading market represents a major milestone, setting the stage for the emergence of a more centralized, trusted international system for private entities and governments to trade credits that represent a metric ton of carbon reduced or removed from Earth's atmosphere. Over time, this may prompt a massive uptick in trading of emissions credits, with both direct and indirect implications for agricultural markets (*Financial Times* 2021a).

Viability of Investments in Greenhouse Gas–Efficient Small-Scale Farming and Farmer-Led Carbon Projects

Initially, the upswing in carbon credit demand and pricing prompted by the emergence of a viable global carbon market is likely to benefit large-scale farms with low crop diversity as well as specialist developers of carbon projects. It will be more challenging in the short term to accurately record and monetize carbon sequestered by smallholders, due to measurement, reporting, and verification costs, as well as the complexities involved when multiple crops are produced on the same land parcel. Security of land tenure presents a further challenge to the "bankability" of smallholder-led carbon projects, as it is difficult under many current land title systems to prove long-term ownership of small land parcels in rural areas. Such proof is essential because many greenhouse gas (GHG) removal and sequestration projects—whether governed by global UN rules or voluntary schemes such as the Verified Carbon Standard—involve a permanence requirement, whereby emissions reductions credited under the project must be not only real and additional but also demonstrably permanent.[2]

Nevertheless, such challenges are surmountable. As newly centralized global carbon markets gather momentum, parallel efforts will be required to develop effective guidance for implementation—both of Article 6 rules and of voluntary carbon market transactions—that addresses the current barriers to bankability of investments into

GHG-efficient small-scale farming practices and farmer-led carbon projects. Only a tiny fraction of farmers currently benefits from carbon markets directly through participation in certified projects, despite strong demand. The scope for future involvement is vast, but this opportunity cannot be unlocked until the technical barriers are resolved:

> By adopting sustainable practices, farmers [can] receive a carbon credit for each ton of emissions reduced, avoided or sequestered. The credits can then be sold to companies on carbon markets looking to buy credits. However, several barriers to entry exist. For example, monitoring soil's carbon baselines and verifying the net change of carbon in soil over time is expensive and time-intensive, especially for remote smallholder farmers. . . . In addition, developing a carbon project requires enrolling in carbon registries (entities that distribute carbon credits), mobilizing farmers to join, collecting data about baseline carbon levels, verifying emissions reductions, selling carbon credits, and so on—all of which are expensive and time-intensive pursuits. (Bora and Prabhala 2020)

To address these bottlenecks, governments, multilaterals, nonprofits, research institutions, and companies all have important roles to play in developing the following:

1. User-friendly and open-source models to accurately estimate project baselines and the anticipated quantity of carbon sequestration using affordable techniques for assessing soil characteristics and farming practices
2. Enabling mechanisms for farmers to leverage land title and/or property rights to access carbon markets (a critical requirement given the multidecade permanence requirement associated with carbon projects)[3]

Multistakeholder advocacy will be required to tailor relatively generic first-generation global carbon market standards to reflect the realities of smallholder farming in emerging markets and low- and middle-income countries (LMICs). In this context, there is an opportunity for global agribusinesses to identify and pilot innovative models that channel funding from carbon offsets into smallholder-led projects, especially in the voluntary carbon market. Global agribusinesses often combine a cross-border footprint and advocacy capability (useful in gaining access to global carbon markets) with well-established smallholder supplier relationships (useful for taking a bottom-up approach to scoping and designing locally relevant carbon project opportunities

in emerging markets)—an integrated proposition that is uniquely placed to capitalize on the opportunity to develop farmer-led carbon projects in emerging markets.

Emergence of Nature-Based Solutions Creates Opportunities in Smallholder Supply Chains

A further trend related to the opportunity for smallholder participation in carbon projects is the emergence of nature-based solutions (NBS), an approach to protecting, restoring, and managing the world's most climate-critical ecosystems in a sustainable and market-oriented way. Several of these ecosystems are situated in emerging markets or LMICs adjacent to smallholder-dominated farming regions where agricultural sourcing operations are also concentrated. Parts of the Sub-Saharan region stand out, not least because Africa is "home to the world's greatest restoration opportunity," with 700 million hectares of degraded land to be restored and with 70 percent of all land under local community ownership (AFR100 2021). The continent also hosts some of the world's most consequential and highest-risk carbon sinks. For instance, the largest tropical peatlands were identified in the Congo Basin as recently as 2017, containing an estimated 30 billion metric tons of below-ground carbon, equivalent to three times the volume of annual global fossil fuel emissions (Wharton, Cusack, and Tilleard 2021).

Although this section provides only a brief summary of NBS, macrotrends, especially accelerating investment into emerging market carbon sequestration projects, present a historic opportunity (1) for farmers to play key stewardship roles in critical ecosystems in return for an additional revenue stream and (2) to roll out nature-positive approaches to food production more broadly. As the Consultative Group on International Agricultural Research (CGIAR 2021) notes, this includes "providing technologies that help farmers grow more food with less water and revitalizing degraded landscapes through holistic strategies that support both food production and ecosystem services."

How Nature-Based Solutions Work

NBS build natural capital assets by enhancing the capacity of ecosystems to sequester atmospheric carbon, regulate flooding, manage water resources, improve pollination and planting, conserve biodiversity, and support sustainable human livelihoods (table 14.2). For local stakeholders involved in maintaining mature forests and other natural carbon

TABLE 14.2 Examples of Nature-Based Solutions

Sustainable landscapes	Protecting, restoring, and improving management of ecosystems including forests, mangroves, wetlands, and oceans in return for carbon credit sales
Nature-based enterprises	Products and services with business models that support natural ecosystems, such as forest-based products, ecotourism, or clean cookstoves
Green infrastructure	Ecosystem-based rainwater collection and watershed management, natural flood and storm surge protection, and green roofs or walls in cities
Food systems	Climate-resilient agriculture, regenerative agriculture, agroforestry, silvopasture, and sustainable aquaculture
Enabling technologies and services	Remote Earth observation for measuring and monitoring natural carbon stocks, solar drip irrigation systems, and so on

Source: Wharton, Cusack, and Tilleard 2021.
Note: Silvopasture = the deliberate integration of trees and grazing livestock operations on the same land.

sinks, NBS offer a structure to capitalize on a new revenue opportunity—carbon credits—by leveraging new technologies to monitor ecosystem services and by deploying results-based or "payment for ecosystem services" financing structures.[4]

The structured approach offered by NBS—while still in need of greater standardization and harmonization—will increasingly attract private capital into an arena long dominated by the public and charitable sectors. To date, over 85 percent of NBS have been funded by governments or nongovernmental organizations (NGOs). Importantly, NBS address climate threats through emissions reductions, carbon dioxide (CO_2) removal, and climate adaptation (for example, prevention of soil erosion and water scarcity)—a threefold win that few other climate investments can match (Wharton, Cusack, and Tilleard 2021).

NBS also address the global biodiversity crisis by preventing the habitat loss associated with inappropriate land-use change, thereby safeguarding the diversity of land and sea life within critical ecosystems. Against the backdrop of a 70 percent decrease in global mammal, bird, amphibian, reptile, and fish populations over the last half century, the economic value of this type of biodiversity preservation effort is increasingly clear: The World Economic Forum (WEF) estimates, for example, that US$44 trillion in gross domestic product (GDP), or half of all global output, is moderately or heavily dependent upon nature (Wharton, Cusack, and Tilleard 2021). In light of this tremendous opportunity, the International Finance Corporation (IFC) (2022) launched the *Biodiversity Finance Reference Guide* at the 2022 27th UN Climate Change Conference of the Parties (COP27) in Sharm El-Sheik, Egypt.

As commonly agreed standards for NBS project structuring, verification, and monitoring are refined and formalized over the coming decade, NBS are set to become a more investable asset class. For example, in a recent illustration of the higher volumes of capital starting to flow into this arena, the Lowering Emissions by Accelerating Forest Finance (LEAF) Coalition announced at COP27 in November 2022 an increase in the amount of finance for purchasing of high-integrity emissions reductions credits from tropical countries to over US$1.5 billion, representing a doubling on the previous figure at the time of COP26 (Slavin 2022).

In this context, agribusinesses invested in well-structured smallholder supply chains are ideally placed to demonstrate and support bold NBS. As global financial markets begin to shift from financing models based on "take-and-deplete" toward models that account for risks to natural capital, private investment will play a growing role in meeting an estimated more than US$700 billion annual funding gap for nature. In this context, global investors are likely to place a premium on securing implementation partners who are able to combine strong local market understanding with established sourcing operations in the smallholder landscapes at the center of the world's twin climate and biodiversity crises.[5]

Key Trend 2: Regenerative and Low-Input Agriculture Move Toward the Mainstream

Regenerative agriculture is the application of diverse technologies and context-specific farming practices to an agricultural production system with the goal of improving yield and income resiliency while cutting emissions, reducing reliance on chemical inputs, making more efficient use of rainfall, improving soil health and biodiversity, and enabling soil-based carbon capture or sequestration. At its heart, regenerative agriculture is a way of producing food that leaves the soil richer and eliminates reliance on costly synthetic inputs. By reducing dependencies created during the transition to intensive commercial farming techniques, regenerative farming is less a new innovation and more a return to self-sustaining practices similar to those used for centuries.

However, despite the positive potential, most regenerative farming business models remain nascent. This is primarily because concerns exist—whether real or perceived—about high up-front costs and slow returns on investment, which imposes limits on adoption and replicability. Examples do exist of sizable investments into regenerative practices,

although these are mostly in developed markets. To take just one example, rePlant Capital's US$20 million investment in 2020 along with Danone North America has supported dairy farms to convert to soil-regenerative and organic-farming practices in the United States (Danone 2020). But many industry observers question whether highly specialized, large-scale commercial farming in advanced economies can ever be truly regenerative, given that (1) the concept of regenerative farming is premised on lower-intensity approaches that seek holistic integration of animal and crop agriculture and (2) regenerative techniques typically require smaller acreage settings due to the need for hands-on farm management and deeper integration of farm inputs and outputs with the local economy.

For agribusinesses working with smallholders across emerging markets and LMICs, regenerative agriculture holds vast potential, but the state of existing approaches is perhaps reminiscent of where the renewable energy industry found itself two decades ago. Just as solar and wind energy have evolved over a 20-year period from one-size-fits-all applications to a far cheaper, more customizable, and modular product mix, so a wave of entrepreneurship and innovation is required to develop a menu of context-appropriate and commercially attractive regenerative farming models (see box 14.1) from which farmers—especially smallholder farmers—can choose (Danone 2020). At present, although the long-term benefits are widely recognized, the speed of adoption of regenerative agriculture by farmers is "too slow to make a significant difference to climate change and biodiversity loss in the near future.

BOX 14.1

Soil Health and Carbon Sequestration: The Essence of Regenerative Farming

Regenerative farming is highly contextualized; interventions must be driven by location-specific needs around soil health, the scope and intensity of current agricultural systems, and the structure of existing on-farm and off-farm livelihoods (Meulensteen and Duurland 2020). Rather than assessing single crop needs or specific farming practices, the farm system as a whole must be assessed against three linked metrics: agronomic efficiency, plant functional diversity, and soil health sustainability. A key focus should be on the role on-farm animals can play in boosting soil health: for example, through rotational grazing systems in which limited areas are grazed for a short time, churning the soil to increase absorption and spreading nutrients via manure and urine.

box continued

BOX 14.1

Soil Health and Carbon Sequestration: The Essence of Regenerative Farming *(Continued)*

Shifting to a more regenerative model is likely to involve a combination of more sustainable and efficient input application, optimized planting, crop diversification, complementary plant traits, and—especially—proactive soil organic matter management (for example, organic composting that uses waste and by-products from one area of farm operations for the benefit of another). Beyond the importance of soil health to long-run yield potential, soils also provide ecosystem services such as improved water uptake and the creation of valuable microclimates, reducing reliance on chemical and/or external inputs and irrigation infrastructures (Meulensteen and Duurland 2020).

The level of urgency around soil health is rising. Practices leading to land degradation and erosion have removed almost one-third of all arable land globally from production over the past four decades, with further losses equating to US$4.6 trillion forecast over the next 15 years unless remedial action is taken (Africa Regenerative Agriculture Study Group 2021). In Africa alone, 650 million people are affected by severe land degradation. On a continent dominated by small-scale farmers with often limited ability to finance the costs of farm system changes whose benefits are neither immediate nor guaranteed, investment in new, regenerative agriculture practices will need—to the extent possible—to revolve around quick wins that deliver rapid results (for example, within one cropping season) *and* rely primarily on knowledge, time, and labor rather than capital.

Key areas of focus include crop diversification and rotation (emphasizing adoption of nitrogen-fixing legumes where feasible), tree planting, reduced tillage, mulching, and water conservation techniques to improve yields via increased soil nutrient and organic content, reduced soil erosion, and improved water retention (Africa Regenerative Agriculture Study Group 2021). Large, integrated agribusiness with structured smallholder sourcing operations can play a catalytic role in this context: for example, Olam International, an agriconglomerate with a footprint in 60 countries, has witnessed an 80 percent increase in cotton lint yields through regenerative techniques such as mulching and crop rotations.

Early pilots and demonstrations are showing promise. One assessment of regenerative agriculture programs reaching over 100,000 farmers in Africa identified potential productivity increases from 68 percent to 300 percent (Africa Regenerative Agriculture Study Group 2021). Regenerative agriculture in Africa also has the potential to boost food security and support close to 5 million jobs by 2040 as farmers benefit from higher and more diversified revenue streams. Finally, it is possible to sequester large amounts of carbon dioxide at relatively low cost: an estimated 4.4 gigatons of carbon dioxide equivalent increase in specific surface area soil-based stock alone is feasible, with another 106 metric tons of carbon dioxide equivalent per year sequestered by restoring degraded land with agroforestry systems.

Regenerative agriculture is currently practiced on approximately 15 percent of cropland and is being adopted at a rate of 0.6 percent hectares per year" (Kassam, Friedrich, and Derpsch 2019).

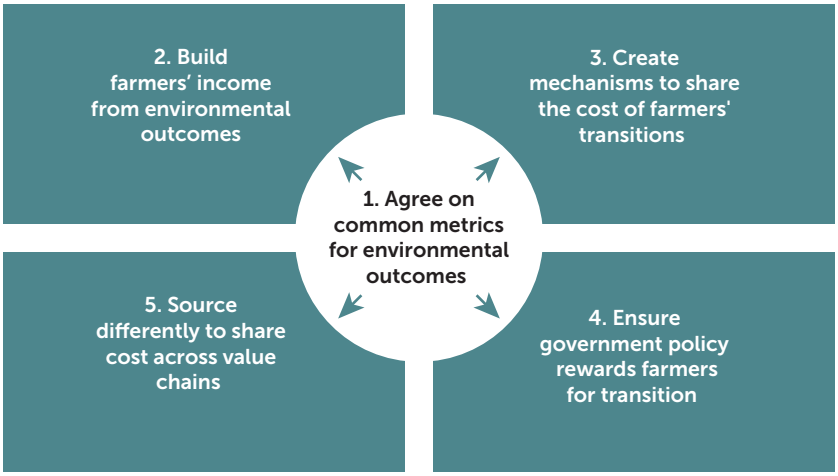
Technology has a role to play here—from tracking carbon to measuring nutrients. Financing, however, is the critical bottleneck to overcome. Flexible financing mechanisms—combining technical assistance, guarantee mechanisms, and grant-based facilities, for example—will be required to underpin regenerative agriculture models that are suitable for small-scale farmers. Smallholders may lack creditworthiness with commercial banks, and for those with low savings operating on thin margins, where short-term risks related to adoption of a change may outweigh potential gain, it is essential that interventions designed to nudge farm operations toward a regenerative model mitigate two risk factors: (1) there may be a multiyear time lag before investments into regenerative practices are recouped, especially for cash crops (for example, wheat, maize, and oil seeds); and (2) transitioning from traditional to regenerative models may involve a multiseason period of reduced productivity before gains are obtained, which has important—if temporary—implications for household and economywide food security. In both cases, innovative mechanisms are needed to smooth the yield-based and financial returns smallholders can expect from investments into regenerative practices.

Above all, a multistakeholder approach is required to drive accelerated uptake of regenerative farming practices, as individual organizations will struggle to recast incentive structures and close knowledge gaps alone. Rather, food producing companies, farmers, governments, financial institutions, and NGOs need to align on specific metrics and actions that drive (and reward) adoption of regenerative farming techniques. One recent study cosigned by several multinational food and agriculture companies identified five key areas for collective action to make the economics of regenerative practices attractive for farmers, summarized in figure 14.1.

The Sustainable Markets Initiative (SMI 2022) *Scaling Regenerative Farming: An Action Plan* identified the following supporting behaviors as essential:

- Shift mindsets from focusing on what the farmer needs to do to what [companies and governments] can do to make it easier and more attractive to adopt regenerative farming.
- Accept ambiguity and make decisions based on the balance of evidence.

FIGURE 14.1 How to Make Regenerative Farming Pay for the Farmer



Source: SMI 2022.

- Get better at collaboration within and across sectors and value chains to maximize benefits and cost-sharing opportunities.
- Assign commercial and procurement experts from global food and agriculture companies to develop new models, not only sustainability teams.
- Design interventions with a high level of local specificity and cultural awareness.[6]

Key Trend 3: Global Shocks Highlight the Need for Flexibility and Redundancy in Agrifood Supply Chains

Since the 1990s, global supply chain managers across all industries have tended to prioritize efficiency over flexibility—often imposing just-in-time cross-border sourcing strategies to reduce stock volumes and consolidate component and product flows to lower unit costs (Schuster et al. 2021). More recently, in the face of a complex range of global challenges and socioeconomic trends, such as the Russian Federation's invasion of Ukraine and the COVID-19 pandemic, the balance has begun shifting in favor of greater supply chain resilience and redundancy (defined as the creation of sufficient alternative sources and routes to ensure product flow despite bottlenecks in one or more segments of a company's

main supply chain). Redundancy may entail marginally higher costs under normal conditions, but it can prove a worthwhile investment when external shocks occur, and lengthy disruptions to the supply chain may be avoided.

This is especially true of the "inherently risky business" of agriculture (*Financial Times* 2014). Complex agrifood supply chains may face sector-specific vulnerabilities regarding the limited shelf-life of food products, complex regulatory environments governing food safety, outsized roles for public and nongovernmental institutions in agricultural supply chain infrastructure, and the inherent seasonality and quality inconsistency of organic produce (Stone and Rahimifard 2018). Although the monetary effects of some production-level risks can be mitigated through crop insurance, hedging strategies, or futures exchanges that guarantee forward prices, there are no ready-made risk mitigation options for the manifold inflationary cost pressures and supply continuity risks that can affect cross-border agrifood supply chains in the event of global shocks. Instead, there is growing recognition that integrated agribusinesses must address increasingly frequent external shocks through preemptive and ongoing investment into shorter, more diverse, and higher-agility supply chain arrangements.

Which key factors have triggered this enhanced focus on redundancy and resilience? Both the COVID-19 pandemic and the effects of Russia's invasion of Ukraine in the first quarter of 2022 placed substantial stress on global trade and underscored the need for greater supply chain decentralization, localization, and capacity. These shocks generated volatility in the availability and pricing of raw materials, as well as disruptions and delays of the physical movement of goods: for instance, via ad hoc import and export bans, movement controls, and demand-side uncertainty related to COVID-19 lockdown policies and economic sanctions, stockouts, and the spate of crop protectionism in global markets that resulted from Russia's invasion of Ukraine.[7]

These very different crises illustrated how a shock in one area can exert ripple effects on multiple segments and locations across global supply chains.[8] Taking the COVID-19 pandemic as an example, impacts on the agrifood system were felt all along the value chain—from farmers' lack of access to inputs due to movement restrictions, to the closure of agriprocessing facilities due to staff COVID-19 outbreaks (forcing, in parts of the livestock industry, the culling and discarding of animals), to logistics bottlenecks (for example, canceled air traffic, which prevented transport of high-value fresh produce by air) and the sudden collapse of consumer demand for food produce

in key market segments—for example, as hospitality sectors closed during lockdowns (*Financial Times* 2020a).

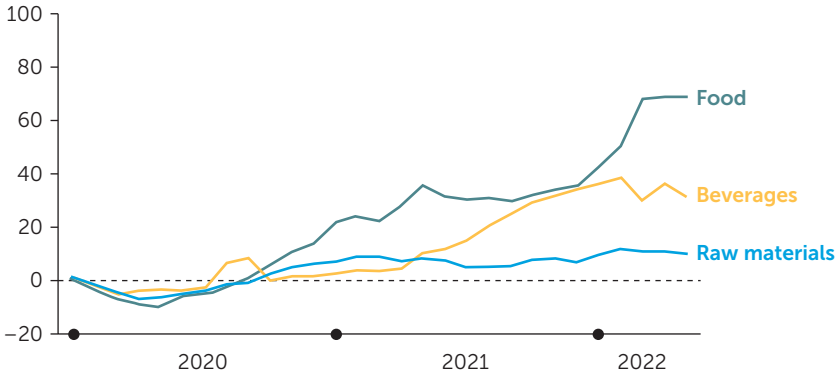
Meanwhile, as figure 14.2 demonstrates, Russia's invasion of Ukraine has accelerated global food costs (alongside a global price spike in fertilizers and animal feeds). This has placed enormous strain on countries that are net importers of staple foods such as wheat, and it creates a strong imperative to boost domestic food production—an objective that must be achieved primarily through increased smallholder production in most emerging markets.

New Normal: Higher-Frequency Global Supply Chain Shocks

While these largely unforeseen public health and geopolitical crises captured media headlines around the world, the requirement for greater redundancy in agrifood supply chains was also being driven by a set of entirely *foreseeable* longer-term trends, including the following:

- *Intensification of trade barriers* will exist in certain key markets through higher tariffs, quotas, or more stringent regulations, due to the more frequent occurrence of so-called trade wars, that is, reciprocal imposition of trade barriers between states. These barriers expose cross-border supply chains that lack inventory buffers or rely too much on a single supplier (*Financial Times* 2020a).

FIGURE 14.2 Increase in Food Costs Resulting from COVID-19
(percentage change since January 2020)



Source: World Bank.

- *Ever-increasing complexity of supply networks* will exist in the context of more diverse and differentiated product offerings that cater to changing lifestyles and consumers' desire for diversified agrifood products.
- *Increased demand-side volatility* will occur, for example, due to faster-evolving customer preferences, which are increasingly shaped not only by quality, price, and availability but also by sustainability criteria and demands for improved food safety profiles.
- *Growing frequency of weather and climate shocks* will exacerbate the vulnerabilities agrifood supply chains face. For instance, quality and consistency criteria for raw produce in many key growing regions risk being undermined over the coming decades by the higher incidence of extreme weather events such as droughts, floods, and wildfires. More than 40 percent of the variation in crop yields in recent decades was caused by extremes in precipitation and temperature, and this figure is expected to increase (De Clercq et al. 2022).

The 2008 global food price crisis provided a particularly striking example of the potential for weather shocks—in this case, drought in key grain-producing regions—to cascade through worldwide agricultural markets and to "impact geographically distant places and people" (Gomez et al. 2021). In this context, the intricate globalized food chains created by multinational conglomerates to enhance efficiency are significantly exposed—through their complexity—to "environmental variability and extreme events at multiple points, leading to the possibility of shock propagation, spillovers, and simultaneous shock events."[2]

- *Emerging market and developing country dietary transitions, shifting consumption habits, and population growth* will place increasing pressure on agrifood supply chains in the medium term. The worldwide population is predicted to be approximately 10 billion by 2050 before plateauing, which will cause an estimated 50 percent (at least) increase in global food demand. Much of this increased need will be concentrated in urban areas and in such product categories as processed protein-dense foods, whose supply chains incur significant energy costs, raw material requirements, and logistical complexity (*Financial Times* 2014). As one recent report stated, "Not only are we likely to require more food to feed the world's growing population, but also our ability to produce and deliver this food without disruption is likely to be constrained" (Stone and Rahimifard 2018).

- *Finally, the long-term trend toward more stringent environmental, social, and governance (ESG) requirements* is also incentivizing agrifood companies to take more direct control over their global supply chains—even if ESG issues were temporarily deprioritized by some in the wake of Russia's invasion of Ukraine and the resulting global energy and supply chain crisis.

The imperative to prioritize ESG criteria stems not only from shareholders and consumers but also from governments. These stakeholders increasingly demand that agribusinesses have full visibility of labor conditions and environmental impacts at every stage of production and value addition. Hence, a key theme in the coming decade will be the introduction of stronger incentives for sustainability innovation and penalties for poor practices, in both legislation and business "norms" (reflected in voluntary initiatives and agreements). Pathfinding sectors such as palm oil will set the pace, and the regulatory curve for the broader food and agriculture system will incrementally catch up.

Underscoring this trend is the recent creation of a new entity—the International Sustainability Standards Board (ISSB)—which aims to develop a set of robust sustainability disclosure requirements to meet all investors' information needs. The ISSB's mission will be to help investors and regulators by creating baseline sustainability disclosure standards so that information is "comparable across industries and financial markets."[10]

Managing Volatility in Agrifood Supply Chains: Proactive Versus Reactive Mitigation

In an environment where recurrent shocks represent the "new normal," how can supply chain managers enhance resilience while minimizing trade-offs in cost-effectiveness? A first option is to proactively shift from a geography-agnostic supply chain model to a model that explicitly prioritizes regional or local hubs of production and consumption. This involves a mind-set of proactive scanning to identify emergent opportunities—such as leveraging new technologies, business models, and partnerships—where shortening of the existing supply chain is feasible while maintaining operating margins and quality (*Financial Times* 2022b). This cost-benefit analysis must be a continuous process, as the factors determining local versus nonlocal production competitiveness are dynamic for virtually all agrifood commodities.

Shortening of supply chains has the additional advantage of boosting market access and competitiveness for global agribusinesses within emerging market regions that have existing—or planned—regional free trade agreements that privilege within-bloc production and trade. The African Continental Free Trade Area, signed by 54 countries in 2021, created the world's largest trading block by membership. The 2020 Regional Comprehensive Economic Partnership, signed by 15 Asia-Pacific countries, created the world's largest trading bloc by share of global GDP and population.

The imperative to regionalize or localize supply chains applies not just to physical agricultural produce and products but also—though less intuitively—to agricultural technology (agtech) applications. In the past, technology and payment companies have tended to imagine a borderless, seamless, global addressable market; however, regulatory trends in the coming decade—including increased emphasis on "data sovereignty," consumer protection, and information security—are likely to place limits on heavily centralized global technology business models. This is especially true of agtech products that use underlying technologies, such as real-time satellite data, cloud-connected autonomous devices, and surveillance technologies, which have potentially sensitive crossover uses. In the future, therefore, agtech business models are more likely to thrive and enjoy host government support if they are (1) viewed as largely homegrown, (2) able to house and analyze data onshore rather than offshore, and (3) can demonstrate robust and locally maintained safeguards. Many LMICs also lag private-sector agtech innovation in terms of their sector-specific regulatory frameworks; therefore, trust must be built between industry and government as sectoral policy is tested and refined. This need is a further reason for global firms to localize the development and rollout of agtech applications.

Second, supply chain managers should work closely with all key functions across the corporate structure when designing shorter and more adaptive supply chain structures. These managers should collaborate with, and seek guidance from, functions such as ESG, marketing, legal, risk, investor relations, and finance. Successfully changing a company's sourcing and production model is likely to require the following: (1) a long-term capital strategy and shareholder relations approach that reduces pressure on short-term results by making the case for long-term sustainable returns, (2) a cross-functional culture that values resilience, and (3) a decision-making lens that

incorporates social and sustainability goals. The third point entails not only seeking efficiency but also maximizing the benefits of more localized sourcing for community and ecological system resilience, product traceability (such as farm-to-fork), and a reduced carbon footprint.

Third, supply diversity should be prioritized within the bounds of minimum necessary cost, volume, safety, and quality criteria. Diversification of production sources, logistics routes, and end markets creates "multiple pathways for absorbing shocks" (FAO 2021), whereas super-efficient and highly centralized food chains are fragile "because if they go 'wrong,' they fail."[11] Especially in LMICs, this proactive widening of the supply base is likely to require that large-scale agribusinesses commit to hands-on, long-term technical support and off-take guarantees to help develop a broader range of small and medium-sized producers and associated cooperatives with the capacity to meet minimum supply standards (*Financial Times* 2020b). This process, in turn, may require changes to company structure—for example, establishing bespoke farm-facing subsidiaries that are colocated with key producer or supplier clusters and have the technical skills and capacity to develop government and NGO partnerships.

Finally, supply chain managers are advised to maintain a rolling review of emerging agtech applications to assess their efficacy in terms of supply chain strengthening and shortening. (Chapter 4, "Agricultural Technology," provides further details on emergent models.) Connectivity can be at the farm level through the internet of things (IoT)–enabled smart devices or at the marketplace level through e-platforms. Either way, connectivity can boost the capacity of agrifood value chains to absorb external shocks (box 14.2) by enabling agile switching of supply sources, routes to market, and retail channels (*Financial Times* 2020b).

At the company level, the digitization of supply chain risk management systems and processes is essential, as it allows for (1) precise analytics and simulations, using real-time and predictive data, to inform and prioritize risk mitigation interventions; (2) early warning notifications and quick decisions on operational problems (Bain & Company 2022); and (3) the ability to build an evidence-based business case internally for supply chain adaptation, identifying and costing key risks and single points of failure across the supply chain to justify investments into improved redundancy and resilience (Bain & Company 2022).

BOX 14.2

Building Automation-Led End-to-End Supply Chain Management Systems to Manage External Shocks

Data-driven tools can enable agribusiness with complex multicountry operations to accurately assess in real time where the company needs to have certainty of supply, excess storage and cold chain capacity, or higher-than-normal inventory levels of specific raw materials and end products. A recent McKinsey & Co. study on building automated end-to-end supply chain planning systems within agribusinesses to manage global shocks identified four critical steps: (1) the integration of data sources to enable real-time monitoring (whereby all information on the current status of the supply chain is accurately reflected in the system in real time in easily accessible format); (2) simulation to produce supply chain scenarios; (3) deployment of appropriate optimization algorithms for real-time responses to shocks; and (4) full automation of the first three steps to produce automatic response systems. See figure B14.2.1.

FIGURE B14.2.1 Four Critical Steps for Automated Supply Chain Planning Systems

1. Integrate data and monitor in real time	2. Create model scenarios and simulations	3. Optimize for real-time execution	4. Automate response decisions
Consolidate public and private data sources across all supply chain stages, from external suppliers to final customers. Make real-time insight across the supply chain accessible to the entire supply chain and related teams.	Simulate thousands of possible scenarios across climate, agronomy, sowing, harvesting, input use, disease pressure, ground and sea logistics, policy, commodity pricing, trade tariffs, and global pandemics.	Preprogram optimal decisions for thousands of individual scenarios ahead of time. If a given scenario comes to pass, optimal responses have already been computed and are accessible in an interpretable manner.	Automate issue resolution; put decision systems on autopilot with minimal oversight required. For example, systems can automatically change distribution plans, postpone distribution orders, and deliver automated suggestions to the frontline sales force

Source: De Clercq et al. 2022.

box continued

BOX 14.2

Building Automation-Led End-to-End Supply Chain Management Systems to Manage External Shocks *(Continued)*

Underpinning these steps is the development of a company culture, communications strategy, and governance structure that support coordinated execution management and build trust in the system being built for automating supply chain monitoring and crisis response. This, in turn, may necessitate appropriate investments in information technology (IT) infrastructure and data science and engineering talent to maintain and fine-tune the system, ensuring that the following are in place: (1) a rapid error-handling capability; (2) delivery of real-time updates of projections for supply, demand, and inventory—as well as resulting costs, shortages, and stock levels—at appropriate time intervals; and (3) a prescriptive decision-response capability (that is, an intelligent engine that can produce optimal recommendations based on efficiency versus resilience trade-offs and can plan for adjustments to deal with problems such as sudden supplier shortages, quality issues at a site, sudden demand spikes, and unexpected orders).

Of course, not all integrated agricultural supply chains will benefit from the full automation of associated planning and risk management systems, but most supply chain management teams using manual or ad hoc systems that currently lack intelligent automation will benefit greatly from shifting to a hybrid model that incorporates semi-automation alongside clearly delineated manual processes.

Source: Based on De Clercq et al. 2022.

Key Trend 4: Urbanization and Value Chain Integration Trigger Expansion in City-Based, Peri-Urban Farming

Although most commentaries on smallholder farming landscapes focus on rural settings, we anticipate that small-scale urban agriculture is set to expand both in scale and importance in the coming years. City-based and near-city farming will never replace the traditional food system; "It may well replace part of our food system . . . and benefit the environment in the process" (Jacobs 2018).

Out-migration from rural areas to urban centers is a global trend: the relative number of rural smallholders is falling, while the proportion of smallholder farmers engaged in urban or peri-urban farming is rising. This is especially evident in larger and more urbanized emerging markets—from China, Mexico, and Nigeria, to India, Indonesia, Malaysia, Thailand, and Vietnam.

In parallel, we see a growing stock of domestic investment in emerging markets and LMICs flowing into short-chain food markets and multifunctional urban agriculture, driven by opportunities created by new connectivity infrastructure and market links, agtech innovation, a desire to strengthen local food system resilience in the face of global supply and climate shocks, and the presence of "megacities" that provide a strong base for food consumption.

Roughly 800 million people are now involved in urban agriculture worldwide, and the majority do so part-time. Of this figure, approximately 200 million produce on a small scale, and 150 million work full time on urban plots—primarily in Asia and Sub-Saharan Africa. These urban farmers, virtually all small in scale, contribute 5 to 20 percent of global food needs and represent the fastest growing category of smallholder farming (Teng 2020). Significantly, as the world's farming population grows older overall and an increasing proportion of young people chose city life, the rise of urban farming provides an important part of the solution to the problem of who will fill the gap between constrained food supply and ever-increasing food demand. This is perhaps especially true in countries where the average age of farmers is 60 or older, as is the case in economies as diverse as Japan, Kenya, and the United Kingdom (Henriques 2019). In these cases, the rise of urban and peri-urban farms provides an entry point into agriculture for young people previously deterred by the stigma sometimes associated with small-scale farming in rural areas—a sense among those entering the workforce that rural farming offers poor prospects due to land rights and succession problems, perceived low margins, and/or a lack of socioeconomic mobility.

In some cities, up to 80 percent of fresh vegetables may come from the city or its immediate urban-fringe farmland; Dakar, Hanoi, and Mexico City are leading examples. Meanwhile, in China, over 85 percent of the vegetables consumed in several main cities are reportedly grown within the bounds of the municipalities (Nandwani and Akaeze 2020). Crops most commonly grown in urban settings for local sale include bitter gourd, broad beans, broccoli, cauliflower, cucumbers, eggplant, kale, onion, peas, pepper, radish, spinach, squash, sugarcane, sweet potato, and tomato.

Innovative Models Emerging

Innovations introduced by city-focused farming enterprises are making the concept of urban farming especially impactful for countries with poor agricultural climates, as emerging models enable produce to be

grown in any setting—at least on a small scale. For example, one company, France-based Agricool, has developed a containerized model it claims is capable of "growing fruits anywhere [including] in the desert."[12] In addition to increasing locally available food production, such models have the potential to bring additional benefits, as they "create new homes for pest-eating predators, reduce flooding and could reduce electricity use by lowering city temperatures during the summer. . . . Soil on rooftops can [also] provide insulation that keeps buildings cooler without the need for air-conditioning" (Jacobs 2018).

Unconventional Urban Planning, Market Infrastructure, and Technology Innovation

The idea of growing food close to where it is needed is not new, but policy makers and consumers will need to embrace unconventional approaches to food production, and even food types, if urban farming is to realize the self-sufficiency gains on offer.

> Urban agriculture is embedded in—and interacts with—the urban ecosystem. Such linkages include the use of urban residents as labourers and the use of typical urban resources (like organic waste as compost and urban wastewater for irrigation), direct links with urban consumers, direct impacts on urban ecology (positive and negative), competing for land with other urban functions, being influenced by urban policies and plans, etc. (Jacobs 2018)

Technology will help to unlock new urban farming models, but technology alone is no silver bullet. Chapter 4, "Agricultural Technology," assesses the current status and future prospects for such technologies—from biotechnology, robotics, automation, and IoT-enabled connected assets to associated farm management software and even novel farming systems (for example, controlled-environment) and the use of cell culture or soilless growing technology. Many of these have a "wow factor" but remain commercially unproven (see box 14.3).

Beyond technology, there is a critical need for city planning and infrastructure investment that is sensitive to land-constrained urban agriculture requirements, alongside an enabling policy environment for innovation in these areas. The greatest barriers to investment in small-scale urban farms across Africa and Asia remain the perennial threat of displacement by construction, uncertainty about zoning and land ownership, and the lack of nodal cool storage and logistics infrastructure suited to urban farming needs (Hoang et al. 2022).

BOX 14.3

High-Tech Solutions versus Platform-Based Approaches

Can high-tech urban farming models work in emerging markets, achieving the kind of scale required to help feed the estimated 6.5 billion people who will live in urban spaces by 2050? The emergent field of vertical farming—whereby crops and plants are grown in stacked layers indoors using aeroponic and hydroponic techniques that radically reduce water usage—provides a useful case study. Vertical farming is drawing significant global media attention and start-up investment capital, despite the absence to date of a business model proven to function effectively at scale.[a] Examples of start-ups in this space include (1) Plenty, a US-based vertical farming company aimed at developing large-scale indoor vertical farms outside of major cities, which in 2022 secured US$400 million in a single round of funding from Softbank, Walmart, and others (Plenty 2022); and (2) InFarm, a Berlin-based company building modular vertical farming units that create the potential to have a "farm in every store," where supermarket customers can pick their own produce from in-store vertical farms. InFarm has signed preliminary deals to place its units with Germany's largest retailers, Metro and EDEKA (Benigson 2018). Looking ahead, a higher proportion of the next generation of experimental start-ups in this space is likely to hail from Asian markets as demographic trends, urbanization, and rising prices in traditional food supply chains create a powerful incentive for innovation (Hoang et al. 2022).

These start-ups generate an exciting vision for the future. For now, though, the up-front equipment costs and energy inputs involved in vertical farming make it virtually impossible achieve a positive return on investment on anything but high-value herbs and leafy greens sold in high-end supermarkets. In emerging markets and low- and middle-income countries, innovations that achieve greater production density without such high capital and operating expense costs—including, especially, advanced glasshouse models—are more likely to gain traction in urban and peri-urban contexts in the near term, alongside "value chain integrators," such as Twiga Foods, that apply mobile-based technology to integrate, formalize, and quality-assure previously fragmented urban food chains. Overall, it is the lower-technology and low-unit-cost business model innovations—those that function well under existing infrastructures—that hold the greatest potential for scale in the context of city-based food production in emerging markets. Further examples include improved intercropping and high-density planting techniques.

Nevertheless, global agribusiness should monitor the evolution of vertical farming techniques closely. As costs gradually fall and efficiencies in energy usage are found, the use case may broaden out beyond the current high-end niches. After all, the attraction of vertical farming lies not just in its ability to solve the density problem but also in supply chain resilience and environmental benefits delivered by a model that involves minimal wastage and transport, with production processes that are largely chemical and pesticide free—factors that will only grow in importance over time.

a. Aeroponic spraying targets plant roots with a nutrient-rich solution, while hydroponic growing techniques involve placing plants in a shallow bath of nutrient-rich water.

Fortunately, there is growing recognition that depending solely on rural agriculture or food imports to supply the food needs of urban dwellers in emerging markets and LMICs is unsustainable. This is exacerbated by the following:

- The speed of urbanization in some regions: in West Africa, for instance, the urban population has almost doubled in 15 years.
- The loss of farm workers due to rural-urban migration reduces the workforce available to produce food.
- The reduction in farmland caused by urban sprawl: at least 2 million hectares are lost in this way annually, according to World Bank data.

In the coming decade, therefore, the solutions to the food production challenges and adverse effects of urbanization—from pollution to urban food insecurity and poverty—will increasingly come from urban and peri-urban agriculture.

Key Trend 5: Increasing Overall Adoption of Agtech Masks Divergence between Emerging Markets

Chapter 4, "Agricultural Technology," assessed the opportunities that agtech provides for smallholder engagement in the current context. Yet the agtech marketplace is highly dynamic, and it is important to consider how smallholder-focused agtech is likely to evolve over a time frame of five to ten years to ensure that new investments are future-proofed and positioned to take advantage of medium-term trends.

Looking ahead, we believe the scope and reach of agtech products will evolve primarily in response to advances in backbone connectivity infrastructure. In many emerging markets and LMICs, the traditional binding constraints to mobile communication, mobile money, and mobile data will ease significantly in the coming five to ten years, providing a strong tailwind for agtech:

- Most farmers will have access to a mobile phone by 2030 (more than 80 percent in Sub-Saharan Africa, with higher rates in all other emerging markets and low- and middle-income regions), as we edge toward *universal phone access*.
- Substantial *increases in smartphone access* are forecast as device costs fall and novel payment solutions help overcome the up-front costs of acquiring a smartphone (including connected-asset financing and third-party payment models). According to World Bank forecasts, current global smartphone penetration of 33 percent is expected to

double by 2025. More widespread smartphone sales via rural agent networks will support farmers in particular, as will the growing trend of localized, stripped-down smartphone design (GSMA 2017).

- The *cost of mobile data* will fall in many countries, enabling e-commerce, data analytics, and IoT solutions to thrive as network coverage also expands.
- *Awareness of and familiarity with agtech solutions* will improve among farmers. One recent survey of smallholders in Sub-Saharan Africa showed that about 60 percent of respondents expected to integrate new agricultural technologies in the next three years, for example (Tsan et al. 2019).
- *A step-change in the role of data analytics* is also likely to occur over the coming half-decade, as we shift from an agtech ecosystem primarily reliant on *static* observational data to one producing real-time and even *predictive* data. The greater ubiquity and affordability of mobile data will be a key driver in this important transition.
- We are also likely to see a *steady rise in the availability of low-cost automation and artificial intelligence (AI)–driven solutions in emerging market agriculture*. To date, business models utilizing AI in emerging markets and LMICs have focused largely on market and financial access issues through the creation of online marketplaces, automated credit scoring, and the like. Increasingly, however, affordable applications for AI in agribusiness will proliferate further upstream in the value chain at the on-farm production and post-harvest levels: examples include smart irrigation through integrated sensors, farm management software that leverages IoT to optimize decision-making, and the use of robotics and satellite weather data to optimize application of inputs and pest control strategies.

Second-Wave Investors in Smallholder-Focused Agtech

A further step-change will occur in the short to medium term regarding the organizational maturity of key agtech players. Joining the field in the wake of pathfinding start-ups in emerging markets and LMICs, more established entities are set to enter the space—including global technology leaders, e-commerce giants, and "big agri" incumbents. This will inject a transformational level of human and financial capital, technical know-how, and supply chain infrastructure. It is hard to overstate the impact on business case viability when comparing agtech start-ups that

face capital repayment costs as high as 15 percent with multinationals able to finance new ventures at rates in the low single digits. The latter are able to plan for the long term, drawing on deep in-house pools of human capital to build multidimensional platforms without the short-term pressure to break even on individual business divisions.

Divergence in Agtech Market Development: Stalled Progress Versus Step-Change Advances

At a country level, divergence will be the key trend in agtech through the 2020s. Agtech ecosystems in countries experiencing breakthrough advances in connectivity and energy infrastructure will race ahead as sudden increases in the availability and affordability of agriculture data open up vast opportunities—especially in remote sensing, data collection and analytics, diagnostics, and IoT. Kenya, where network operator Safaricom is preparing for the commercial launch of its 5G network, is a prime candidate to make this abrupt leap toward massively higher data volumes.

The same enablers are necessary across all emerging markets. As such, it is the larger, more urbanized emerging markets and LMICs with strong connectivity networks that have the greatest potential.[13] China has emerged as a world leader in this respect, while Kenya currently stands out in the Sub-Saharan context. Elsewhere, the Indian market is noteworthy, as it combines a uniquely competitive software development ecosystem with relatively strong digital infrastructure, and it already hosts several early-stage players in the e-platform category all seeking to capture a share of the country's US$24 billion agtech market potential.[14] Meanwhile, in Latin America, Colombia has emerged as a high potential market. It hosts more than 20 established agtech companies, the highest number regionally, including several e-commerce platforms (Phatty-Jobe 2020).

In contrast to these high potential markets, many countries risk stagnation in agtech market development, as poor or nonimproving backbone infrastructure places a handbrake on innovation and uptake. Governments that fail to adequately invest in backbone infrastructure while also stifling private-sector investment through overregulation are especially at risk of stalling agtech market development potential.

Indonesia, for example, has strong supply-and-demand dynamics for agricultural e-commerce, but growth is curtailed relative to the market's potential by restrictive regulations for mobile network operator–led

digital financial services (GSMA 2019). This has not prevented a sizable cohort of Indonesian start-ups from "developing solutions that optimize the value chain by addressing pain points faced by both producers and buyers" (GSMA 2019), especially in the country's most structured value chains (coffee, cocoa, and palm oil). But with only two subscale mobile-money offerings in the market, adoption of mobile money remains relatively low.

The same barriers are present in a more pronounced way in Ethiopia, a country with vast agricultural potential where the historical absence of private investment into mobile networks keeps mobile data costs high and digital financial services uptake low. Meanwhile, in many smaller markets across Africa and Asia, there are few quick fixes to the long legacy of underinvestment in digital infrastructure, given the high up-front costs of network development.

As the examples suggest, we are entering an era of marked divergence in the pace of connectivity infrastructure development between different regions, countries, and subnational localities. For this reason, jurisdiction and/or location will become a decisive determinant of agtech business model viability in the coming decade.

The most successful agtech models will adapt to an environment in which digital infrastructure progresses at widely different rates, both between and within countries. For agtech providers, the challenge—and the opportunity—is in configuring technology to suit markets that are highly price sensitive and variable in terms of mobile data and digital finance coverage. More often than not, this will involve building the technology globally but living locally via parallel investments in human agent networks, offline infrastructure, and pared-back and/or lower-cost versions of agtech hardware and software.

Key Trend 6: Traceability Emerges as a Key Requirement of Firm-Level Competitiveness in Agriculture

Across all agricultural value chains, the shift toward full-spectrum traceability is building. While the concept of full traceability and verification of product origin has long been a priority for a subset of premium food brands, advances in traceability technologies and changes in consumer preferences and regulation are set to drive a much broader transition. As one consultancy observed, "In the coming decade, we expect firms to cluster around two different performance curves: a higher-performance curve for companies that invest in

traceability and a lower-performing curve for those that lack traceability" (Saenz, Hinkel, and Bysong 2021).

There is growing demand for full-spectrum traceability, but challenges remain because of the up-front costs involved and the requirements imposed on supply chain managers and leadership teams to manage greater organizational complexity. This complexity includes higher data volumes and monitoring of product flows involving not just tier 1 suppliers and first-line customers but also "every supplier's supplier and every customer's customer" (Saenz, Hinkel, and Bysong 2021). In a prevailing business culture dating to the 1990s that prized supply chain efficiency above all, companies have in the past often deprioritized traceability in the pursuit of simplification. Today, however, these priorities are changing on three levels: (1) to compete effectively, agribusinesses must ensure that their supply chains are not just efficient but also *resilient, agile,* and *equitable*; (2) new technologies and partnerships are reducing the complexity and cost involved in developing best-in-class traceability and tracking; and (3) global food and agriculture companies are increasingly required to holistically assess and disclose their business operations across all jurisdictions in order to report on their climate impacts to regulators, shareholders and other stakeholders. Indeed, in the medium term, lack of internal supply chain traceability and reporting may directly increase the risk of climate change litigation or reduced financing options as global regulations tighten around corporate disclosure of climate-related risks and actions to transition to more sustainable operations (Norton Rose Fulbright 2019). Given the intrinsic link between land use and GHG emission profiles, food and agribusinesses that are laggards on self-reporting of climate impacts in their own supply chain may find themselves at the forefront of an upsurge of climate-related litigation, just as farmer organizations may emerge over the coming decade at the vanguard of efforts to bring climate-related proceedings where necessary to protect their livelihoods and land-use sustainability (Norton Rose Fulbright 2019).

A Multidimensional Business Case for Full-Spectrum Traceability

The benefits of eliminating information asymmetry within the supply chain increasingly outweigh the costs for four main reasons. First, full product traceability provides unparalleled *control and transparency* of information within the supply chain. Second, effective tracking and tracing capability can *build trust and confidence* with distribution partners and consumers. Third, robust traceability is an increasingly necessary

capability for agrifood companies to comply with regulations and obtain the certifications required for *access to the best end-markets*. Fourth, traceability enables *resilience and agility* in supply chains.

1. **Full product traceability provides unparalleled control and transparency of information within the supply chain.** This, in turn, boosts *quality, safety, and consistency*. In the food sector, for example, fully digitized ledgers that track and trace materials from farm to fork provide a powerful mechanism for tracking supplier performance and for avoiding reputationally damaging product recalls (Lawson 2021).

2. **Effective tracking and tracing capability can *build trust and confidence* with distribution partners and consumers.** This matters especially in emerging and frontier markets where counterfeiting is often prevalent and where consumer awareness of the safety risks involved with counterfeit products is rising. By generating higher levels of trust, traceability builds brand equity and becomes an essential point of differentiation.

The extent to which this contribution to brand loyalty converts into pricing power and market share will vary by product and geography, but the direction of travel is clear given that consumers across the globe are placing ever-increasing priority on safety, sustainability, and equity criteria. As one commentator observed, "Now more than ever, people are interested in the provenance of the products they consume. Is your poultry and livestock being treated humanely? Are your food processing methods harmful to the environment? Are the workers who harvested these foods treated ethically?" (Lawson 2021).

3. **Robust traceability is an increasingly necessary capability for agrifood companies to comply with stringent regulations and to obtain the certifications required to maintain *access to the best end-markets*.** When companies can follow products as they progress along the value chain—collecting precise data on the origin of inputs and on suppliers' working methods—they can dynamically adapt the data they provide to meet the needs of certification bodies, regulators, and shareholders as those needs evolve.

This capability is essential because the regulatory environment for food safety is dynamic, especially in the largest consumer markets globally. For example, the European Union has adopted multiple regulations and directives aimed at harmonizing or strengthening food safety

and traceability requirements, building off the foundational European Parliament and Council of the European Union Regulation No. 178/2002, which stated, "It is necessary to ensure that a food or feed business including an importer can identify [their supplier or suppliers] to ensure that on investigation, traceability can be assured at all stages" (Tsolakis et al. 2013). Most recently, in February 2022, the European Commission adopted a proposal for a Directive on Corporate Sustainability Due Diligence. This directive aims to foster sustainable corporate behavior and to anchor human rights and environmental considerations in companies' operations by requiring transparency over their value chains inside and outside Europe, and by imposing requirements that firms address identified adverse impacts (EC 2022).

Meanwhile, in the United States, planned US Food and Drug Administration rules applying to roughly 25 percent of food products would require food chain actors to maintain sortable end-to-end electronic records "to be made available upon request within 24 hours during a food-borne outbreak or food recall investigation" (Unnikrishnan et al. 2021).

As these regulatory trends show, without tech-enabled end-to-end visibility of a company's supply chain, compliance will become an increasingly costly or simply unfeasible exercise.

The correct traceability platform also contributes to companies forming *precompetitive partnerships and alliances*—either with suppliers or with a subset of competitors—that build the marketplace for their products to the mutual advantage of cooperating partners. This can involve, for example, codevelopment of traceability technologies through pooled cost sharing, joint advocacy to develop enhanced standards, or collaboration on the design of incentive structures for suppliers. An example of the latter is Fishcoin, an open-source platform developed to reward small-scale seafood producers across the globe for information about their catch. Fishcoin is based on highly scalable blockchain technologies, using digital tokens as the medium of exchange for the key data elements.[15]

4. **Traceability enables *resilience and agility* in supply chains.** Firms that fail to ensure traceability are exposed to supply chain disruptions and external shocks (Saenz, Hinkel, and Bysong 2021). And as shifts in consumer demand become more frequent, greater supply chain customization and responsiveness are needed to retain and build market share. This includes the ability to use traceability platforms to make data-driven predictions of evolving consumer behavior to optimize supply chain planning. In this sense, a digitized

traceability function is "both an offensive and a defensive strategy" tied to core commercial objectives (Saenz, Hinkel, and Bysong 2021).

Taking these factors together, it is clear that end-to-end traceability in agrifood supply chains is not just nice to have; rather, it is becoming a cornerstone of competitiveness. And with more rigorous certification regimes coming onstream, agrifood companies that have end-to-end traceability also have *greater agency*: They possess the data and the credentials to help shape standards and market parameters in their sector in partnership with wider industry stakeholders. As one recent report concluded:

> The rewards of getting it right are substantial. Companies that build robust traceability capabilities will be able to deliver the right product to the right place at the right time with the right level of customization and speed—all at a competitive cost. They also will be in a position to meet stakeholders' key sustainability demands and regulatory requirements. And they will have greater resilience to respond to supply and demand shocks. Those capabilities will deliver strong growth and profits and enable new business models. (Saenz, Hinkel, and Bysong 2021)

In-Depth: Full-Spectrum Traceability

What does full-spectrum traceability look like in practice—and where should supply chain managers begin? A useful first step is to design a pilot solution that (1) is clearly linked to top-line commercial objectives, (2) has minimal customizations and maximum scalability, and (3) will create short-term business value. This approach—that is, linking investment into the end-to-end traceability platform directly to core business goals—will ensure buy-in from key stakeholders.

As a second step, map out the data model that will support the envisaged traceability platform. This will involve conducting a gap assessment and capability assessment to identify which data are needed, how much of these data are already available from disparate internal sources (for example, from existing enterprise resource planning systems), how reliable these existing data sources are, and which external data sources are available to plug data gaps or augment internal data quality (Saenz et al. 2020). This assessment can then inform design of a full-stack, integrated data model.

As a third step, consider how the planned system will send and/or receive usable data and insights to and from ecosystem partners—such as regulatory agencies, suppliers, customers, media, and NGOs—while

balancing the need to maintain privacy of source data where relevant (Saenz et al. 2020). It is crucial to include this design consideration up-front, and it is highly likely to entail functionality that is different from any preexisting internal enterprise resource planning systems the company may have, because it requires integration of direct and indirect supply chain data, some of which may have to be gathered offline. For example, it may include functionality that enables connection of the company's traceability system with crop-specific sustainability projects led by public institutions or NGOs on the ground in producer jurisdictions.[16]

Key Considerations for Agrifood Supply Chain Traceability

For business models focused on agrifood products, core data-capture capabilities required under the traceability platform are likely to include the following:

- Real-time traceability of product location
- Real-time traceability of the value addition process, giving visibility of each processing stage and what went into the process at each stage
- Traceability of the inputs used for growing each product (feeds, fertilizers, agrochemicals, and so on)
- Up-to-date information on any pathogens or pesticides potentially associated with each product[17]
- Authenticity checks at each phase of the product cycle
    - Note that blockchain technologies provide the opportunity for decentralized, open-source product tagging using digital tokens. By ensuring that all ecosystem players—suppliers, regulators, and consumers—have access to the same information, bespoke blockchain solutions can reduce tamperability, enhance sector coordination, boost brand recognition for ethically and sustainably sourced produce, and open up new financing opportunities (World Bank 2021).
- A failsafe capability for checking food safety, whereby supply chain managers can observe products on a unit-by-unit basis at the packaging stage before the products are passed downstream into retail chains
    - Note that it may be feasible to partly or fully virtualize this observation capability with deployment of smart IoT-enabled

infrastructure, providing the opportunity to optimize monitoring, planning, and safety controls and to eliminate the risk of human error associated with physical checks. Virtualization also opens up opportunities for advanced food safety prewarning systems that leverage machine learning and data processing or data mining to flag potential food safety risks, based on defined tripwires (that is, automated detection of anomalies with greatest potential—at predefined thresholds—to incur safety risks).

- Note that in the coming decade, we also expect a growing range of molecular tools to come to market for authenticating and tracing agrifood products. These will enhance precision in the determination of food authenticity and detection of adulterations. While methods based on molecular marker methods are already available, innovative approaches based on isothermal amplification and DNA metabarcoding are more novel. Metabarcoding is a technique of plant and animal identification based on DNA-based identification and rapid DNA sequencing. We therefore recommend a review of the commercial viability of new-to-market tools at the time of platform design, as well as periodic review to coincide with system upgrades (Fanelli et al. 2021).

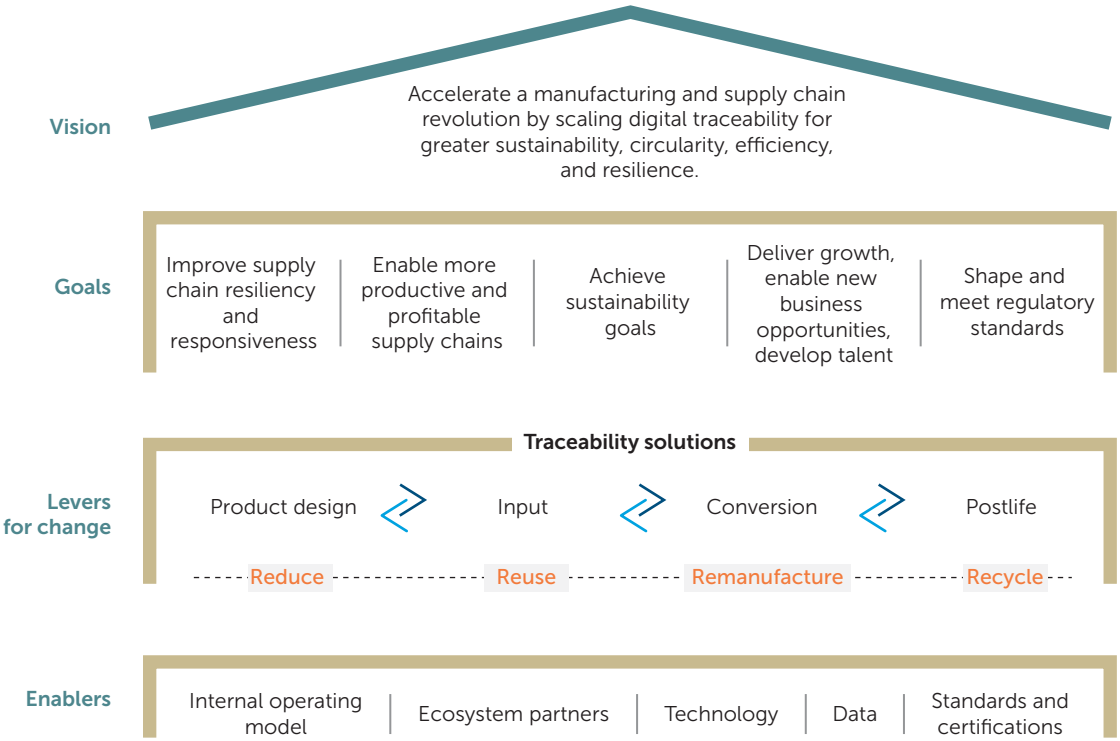
- Matching of all trade documentation (tagged in sequential order) with physical product information, to facilitate the ease of information-sharing with partners on the platform

The above-listed capabilities can be held within the company's individual systems or via a multistakeholder system that provides coverage at the value-chain level. Either way, the most important capability for the chosen system is that it can seamlessly combine internal and external data sources, as shown in figure 14.3.[18]

Key Trend 7: Evolving Preferences and Technologies Drive Evolution in Both Traditional and Alternative Protein Markets

As populations and incomes grow across emerging markets, demand for animal-source foods—from poultry and dairy to meat and fish products—is forecast to grow. However, there are mounting concerns over the sustainability of certain modes of livestock production, some of which use high volumes of water, energy, and land.[19]

FIGURE 14.3 Traceability Platform Enablers, Levers, and Goals



Source: WEF 2021.

Direct climate impacts are not the only concern over resource-intense animal protein business models. Livestock production systems can also generate water pollution, zoonotic disease, antimicrobial resistance, and land degradation risks, while potentially competing for human food sources. In light of these issues, a growing number of industry participants have argued for a rebalancing of human diets in favor of alternatives to intensively farmed livestock proteins. In this section we provide a perspective on (1) the emerging alternative protein (alt-protein) marketplace—assessing the capacity of different production technologies to achieve scale globally; (2) the ways deintensification and sustainability objectives are driving change in existing markets for traditional sources of protein; and (3) the direct and indirect impacts of rapid evolution in the protein industry for decision-making at global companies invested in smallholder supply chains.

Alt-Protein Sector Expanding off a Small Baseline, but Unlikely to Gain Traction in Developing Economies

In practice, the direct impacts for smallholder supply chains of innovations in the alt-protein space are likely to be minimal in the near term. There may be spillover effects and market opportunities in emerging markets for a subgroup of alt-protein products, such as biomass fermentation cocoa and coffee and edible insects (assessed in the following section), but for the most part alt-proteins are not likely to become a "sustainable, economically viable solution to help meet the nutritional challenges facing developing countries' needs" on a meaningful scale in the short to medium term (WEF 2019). Nevertheless, there will be indirect impacts as the emergence of new technologies, higher sustainability standards, and evolving costs and consumer expectations across the protein industry combine to reshape the role smallholders play.

Sustainability Profile of Alt-Protein Products

Before assessing the outlook for alt-proteins, we must first acknowledge that the central claim underpinning many marketing strategies—namely, that novel alt-protein products can be produced more sustainably than farmed meat or dairy—remains the subject of robust ongoing debate. For some proponents of alt-proteins, animal-free products have across-the-board potential to deliver positive impacts for people and the planet alike.[20] Because fermentation and cell-based products can be used to produce agricultural products largely without the need for farmers or land (the use of algae and microalgae to produce food supplements or seafood alternatives is a frequently cited example), the potential for alt-proteins to reduce deforestation, water and energy use, and GHG emissions (CO_2, methane, and nitrous oxide) appears obvious and self-evident to many. Yet this is unlikely to be universally true. Recent analyses have shown the following:

- Some alt-protein supply chains are unlikely to meet a robust definition of sustainability. For example, certain soy-based burgers and almond-based milks are likely to be more water-intensive than equivalent conventionally farmed products. Meanwhile, cell-based meats that involve extensive energy inputs potentially offer no environmental benefits versus farmed seafood or dairy. Hence, careful segmentation of the alt-protein market is required before any claims over environmental sustainability can be made.

- As a range of recent studies highlight, the sustainability profile of some alt-protein products may be equivalent to—or weaker than—farmed meat when low-intensity or small-acreage integrated crop and animal farming models are used as the comparator, rather than using high-intensity commercial livestock production as the yardstick for comparison. This important finding means that reforming existing livestock farming methods is likely in many instances to produce faster and more wide-reaching environmental benefits than focusing solely on switching consumers away from farmed meat.[21]
- Impacts on social sustainability are complex. For instance, some modes of alt-protein production have the potential to disrupt agricultural systems through heavy concentration of capital and high-skilled labor into production chains that involve high barriers to entry, leading to a loss of farming and ranching livelihoods.
- Some categories of alt-protein have also received criticism for being overly processed, with unclear nutritional benefits. This is especially the case for cell-based meat, which remains the most unproven technology in the alt-protein marketplace.

Affordability and Scalability of Alt-Proteins

Although small, premium markets for plant-, fermentation-, and cell-based alternative proteins already exist in industrialized countries,[22] many food industry observers question the feasibility of scaling up alt-protein markets as a solution for price-sensitive middle- and low-income consumers in global emerging markets. This is partly because existing plant-based substitutes that aspire to be viscerally equivalent to farmed meat—such as fungi or soy, wheat, or pea protein isolates and concentrates—are often too expensive or lack sufficient texture and quality. In an apparent indication of these barriers to mass-market adoption, consumer interest in soy-based products—currently the most mature value chain in the alt-protein space—has actually declined over a 15-year period (Dongoski 2021).

Nevertheless, while some segments of the alt-protein market—such as premium branded "plant burgers" sold via retail channels[23]—may struggle to gain traction as mass-market products, newer and less publicized segments have greater potential to break out of existing niches over the next decade, at least in the premium consumer segment. Five trends underpin this potential market opportunity:

1. **The nascent alt-protein industry is demonstrating steady technological advancement, which may lead to decreasing cost curves.** This may accompany improved economies of scale in manufacturing operations and price optimization of raw materials. One recent study estimated that the average cost of alt-protein production is set to fall below the average cost of conventional protein production by the mid-2020s—a critical inflection point, even if this high-level forecast masks substantial unit cost differences between different segments of the farmed meat and alt-protein markets (Dongoski 2021).
2. **Innovation is generating new product categories**. The emergence of plant genetics start-ups focused on ultra-high-protein crops for use in plant-based consumer foods promises to expand the universe of alt-protein products (Dongoski 2021). Similarly, new fermentation applications are coming to market focused not only on using microorganisms to process and improve plant-based ingredients but also on *biomass fermentation* (where protein-rich microorganisms are used to produce high volumes of protein as the main ingredient of plant-based end products) and *precision fermentation* (where microbes are used to produce flavor and texture as functional ingredients) (GFI 2021). Precision and biomass fermentation can be used to produce a wide range of agricultural products beyond animal protein and seafood. Start-ups are currently developing fermentation processes that use yeast to generate cocoa, coffee, cotton, and silk. If these experimental initiatives can scale and produce cost-effective products, they could significantly disrupt smallholder agriculture. These techniques are advancing thanks to a surge in investment into fermentation technology; global investment in this area has recently been doubling each year. This, in turn, is leading to falling costs and a growing number of use cases.[24] What is clear, for now, is the impressive speed at which consumer adoption challenges around taste and quality are being addressed via technology innovation.
3. **The flow of investment capital into makers of plant-based, lab-grown, and fermentation-based alt-protein products is expanding.** Worldwide, more than 1,000 start-ups are now active in the alt-protein sector, with venture capitalists, angel investors, and agrifood conglomerates (including farmed meat processing companies) investing a total of $3.1 billion into alt-protein start-ups in 2020 alone, up threefold from $1 billion in 2019 (*Financial Times* 2021b). This step-change injection of capital will accelerate product development, scale, and sector consolidation in the short to medium term, with a wave of mergers and acquisitions likely to occur.

Notably, the alt-protein market has already recorded liquidity events that demonstrate the potential for financial returns. Quorn, an early mover in mycoprotein, was initially marketed to UK-based supermarkets via a joint venture between Rank Hovis McDougall and Imperial Chemical Industries in the 1980s and subsequently—after a change in ownership—was sold to Monde Nissin, a Philippines-based company, for US$726 million in 2017. Monde Nissin went on to file for the Philippines' first-ever billion-dollar initial public offering (IPO) in 2021 (GFI 2021).

4. **Structural changes in the wider food system, climate, food regulations, and consumer attitudes are likely to boost aggregate demand both for alternative proteins and for more sustainably farmed meats.** While there is debate about the pace and scale of change, the direction of change in consumer attitudes is undisputed as a growing proportion of global consumers shift diets, display greater concern over animal welfare and antibiotic use, and show increased awareness of the negative effects of certain modes of intensive livestock production on the environment.
5. **A combination of enabling regulations and more stringent requirements for traceability and supply chain due diligence may provide further support to the business case for alternative proteins, given that such products can feature shorter and higher-visibility supply chains than farmed meat.** Several governments are also ramping up public investments into research and development and subsidized financing for alt-protein market development (led, initially, by the countries with the largest innovation ecosystems for alt-protein products: France, Germany, Israel, the Netherlands, the United Kingdom, and the United States). Meanwhile, regulators around the world are creating positive network effects by approving novel alt-protein ingredients, production processes, and products. In the fourth quarter of 2020, for example, Singapore approved commercial sales of a cultivated chicken product marketed by Eat Just, a US-based start-up (Dongoski 2021), although no other jurisdictions have as yet.

Outlook for the Alt-Protein Sector

The above factors will drive significant year-on-year growth in the alt-protein market over the coming decade relative to current levels—although a small number of products will account for a disproportionate share of overall sales growth, and growth will likely be concentrated

in a handful of advanced economies. However, as global food and agriculture businesses strategize over long-term capital allocation, research and development (R&D), and the balance of wholly owned versus smallholder-based supply chains, perhaps the most important consideration should be that even rapidly expanding alt-protein sales will place only a minor dent in global animal protein market share over the next decade. Ernst & Young's Food and Agriculture practice estimates a total alt-protein market size of between US$77 billion and US$153 billion by 2030, up from between US$5 billion and US$10 billion in 2021 (Dongoski 2021; Boston Consulting Group 2021); future protein consumption cannot be simplified to an expected replacement of farmed meat for plant-based "meats." In the period to 2030, it is credible that the cost curve for some—although by no means all—alt-protein products will achieve pricing parity with, or even a price advantage over, farmed meats (Santo et al. 2020). The alt-protein sector also brings the potential for improvements in terms of carbon emissions, land, water and pesticide use, eutrophication, and biodiversity, especially by comparison to the highest-intensity forms of farmed meat production. Nothing, however, close to full substitution of alt-proteins for animal proteins is likely ever to occur; in any case, substitution alone achieves little in terms of sustainability and nutrition if it only replaces processed food types within otherwise unhealthy dietary patterns and inequitable supply chains.

Alt-Protein Market Segments to Watch In Emerging Markets

Although meat substitute products have limited growth potential in LMICs, two other segments of the evolving alt-protein industry have greater potential and merit close monitoring: biomass fermentation and edible insects.

Biomass fermentation, which can produce healthy and high-quality protein,[25] has strong potential in African and Asian markets that host large existing agricultural sectors for several reasons. First, this is a technology with strong potential for scale and volume as emerging industrial techniques allow for the production of large quantities of protein biomass through fermentation. Second, the cost curve for protein via fermentation is falling faster than perhaps any other market segment and could be "substantially less expensive than conventional proteins between 2030 and 2035," thanks to the high velocity of investment in relevant R&D and efficient manufacturing technologies (University of Exeter 2019). Third, and most important, investments into biomass

fermentation can leverage existing agroindustrial supply chains as well as the biodiversity of local feedstocks to reduce capital and operating expense requirements for new projects. This enables countries with a large existing food production base to use their natural endowments and established agricultural value chains to drive competitiveness in fermentation-based alt-proteins. While the specific project economics and material flows are beyond the scope of this section, one tangible example would be the construction of a large-scale zero-waste biorefinery coupled with an aerobic fermentation plant to produce both food-grade mycoprotein and bioethanol from cereal crops.

Turning to edible insects, crickets and grasshoppers theoretically represent an effective source of protein and can be milled for flour. At present, processes to isolate protein from the flour are cost-prohibitive, although a range of innovators are investing in R&D in an effort to address this. Instead, in the near term, insects such as black soldier flies (BSFs) or mealworm used for the animal feed industry have the greatest commercialization potential. In many emerging markets, the cost and scarcity of existing animal feeds such as fish meal and soy are rising due to reliance on imports and other factors, thus making BSF larvae produced from locally available animal manure or vegetable waste a potentially competitive option. As a homegrown, low-cost, and high-quality protein source, BSF larvae could feasibly supply local commercial poultry, pork, or aquaculture value chains. BSFs can be produced from bio-waste, giving the production process a low carbon footprint, and requiring relatively limited land, water, and energy. Production timescales are also fast: larvae can be fully dried and ready for use as animal feed in 22 to 24 days.[26]

While this subsector remains in the "test and learn" pilot phase, several start-ups are showing progress. Examples include Vietnam-based Entobel, which produces and processes insects using brewery waste as a feedstock component; the Netherlands-based Protix, which launched commercial operations to produce BSFs in 2019; France-based Ynsect, which is developing a mealworm-based model; and UK-based Beta Bugs, which is focused on genetic development of BSFs. Elsewhere, in African markets, Insectipro is producing BSF larvae as an alternative high-quality protein source for aquafeeds in Kenya, and Protek is supporting out-growers to farm BSFs as a side income stream, buying back the larvae from farmers for cash.

Despite its nascency, this is certainly an exciting space to watch as entrepreneurs continue to explore use cases for insects as both food source and feedstock. As one recent WEF study observed,

> Compared to traditional livestock, insects and other invertebrates are more efficient at converting feed to meat. Insects require little land, water and labour, generate few GHGs and raise few animal welfare issues. They are particularly good for converting waste to feed, thus supporting a circular bioeconomy. . . . Several initiatives are addressing the hurdles of scaling up production, including economic models, food safety, regulations and allergens. Additionally, further research may be needed to determine the optimal species, as the nutritional value of insects varies given their huge diversity. For instance, studies have shown the protein content of insects ranges from 30 percent to 60 percent, and their levels of vitamin B12 and a range of other macro- and micronutrients are variable. (WEF 2019)

Livestock Operations Remain Central to the Protein Industry, but Sustainability Credentials Will Increasingly Determine Companies' Access to Markets and Financing

If the challenge for global agriculture is to increase affordable protein supply by approximately 30 percent to feed a future global population of 10 billion (GFI 2021) and to ensure that this supply is environmentally friendly and nutritious, the solution will need to comprise a combination of three concurrent shifts: (1) increased market share for the most price-competitive and scalable alt-proteins, although this will largely be contained to industrialized countries in the medium term; (2) rebalancing of human diets to manage protein demand;[27] and (3) a transition from overly intensive livestock rearing to agroecological modes of animal protein production.

Therefore, we can expect to see a multidecade shift toward a mixed-protein marketplace in which some farmed meat products become a premium product and some low-cost plant-based substitutes gain meaningful shares of the market in certain countries and cultures, but without anything close to a full transition away from animal proteins. The following are entailed under this scenario:

- Many global consumers will adopt a more mixed protein intake—according to one source, more than 90 percent of alternative-meat customers also buy animal meat (Djanian and Ferreira 2020).
- Although production of meat and dairy will continue to grow, companies operating in livestock value chains in both developed and developing economies will need to demonstrate increasingly robust sustainability credentials to retain market access and share (see box 14.4 for a summary of IFC's work in this critical area).

BOX 14.4

International Finance Corporation (IFC) Practices for Sustainable Investment in Private Sector Livestock Operations

Rising incomes, changing diets, and an increasing global population make the livestock sector one of the fastest-growing agricultural subsectors in low- and middle-income countries. Trade in live animals supports the livelihoods and food security of 1.3 billion people, including the world's estimated 500 million pastoralists, for whom livestock provides draught power and manure to support crop production and is a source of high-quality nutrition and regular income. For pastoral communities in particular, livestock provides resilience to shocks and can be a store of wealth, in addition to often holding cultural significance. Meat and dairy products are also important in terms of helping people to meet their nutritional needs. Micronutrient deficiencies, including in iron and zinc, affect more than 2 billion people worldwide, and meat and dairy products are rich sources of these essential nutrients.

The Challenge

The projected increase in meat and dairy consumption will lead to significant sustainability challenges that, as the analysis in this chapter has shown, cannot be solved by simply directing consumers toward alternative proteins. Among these are a rise in greenhouse gas (GHG) emissions related to animal husbandry and food production, an increase in land conversion to grow crops for animal feed, and more risks for deforestation and the associated loss of biodiversity. In addition, there are other concerns related to the production of meat and dairy, such as animal health and biosecurity, animal welfare, and antimicrobial use.

The Opportunity

In a world where the demand for animal protein is expected to grow, and given the challenges mentioned in this chapter, it is imperative that support for the industry follows a sustainable growth path. IFC understands that livestock companies that incorporate sustainable management practices are likely to achieve a competitive advantage in the global marketplace while minimizing the environmental and social footprint of their operations. These practices include developing environmental safeguards, human resources, and occupational health and safety management systems; instituting enhanced animal health and protection of animal welfare measures; implementing food safety and quality guidelines; creating a pathway toward lower GHG emission intensity and a greener production model; and incorporating climate-resilient development. IFC's approach to investing in livestock companies is based on ensuring that sustainability underpins companies' activities. Companies that do this successfully are likely to see business gains while cutting down on GHG emissions. In particular, this means that they can achieve the following:

box continued

BOX 14.4

International Finance Corporation (IFC) Practices for Sustainable Investment in Private Sector Livestock Operations *(Continued)*

- Reduce costs of production and increase productivity by adopting better health and animal welfare practices
- Decrease their GHG emissions intensity by adopting good international industry practices
- Realize growing market opportunities by becoming the producer of choice for retailers and consumers concerned with animal health and welfare, human health, food safety and the environment

The Practices

Seven fundamental practices inform IFC investments in livestock and aquaculture projects. These practices must underpin a client's operations, and IFC works with clients to help them transition to operations that follow these practices during the course of the investment. The goal is to ensure that IFC investment projects are aligned with these seven practices within three years of the investment, with the exception of practice 7, which must be adhered to from the outset.

1. Implement robust animal health management and biosecurity protocols.
2. Implement prudent and responsible use of veterinary antimicrobials and medicines.
3. Implement animal welfare management systems codified by credible standards.
4. Promote decarbonization pathways and enhance the climate resilience of operations.
5. Prevent the loss of biodiversity.
6. Provide safe food.
7. Respect relevant national laws and regulations.

- Traditional nonanimal sources of protein such as pulses (primarily beans, peas, and lentils that are high in protein, carbohydrates, vitamins, and minerals) will achieve greater mass market prominence and end-product diversification and value addition, with growth likely to prove fastest in the largest and most populous markets in the Asia-Pacific region, where some processed protein-rich plant-based foods (for example, tofu and tempeh) are already well established.[28]

Conclusion

What overarching lessons can be drawn from this snapshot of key trends driving the evolution of smallholder supply chains over the next decade? Above all, what stands out is the *accelerating pace of change* affecting the factors that shape the operating context for agribusiness supply chains—changes in technology, demographics, consumption, regulation, resource use and, above all, climate.

As the preceding chapters illustrate, one long-term structural trend is clearly observable: the incremental smallholder transition in which farmers everywhere are either shifting toward more commercialized and technology-enabled farming or exiting farming for other roles in the supply chain or for other sectors in the economy. This incremental transition, occurring at different speeds between and within countries, may tempt industry participants to view the trajectory for agricultural market development as predictable and certain. That would be a mistake. Any notion of a linear transition is belied not just by the increasing frequency of unanticipated market shocks (from COVID-19 to Russia's invasion of Ukraine), by the increasing number of disruptive business models and new technologies coming to market, and by the *certainty* that the climate crisis will worsen before it stabilizes. For smallholders, climate conditions will increase in volatility in the coming decades, upending growing conditions not only for crops but also for pests, weeds, and diseases, with knock-on effects for yields.

Hence, taking a more nuanced view, while the endpoint for the gradual smallholder transition is clear, we anticipate that the journey is likely to be marked by greater market volatility and operating model disruption than agribusinesses have faced in the past. This, in turn, underscores an unprecedented need for built-in agility, strong local market intelligence, and continuous adaptation in supply chain models—in short, a focus on flexibility and context-specific design in place of the overwhelming focus on efficiency that largely defined agricultural supply chain management in previous decades.

We hope this summary of key trendlines proves useful in driving discussion and decision-making as agribusinesses seek to mitigate risks, and capture emergent opportunities, in a global smallholder landscape that is evolving more rapidly than ever before.

Notes

1. This point was highlighted by the Sustainable Markets Initiative's Agribusiness Task Force in the buildup to the COP27 climate summit in Egypt in November 2022 (SMI n.d.).
2. For an excellent overview of the challenges involved in carbon project structuring, see de Wit, Whitehead, and Withers (2022), *Creating Carbon Offset Units on the Voluntary Market*.
3. Permanence requirements refer to the need for the increased carbon stock or avoided loss to be maintained for long periods, often for more than 50 years, to be used as an offset (Bora and Prabhala 2020).
4. New high-resolution satellites and machine learning algorithms allow for increasingly accurate estimates of carbon sequestration from forests. One example of this emerging capability in action is Land Carbon Lab's development of a comprehensive monitoring system to track all forms of land cover, land use, and land-use change globally, plus the associated carbon stocks and flows. See World Resources Institute (WRI) Land & Carbon Lab, database, Washington, DC. www.landcarbonlab.org/.
5. Early movers include the US-, UK-, and Norway-backed LEAF Coalition, which aims to catalyze US$1 billion in financing for tropical forests in emerging markets; WWF and South Pole's Landscape Resilience Fund; and Acumen's Resilient Agriculture Fund.
6. The SMI Agribusiness Task Force is now focused on building "a common set of metrics for measuring environmental outcomes, establishing a credible system of payments for farmers for environmental outcomes, easing the cost of farmers transitioning to sustainable practices, ensuring that government policy rewards farmers for greening their business, and encouraging the sourcing of crops from particular areas converting to regenerative farming" (SMI 2022). However, aligning all stakeholders around a common vision will not be straightforward. While the above commitment to regenerative farming from several of the world's largest food and agriculture companies demonstrates positive momentum, nonprofit organizations have highlighted the potential for inherent tension between largescale "industrial" agricultural systems and the small-scale, local food systems that arguably have greatest potential for adoption of regenerative techniques and which "still feed most of the people on the planet" (Rushe 2022).
7. Because Ukraine is a leading global producer of products such as wheat and edible oils, food-deficit and import-reliant countries around the world engaged in a spate of preemptive food export bans to preserve domestic availability of these products or their substitutes. See Listiyorini and Raghu (2022) and *Financial Times* (2022a).
8. See Listiyorini and Raghu (2022) and *Financial Times* (2022b). As the Food and Agriculture Organization's (FAO's) flagship *State of Agriculture Report* for 2021 observed, "Because agrifood systems are complex—including primary production, food supply chains, domestic transport networks, and households—and involve many interlinked actors, a shock in any component can spread rapidly throughout systems" (FAO 2021).
9. Gomez et al. 2021. The report continues: "Research is only beginning to understand how these dynamics influence the propagation of the effects of

environmental variability through global and local food supply chains, how large-scale events (for example, blockades, recessions, and pandemics) may compound these effects, and what they ultimately mean for the stability and affordability of nutritious diets."

10. See *Financial Times* (2021c). In this context, there is a potential future role for approaches that may once have appeared radical, such as (1) "true cost accounting" as a mechanism to drive accelerated food system transformation (that is, accounting rules that reflect negative environmental costs in the shelf price of food products) and/or (2) new reporting standards that bring full-spectrum transparency into companies' social and environmental performance and hold them accountable.
11. The quotation is by Tim Benton, research director at Chatham House, the international affairs think tank, quoted in *Financial Times* 2020b.
12. See Jacobs (2018). To achieve scale, the challenge for such nascent models will be to optimize energy inputs and leverage renewable electricity to ensure that the social and environmental benefits brought by city farms are not undermined by high energy costs and usage.
13. E-platform businesses have also been spurred by COVID-19, which accelerated adoption of digitized solutions because, as one agtech investor observed, "When traditional markets fell apart during the lockdowns, farmers, traders, and rural retailers turned to agritech startups for solutions" (Omnivore 2021).
14. India today hosts more than 1,000 agritech start-ups, having attracted US$2 billion in agtech investment over the half-decade to 2019. See Ernst & Young (2020).
15. For details, see Fishcoin's website, "Seafood Traceability Powered by Blockchain," https://fishcoin.co/.
16. EEFS (2019) delves deeper into this challenge.
17. See, for example, TraceX Technologies' "6 Best Practices for Traceability in the Food Supply Chain" (Bharadwaj 2022).
18. In this respect, advances in real-time satellite imaging and data science may provide a valuable additional supply chain transparency and compliance/verification tool for global agribusinesses in the coming years, as software for highly granular real-time imaging and analysis of agricultural production and land use comes to market. See, for example, Wilson (2022).
19. Livestock production is responsible for the majority of the 25 percent share of total greenhouse gas emissions accounted for by global food production, although some modes of livestock production produce more carbon emissions than others.
20. IFPRI's (n.d.) Alternative Proteins: Exploring Emerging Markets for New Protein Solutions project documentation provides a useful summary of the challenges and opportunities.
21. See, for example, Santo et al. (2020).
22. The three emerging technologies that dominate alt-protein production are plant-based meat substitutes, fermentation using genetically modified yeast or other microorganisms, and cell-based production, typically grown in bio-reactors from stem cells in specialized media. Of these categories, cell-based production is the most nascent.
23. Examples of this product category include Beyond Meat's Beyond Burger and Impossible Foods' Impossible Burger.

24. In addition, a new subsector—cellular cultivation—is emerging, although it remains unproven to date. An increasing number of innovators are developing cell-based meats (cultivated from animal cells) that claim to be not just experientially equivalent but also "biologically equivalent" to farmed meat, copying key aspects of meat products on a molecular basis. This innovation aspires to recast the basic definition of meat, even if the long-run cost dynamics of products in this novel category remain unclear (the cost of animal-free growth media is currently many times higher than the level required to be cost-competitive with farmed meat). On another front, from 2018 to 2021, the total recorded investment into fermentation for alt-protein uses doubled per annum, albeit off a low base (GFI 2021).
25. To take one real-world example, Quorn's mycoprotein can build muscle more effectively than can cow's milk, according to a landmark University of Exeter (2019) study.
26. See, among other sources, Rockefeller Foundation (2020) and IDH (2020).
27. The importance of dietary balance is illustrated by the difference between the increase on existing protein production required to feed 10 billion consumers at the World Health Organization (WHO)–targeted daily protein intake of 60 grams per person (only a 2 percent increase required), and the increase required if 10 billion people consume at the current developed world average rate (79 percent increase needed). All figures are estimates (IFC internal presentation 2022). See also Sweet (2019).
28. A challenge for this category of plant-based foods is that they can be less nutrient-dense than livestock-derived foods and "may need to be supplemented through a diverse diet to ensure the full complement of nutrients is provided" (WEF 2019).

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green press INITIATIVE

Smallholder farmers are the stewards of more than 80 percent of the world's farms. These small family businesses produce about one-third of the world's food. In Africa and Asia, smallholders dominate the production of food crops, as well as export commodities such as cocoa, coffee, and cotton. However, smallholders and farm workers remain among the poorest segments of the population, and they are on the frontline of climate change. Smallholder farmers face constraints in accessing inputs, finance, knowledge, technology, labor, and markets.

Raising farm-level productivity in a sustainable way is a key development priority. Agribusinesses are increasingly working with smallholder farmers in low- and middle-income countries to secure agricultural commodities. More productive smallholders boost rural incomes and economic growth, as well as reduce poverty. Smallholders also represent a growing underserved market for farm inputs, information, and financial services.

Working with Smallholders: A Handbook for Firms Building Sustainable Supply Chains (third edition) shows agribusinesses how to engage more effectively with smallholders and to develop sustainable, resilient, and productive supply chains. The book compiles practical solutions and cutting-edge ideas to overcome the challenges facing smallholders. This third edition is substantially revised from the second edition and incorporates new material on the potential for digital technologies and sustainable farming.

This handbook is written principally to outline opportunities for the private sector. The content may also be useful to the staffs of governmental or nongovernmental development programs working with smallholders, as well as to academic and research institutions.

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