ACUMEN ACADEMY

The ROCKEFELLER FOUNDATION

SECTOR BRIEF

Food + Agriculture

TABLE OF CONTENTS

1. INTRODUCTION TO THE FOOD AND AGRICULTURE BRIEF

Supporting Student Innovators Around the Globe

Welcome! You've likely picked up this sector brief because you're curious about entrepreneurship and you want to learn how to build a business that can change the world for the better. The Rockefeller Foundation and Acumen want to support you.

We designed this sector brief for student innovators who want to create a social enterprise in the food and agriculture sector. It will help you understand where business model innovation is needed to improve the yields of smallholder farmers, deliver financial services, create market linkages, and address the challenge of food loss.

As funders and investors, The Rockefeller Foundation and Acumen have worked with many social enterprises across the agricultural value chain. Along the way, we have seen social entrepreneurs learn important lessons and encounter common pitfalls. This sector brief is designed to package critical lessons so you can build upon the work done by other entrepreneurs across geographies.

It features advice from a variety of experts across the food and agriculture sector, including:

+ Jorge de Angulo, Associate Director; Camilo Cortes, Portfolio Associate; and Catalina Torres, Portfolio Manager, Acumen (Latin America)
+ Olúwatóyìn Emmanuel-Olubake, Associate Director, Acumen (West Africa)
+ Betty Kibaara, Associate Director of YieldWise Food Loss, The Rockefeller Foundation
+ Kagwiria Koome, Program Associate of YieldWise Food Loss, The Rockefeller Foundation
+ Sunanda Madan, Agriculture Lead, Acumen (India)
+ Chris Mitchell, Partner at Bain & Company and Co-Author of "Growing Prosperity"
+ Adam Reineck, Global Design Director, and Luan Nio, Senior Partnerships Lead, IDEO.org
+ Roy Steiner, Managing Director of the Food Initiative, The Rockefeller Foundation

1. INTRODUCTION TO THE FOOD AND AGRICULTURE BRIEF

How to Use this Sector Brief

Whether you have an idea for a business already or are just looking for inspiration, we hope the lessons contained in this brief help on your journey of entrepreneurship.
This sector brief will give you an overview of the key trends and opportunities in the food and agriculture sector that we think can be most effectively tackled by social entrepreneurs. It is designed as a workbook so that, as you go through it, you can actively take notes and apply the information to the business model you're developing. Then, as you begin to create a pitch deck for your new enterprise, you may find it helpful to go back and reference some of the statistics and insights in this sector brief.

Here's what you can expect to walk away with after having gone through this sector brief and workbook:

+ Understand the agricultural value chain and the challenges faced by smallholder farmers
+ Identify the unique opportunities where social enterprises can improve the productivity of smallholder farmers and create market linkages between farmers and buyers
+ Gain best practices from innovative social enterprises in the food and agriculture sector
+ Learn about the evolving approach to investing in the agriculture sector and approaches that have failed in the past

Do you have a pen and paper ready?

STOP + REFLECT

Take a minute to reflect on your own experiences with the food and agriculture sector. Whether you are just getting started or you have been studying these challenges for many years, it can be helpful to reflect on your passions and motivations for getting involved.

+ What do you understand to be the greatest challenges in the food and agriculture sector?
+ Do you know the definition of a "smallholder farm"? How many smallholder farmers do you estimate there are in the world? What are their lives like?
+ Why do you care about making an impact in the food and agriculture sector? Is your motivation rooted in a specific memory or experience? Is it an academic interest?
+ What other skills and knowledge can you apply to solving the challenges in this sector?

Write down any critical questions you hope to have answered by this sector brief to guide your reading.

2. UNDERSTANDING CHALLENGES IN FOOD AND AGRICULTURE AND THE ROLE OF SOCIAL ENTREPRENEURS

Why should social entrepreneurs care about food and agriculture?

"What brought me to the food and agriculture sector is a fundamental belief that it's the foundation of human civilization," said Roy Steiner, Managing Director for the Food Initiative at The Rockefeller Foundation.

Around the world, about two-thirds of the poorest working adults—defined as earning $2 or less a day—are employed in agriculture.[1]

Agriculture is particularly significant for economic growth in Sub-Saharan Africa, where about 55% of the population is engaged in the agriculture sector.[2] In some countries, like Ethiopia and Kenya, agriculture accounts for one-third of GDP.[3]

The food and agriculture sector is responsible for feeding the world and employing hundreds of millions of people. But unless we transform the agricultural value chain, there will be severe consequences for global health, poverty reduction, and environmental sustainability.

[1] World Bank Group, Who Are the Poor in the Developing World?

[2] World Bank Group, Employment in agriculture (% of total employment) (modeled ILO estimate)

[3] World Bank Group, Agriculture, forestry, and fishing, value added (% of GDP)

WHAT IS A SOCIAL ENTERPRISE?

If you're thinking about starting a non-profit and are worried that the lessons in this brief won't apply to you, you should know that Acumen defines social enterprises as **any enterprise that prioritizes transformative social impact while striving for financial sustainability**. Note that this definition does not specify the type of governance structure that a social enterprise needs to have (non-profit, for-profit, hybrid). All of the companies Acumen invests in have a for-profit structure, but we believe that a social enterprise can be incorporated as a non-profit if it strives to be financially sustainable and support its own operating costs.

2. UNDERSTANDING CHALLENGES IN FOOD AND AGRICULTURE AND THE ROLE OF SOCIAL ENTREPRENEURS

What are the most urgent challenges in the food and agriculture sector?

The food and agriculture sector is characterized by complex and interdisciplinary challenges that have an impact on billions of lives:

+ **Productivity and market access for smallholder farmers**: There are inefficiencies throughout the agricultural value chain, from poor productivity on farms to weak linkages between farmers and buyers. Smallholder farmers are increasingly unable to sustain a living from agriculture and respond to the demands of the market.
+ **Food waste and spoilage**: In developing regions, more than 40% of fruits and vegetables spoil before they can be consumed. These post-harvest losses reduce the income of smallholder farmers by 15%.[4]
+ **Global food security**: The global population is expected to reach 9.7 billion by 2050.[5] The food system must increase the production of calories by more than 50%, while reducing the emission of greenhouse gases and the conversion of forests into farmland.[6]
+ **Climate change resilience**: Farmers need support in adapting to climate change, which is expected to increase the occurrence of droughts, floods, and disease and pest outbreaks.
+ **Health and nutrition**: As developing regions grapple with food insecurity and undernutrition, there has been a simultaneous rise in noncommunicable diseases associated with diet and lifestyle, such as diabetes and heart disease. This is known as the "double burden of disease."

We believe social enterprises are best positioned to make a difference in this sector by working with smallholder farmers to improve their productivity and creating market linkages between farmers and large buyers.

[4] The Rockefeller Foundation, YieldWise Food Loss

[5] United Nations, Growing at a slower pace, world population is expected to reach 9.7 billion in 2050 and could peak at nearly 11 billion around 2100

[6] World Resources Institute, How to Sustainably Feed 10 Billion People by 2050, in 21 Charts

2. UNDERSTANDING CHALLENGES IN FOOD AND AGRICULTURE AND THE ROLE OF SOCIAL ENTREPRENEURS

Over the last decade, Acumen has invested in 24 agriculture businesses in East and West Africa, Latin America, and South Asia. These businesses have ranged from a mobile platform that provides credit and agronomic advice to farmers to a state-of-the-art wet mill co-created with a farmer's association.

"One of our key areas is helping smallholder farmers improve their yields and incomes," said Esha Mufti, Insights Lead at Acumen. "That's the focus of Acumen—working with smallholder farmers, understanding what's keeping them in poverty, and helping them get out."

The Rockefeller Foundation is building a sustainable food system through YieldWise, an initiative to reduce food waste in the United States and food loss in Kenya, Nigeria, and Tanzania. Since 2006, the Foundation has also helped farmers boost their productivity and incomes through the Alliance for a Green Revolution in Africa (AGRA).

This brief will share insights and advice from Acumen's community of investors, researchers, and entrepreneurs, accompanied by examples of social enterprise models in the food and agriculture sector.

3. UNDERSTANDING SMALLHOLDER FARMERS

What is the definition of a "smallholder farm"? These are plots of land smaller than two hectares where farmers grow subsistence crops for their families, as well as cash crops—such as coffee or cacao—for sale.[7]

There are about 475 million smallholder farms around the world and 1.5 billion people live in smallholder households.[8] Although their exact production is not known, smallholder farms are estimated to produce a majority of the food consumed in developing regions.

This brief will focus on innovative agriculture businesses in East and West Africa, Latin America, and South Asia, where there is strong potential to reduce poverty by integrating smallholder farmers in equitable and efficient supply chains.

Before you build a social enterprise, you need to better understand the lives of the most vulnerable smallholder farmers.

[7] CGAP, The Global Distribution of Smallholder and Family Farms

[8] Food and Agriculture Organization of the United Nations, The Number, Size, and Distribution of Farms, Smallholder Farms, and Family Farms Worldwide

3. UNDERSTANDING SMALLHOLDER FARMERS

Understanding the Lives of Smallholder Farmers

Imagine you are a farmer in Iringa, Tanzania. On a small plot of land about one acre in total, you and your family grow tomatoes. You depend on the annual harvest for nearly all of your income.

Because your farm is miles from the local market, you sell to a middleman who visits your farm gate after harvest. Although you think the price he offers is low, you don't have any information to verify your suspicion. Besides, if you don't accept the offer, your tomatoes will spoil before you can find another buyer.

What if you wanted to refrigerate the tomatoes so they last longer? There is no electricity or cold storage rooms in your community. Sometimes you dry your tomatoes outside in the sun, where they are exposed to dust and pests.

Then one day, a drought wipes out your harvest. Or maybe disease strikes your tomato plants. Perhaps the middleman never pays you and you have no recourse.

Your family has no savings account, insurance, or source for an emergency loan. Without this harvest, you cannot afford healthcare or school fees for your children.

This story introduces a few facets of life for many smallholder farmers:[9]

+ Seasonal fluctuations in income
+ Exploitation by middlemen
+ Limited information on market prices and farming practices
+ Limited access to products for improving yields and reducing spoilage
+ Limited access to financial services for savings and loans
+ Exposure to extreme weather (like droughts or floods), disease and pest outbreaks, and volatile commodity prices

Women have a particularly challenging life as smallholder farmers. Although they are more likely to perform the manual labor of farming, they tend to be excluded from decision-making and participating in markets.[10]

[9] CGAP, A Year in the Lives of Smallholder Farmers

[10] FAO, Investing in Women Smallholder Farmers

3. UNDERSTANDING SMALLHOLDER FARMERS

Engaging with Smallholder Farmers as Suppliers or Customers

The story above illustrates what life is like for the most vulnerable farmers. However, there is significant diversity among smallholder farmers around the world. You can understand them in roughly three categories:[11]

+ **Subsistence**: Most of these farmers produce food for survival. They may sell excess to small local markets or intermediaries. They need access to basic inputs like water, fertilizer, and pesticides, and they often use these resources incorrectly. They have no savings and limited support from NGOs or farmer's associations. Therefore, they are unable to take on too much risk—for example, by investing in new crops.
+ **Transitional**: These farmers are better educated on the best practices for inputs and quality harvests. They receive support from NGOs and consistently produce excess that can be sold. However, they want to increase their production and connect with more reliable traders and markets.
+ **Stable**: These farmers have all the inputs they need and full-time employees. They often use mechanized tools to improve their efficiency and keep detailed financial records. They sell to regional markets and processors and they have more appetite for risk. They are a small percentage of smallholder farmers.

As more smallholder farmers transition toward stability, both the farmers and the food system will benefit. After all, the food system cannot thrive when smallholder farmers consistently experience poor harvests and lose their yields to spoilage.

[11] IDEO.org, Research on smallholder farmers for Project Post Harvest Loss, The Rockefeller Foundation

3. UNDERSTANDING SMALLHOLDER FARMERS

You can think about social enterprises as working with **farmers as suppliers** or **farmers as customers**:

+ Farmers as suppliers of produce to aggregators, processors, and global brands
+ Farmers as customers of agricultural inputs or financial services

In the next section, we will introduce opportunities for innovation in the agricultural value chain that improve the yields and incomes of smallholder farmers, while addressing related challenges like food loss.

STOP + REFLECT

Take a moment to reflect on the smallholder farmers you would like to serve through your social enterprise. Before you think about founding a social enterprise, you should be able to confidently answer all of these questions.

+ Where do they live? How close is the nearest market?
+ How large is their farm? What agricultural inputs and equipment are they using (e.g., seeds, fertilizer, irrigation technology, tractors)?
+ What are they growing? What are the characteristics of the harvest cycle?
+ How do they sell their crops? Do they sell through a middleman? How does their income fluctuate over the year?
+ Do they have access to mobile money or other financial services? How do they save and make payments? Where could they turn for a loan or cash in an emergency?
+ What digital devices do they have access to? What is their technological literacy?
+ How do they learn about farming practices or market prices?
+ Do they have access to products for post-harvest storage or processing to reduce spoilage?
+ Are they a member of a farmer's association or cooperative?
+ Are there social norms that influence how they approach growing or selling their crops?

4. Evaluating Opportunities for Innovation in Food and Agriculture

How can social enterprises improve the productivity and incomes of smallholder farmers and contribute to sustainable food systems that nourish the world?

In this section, we will introduce opportunities for innovation in the food and agriculture sector. You might also think of these as "calls to action" for aspiring social entrepreneurs.

What do we mean by "business model"? A business model describes how an organization creates, delivers, and captures value.

+ A business creates value by solving the problems of customers and end users, including smallholder farmers.
+ It delivers value through new products, services, or platforms.
+ It captures value by generating revenue and managing costs.

Each "opportunity for innovation" that follows is accompanied by examples of social enterprises working in East and West Africa, Latin America, and South Asia.

Take note of the **bundled services** provided to smallholder farmers. You will find that the social enterprises in this brief do not provide access to finance, inputs, or market linkages alone.

Instead, they offer a bundle of services to address challenges throughout the value chain.

In an article for the Stanford Social Innovation Review, Seth Silverman, founder of Apollo Agriculture, makes the case that agriculture companies need to "cover all the bases" to support smallholder farmers:

> *"Want to sell an irrigation solution to a farmer? Good luck if your customer doesn't have sufficient funds or a distribution point to purchase your system nearby. Ultimately, you're going to have to bring your irrigation solution to them and find a way to finance it... That's an awful lot, especially for entrepreneurs who really just wanted to engineer a great product."*[12]

Finally, in our interviews with experts, we heard that one of the greatest challenges for social enterprises in the food and agriculture is **skilled talent**.

As you read about the social enterprises below, ask yourself how you might learn from and build upon their experience to reach new customers and geographies—or even join their team.

[12] Seth Silverman, In Defense of 'Doing Too Much'

ACCESS TO FINANCE

EVALUATING OPPORTUNITIES FOR INNOVATION IN FOOD AND AGRICULTURE

Millions of smallholder farmers cannot access or afford productive assets—such as seeds, fertilizer, and irrigation systems—to improve their yields.

Their incomes fluctuate with the harvest cycle and can be wiped out by drought or disease. Many farmers find themselves trapped in debt: Unable to pay back previous loans, they take on new credit, resulting in a cycle they cannot escape.[13]

As a result, most smallholder farmers are not able to reach their potential and supply the quantity and quality of crops that are demanded by the market.

In the 1990s, governments and donor agencies established agricultural development banks to provide credit to farmers who were too risky for commercial banks. However, these banks have not been able to offer the full range of services—including savings, credit, and insurance—needed by smallholder farmers, particularly the most vulnerable.[14]

Today, there is an emerging generation of innovative non-bank providers of finance and microinsurance. These social enterprises develop solutions for a smallholder farmer's unique needs—helping them insure against risks, smooth their income across seasons, and invest in assets to increase productivity—and reduce the costs of lending through digital technologies.

"It is risky to lend to farmers and there are high transaction costs to reach the last mile," said Sunanda Madan, Agriculture Lead for India at Acumen. "Technology interventions and platforms for bridging the gap of the supply of capital—this is ripe for innovation."

[13] World Bank Group, Private Sector Solutions to Helping Smallholders Succeed

[14] Hans Dieter Siebel, Agricultural Development Banks: Close Them or Reform Them?

ACCESS TO FINANCE

Credit for Productive Assets

EVALUATING OPPORTUNITIES FOR INNOVATION IN FOOD AND AGRICULTURE

"Agricultural lending remains a frontier area, particularly to smallholder growers. This is despite the fact that smallholders are often a large untapped client segment for lenders."
—CGAP[15]

Founded in 2004, **Juhudi Kilimo** is a microfinance company that provides loans to smallholder farms in Kenya. Today, Juhudi is lending to more than 35,000 farmers.

Juhudi lends for productive assets, such as dairy cows and chickens, that enable farmers to generate additional income. Juhudi also offers financing for farm equipment, such as milking sheds and irrigation technology, and for energy products like solar lighting systems.

To reduce default rates, Juhudi lends to groups of 15–20 farmers. The dairy cows and poultry are also insured against disease. If a farmer does default on payments, the productive asset can be returned to repay the loan, which helps safeguard farmers against over-indebtedness.[16, 17]

[15] CGAP, 5 Insights into Credit Scoring for Smallholders

[16] Acumen, What Do We Owe Smallholder Farmers? Everything.

[17] World Bank Group, Private Sector Solutions to Helping Smallholders Succeed

To assess the credit worthiness of farmers, Juhudi has established about 20 field offices that each serve a 30-mile radius. Loan officers travel by bus, motorbike, and foot to visit the farms in person and determine whether a financing product is appropriate.

Before they can receive the loan, each group of farmers must participate in two months of training. Depending on the group's needs, the training might include an introduction to loan management or information on farming best practices. Juhudi partners with NGOs to carry out the trainings. (To learn more about training, refer to the "productivity" section of this brief.)

With these strategies in place, Juhudi Kilimo became financially self-sufficient in 2015. About 80% of its revenue comes from interest on loans—while maintaining interest rates that are lower than comparable microfinance institutions—and the social enterprise also receives grants for technical assistance projects.

A report from the World Bank, "Private Sector Solutions to Helping Smallholders Succeed," summarized these strategies for delivering financial services to smallholder farmers:[18]

+ **Risk mitigation and collateralization**: Most smallholder farmers do not have land titles and other property that is typically used as collateral. Social enterprises are accepting agricultural assets and purchase agreements as collateral for loans instead. Group lending is another common strategy to mitigate risk.
+ **Customized financial products and flexible repayment plans**: A smallholder farmer's income fluctuates with the harvest cycles. Furthermore, a farmer's financial needs differ depending on their crops and other variables. Social enterprises are developing financial services that are suitable for a farmer's unique cash flows.
+ **Bundling of non-financial and financial services**: Many smallholder farmers lack the financial literacy to spend their capital productively. Social enterprises are bundling financial services with access to inputs, training on best practices, and market linkages.

The social lender **Root Capital** illustrates an alternative approach to lending directly to smallholder farmers. Root Capital funds agricultural enterprises and cooperatives that are too large for microfinance and too risky for commercial banks. These enterprises aggregate supply from hundreds of smallholder farmers to ensure reliable demand for their crops.[19]

You will learn more about aggregator models in the "access to markets" section of this brief.

[18] World Bank Group, Private Sector Solutions to Helping Smallholders Succeed

[19] Root Capital, About Us

ACCESS TO FINANCE

Digital Technologies for Loan Payment, Credit Scoring, and Insurance

EVALUATING OPPORTUNITIES FOR INNOVATION IN FOOD AND AGRICULTURE

"If the financial inclusion community is going to build truly scalable models for financing sparse, remote populations, then we need to find smarter ways of using data to understand smallholders as customers: their needs, behaviors, incentives, and crucially, their agricultural activities."
—CGAP[20]

The process of lending to smallholder farmers is risky, complex, and administratively costly. So much work goes into every micro-loan; for example, loan officers often travel hours to remote farms for appraisals and monitoring.

Founded in 2006, **One Acre Fund** is overcoming some of these challenges through digital service delivery. The nonprofit social enterprise has provided loans for seeds and fertilizer, education on crop management, and post-harvest storage solutions to 800,000 smallholder farmers in Burundi, Kenya, Malawi, Rwanda, Tanzania, and Uganda.

Traditionally, One Acre Fund's farmer customers deposited their cash at weekly meetings with field officers. These payments had to be hand-recorded and then transcribed in One Acre Fund's system, a system that took two weeks and resulted in errors and fraud.

After a multiyear trial, One Acre Fund concluded its first "cashless" repayment season in 2016. Rather than pay in person, farmers now deposit their funds directly with M-Pesa.

The digital payment system eliminates safety risks and saves time for field officers, who can now focus on agricultural education. It reduces uncertainty for farmers, who receive immediate confirmation that their deposit was received. It improves the accuracy and quality of data. And importantly, One Acre Fund's high loan repayment rate has remained steady.[21, 22]

[20] CGAP, 5 Insights into Credit Scoring for Smallholders

[21] USAID, Finding the Best Fit: One Acre Fund's Integration of Digital Tools in Kenya

[22] The Better Than Cash Alliance, How Digitizing Agricultural Input Payments in Rural Kenya Is Tackling Poverty: The Case of One Acre Fund

Digital technologies can also be applied for credit scoring and building a farmer's credit history. Traditionally, banks have been unable to determine the credit-worthiness of smallholder farmers because they lack bank accounts and records of payments.

"A prominent segment of agritech in India is using data analytics to improve the quality and availability of data on farmers and their land," said Sunanda Madan. "This solution can be powerful for financial institutions. It gives them alternative data points and methodologies to provide finance and extend credit to farmers."

Atlas AI applies machine learning to satellite imagery and field data to generate insights on agricultural and economic trends. The social enterprise offers maps and datasets on household assets, household expenditures, crop yields, and crop types for countries across Sub-Saharan Africa. Companies can integrate this data into their own products with Atlas AI's API.

"It can create more accurate [crop yield] estimates than the governments themselves, providing information for policymakers as well as the private sector," said Roy Steiner, Managing Director of the Food Initiative at The Rockefeller Foundation.

Apollo Agriculture is drawing from a broad array of data—including high resolution satellite imagery and farmer registration information—to inform its lending business. If this model proves to be successful, the social enterprise could predict the appropriate financial products for farmers without the need for costly appraisal visits.

Similarly, CGAP is partnering with **Harvesting, Inc.** to develop a credit scoring system for smallholder farmers in Uganda. Harvesting, Inc. will combine satellite and weather data with non-traditional data like social networks to determine a farmer's credit risk score. Then the farmland will be monitored over time to provide an early warning system for potential defaults.

Finally, crop insurance is an opportunity to help farmers recover from poor harvests and climate-related risks. Today, social enterprises like One Acre Fund offer a partial reimbursement on the cost of inputs when harvests are damaged by weather.[23]

However, it's risky for social enterprises to provide crop insurance to a relatively small population: Farmers who live in the same area are likely to experience the same poor harvest at the same time.

Social enterprises could partner with government programs, like the Kenya Agriculture Insurance Program, on data-driven crop insurance solutions to help spread these risks across a larger population.

[23] One Acre Fund, Crop Insurance Can Improve Food Security in Africa

PRODUCTIVITY

EVALUATING OPPORTUNITIES FOR INNOVATION IN FOOD AND AGRICULTURE

Smallholder farmers cannot improve their productivity without the proper use of quality agricultural inputs, such as seeds and fertilizer, that are suitable for their regional climate and soil. However, smallholder farmers often have few places to turn for advice.

Additionally, farmers could benefit from real-time data on weather patterns, crop health, and soil moisture, especially as conditions are rapidly shifting in response to climate change.

Social enterprises are developing new solutions—from digital platforms to irrigation equipment and solar energy products—to share information and help farmers increase their yields.

PRODUCTIVITY

Education on Farming Practices and Data for Decision-Making

EVALUATING OPPORTUNITIES FOR INNOVATION IN FOOD AND AGRICULTURE

"We have to improve the efficiency of our production and get more from our inputs," said Roy Steiner. *"But there is currently quite a bit of inefficiency in the way we produce. For example, 70% of the fertilizer we use is wasted."*

For many years, the process of sharing best practices with farmers was known as "agricultural extension" or "extension services." An "extension officer," often employed by the ministry of agriculture or an NGO, would visit a farming community to demonstrate the use of fertilizers or insecticides. These officers were often overworked and poorly funded with little oversight.

Today, social enterprises are introducing digital technologies and experimenting with new approaches to help farmers adopt more productive practices.

"Farmers are very thoughtful about what they grow but often don't know or don't have access to the tools to invest in the soil to make it the most productive possible," said Chris Mitchell, Partner at Bain & Company and co-author of *Growing Prosperity*. "Some don't know the relationship between the soil and what they want to grow. Many should be using rotational crops, like legumes and beans, that restore nitrogen back into the soil. But a lot of farmers are planting the same crop again and again."

Launched in India in 2008, the nonprofit **Digital Green** works with local farmers to produce instructional videos about farming practices like crop rotation. The videos are designed "by the farmers, of the farmers, for the farmers" and shared in groups with facilitators to encourage discussion. After the screenings, Digital Green arranges follow-up visits and collects data so the community can learn and iterate together.

Most of the labor on farms in developing regions is done by women. Yet extension services have historically reached out to men. At Digital Green's screenings, 71% of attendees are women, as are most of the farmers featured in videos.[24]

[24] World Bank, Digital Libraries for the Poor

In a year-long study of 16 villages in India, the cost-per-adoption of Digital Green's approach was found to be 10 times more effective than traditional extension services.[25]

Farmers can also trade tips on platforms like **WeFarm**, upending the "top-down" approach to training. Farmers can post questions and receive answers from a community of one million farmers in Kenya and Uganda. When farmers don't have access to an internet connection, they can still use the platform through SMS.

"One of our insights is 'show, don't tell,'" said Luan Nio, Senior Partnerships Lead at IDEO.org. "Farmers gain trust from seeing other farmers. On platforms like **Farm.ink**, a farmer can pose a question like 'What's the best way to grow tomatoes?' and then the community answers. That gives them confidence."

Beyond knowledge sharing, there is incredible opportunity around delivering real-time data to farmers to help them make informed decisions.

"Food and agriculture is one of the least digitized sectors of the economy," said Roy Steiner. "There is not enough application of good data and analytics to improve

[25] USAID, Digital Green: Amplifying Impact of Innovative Agricultural Practices in India

decisions—for example, to identify where to plant more effectively and what kinds of inputs to use."

The emergence of high-resolution satellite imagery (also referred to as "remote sensing technology") and weather pattern data has presented opportunities to improve decision-making at critical moments, including:

+ predicting the seasons for planting and harvesting
+ assessing the health condition of crops
+ identifying the signs of pests or diseases
+ estimating soil moisture and mapping soil types to select appropriate crops
+ monitoring and managing irrigation
+ monitoring drought and flood patterns
+ forecasting crop yields

This information can contribute to "precision farming," which is the concept of maximizing crop yields through the use of data and monitoring. Social enterprises can play a role in delivering this real-time information to farmers in a user-friendly way.[26]

"Just getting good information to farmers is a challenge," Roy added. "There is increasing use of cell phone technologies to enable farmers to make better decisions. But we need to get better at that—we still don't have many killer applications."

However, it may be difficult to sustain a business model based on providing information to smallholder farmers alone, according to Sunanda Madan.

"While I believe access to information and training is important, it has to be bundled with other services and value propositions for a farmer to adopt it," she said. Sunanda explained that farmers do not find data to be a strong value proposition, and it is difficult for social enterprises to generate revenue.

"But hypothetically, if a social enterprise is solving for access to markets and overlaying with market information that helps smallholder farmers make informed decisions, that social enterprise would be better positioned for sustainability."

Based in Kenya, **Tulaa** is an example of that bundled approach. Drawing from satellite data, the social enterprise shares agronomic advice with farmers at essential moments during the crop cycle, depending on their crops, location, and inputs. Additionally, Tulaa provides credit for purchasing inputs and brokers the sale of farmers' produce with buyers.[27]

[26] USAID, Data-Driven Agriculture: The Future of Smallholder Farmer Data Management and Use

[27] Tulaa, Our Solution

PRODUCTIVITY

Improved Inputs and Mechanization

EVALUATING OPPORTUNITIES FOR INNOVATION IN FOOD AND AGRICULTURE

What are "agricultural inputs"? These include water, seeds, and fertilizer, as well as irrigation technology and other equipment that smallholder farmers use to improve their productivity.

Today, many farmers in India and Africa still water their fields by filling buckets from wells or rivers. Irrigation systems allow farmers to grow during the dry season and help them be more resilient to droughts.[28] However, about one-third of the land in Sub-Saharan Africa equipped for irrigation is actually irrigated, according to the World Bank.[29]

"Now that solar energy is so much less expensive, it's starting to enable innovations we had never imagined," said Roy Steiner. "Everything from solar irrigation pumps to solar drying and solar energy processing is just starting to become economically viable."

In Myanmar, farmers have traditionally used irrigation systems that are reliant on diesel power. **Proximity Designs** partnered with the Stanford d.school to develop Lotus, one of the world's most affordable solar irrigation pumps.[30]

Compared to Proximity's $39/0.1 acre sprinkler irrigation system, the $350 solar pump is expensive upfront. However, solar pumps are less costly to maintain than sprinkler systems, which require high fuel costs. Studies found that a farmer who replaced a diesel engine with the Lotus solar pump could break even in a year.[31] Proximity introduced a rent-to-own program to help farmers afford the initial investment.

In partnership with IDEO.org, Proximity Designs is also testing devices to inform farmers about the soil saturation in their fields. One of the prototypes is a sensor that can be inserted into the ground to measure the water levels in rice fields. Another is

[28] FAO, Irrigation Techniques for Small-scale Farmers

[29] World Bank, New Evidence Overturns Traditional Approaches to Agriculture Investment

[30] Proximity Designs, Farm Tech

[31] The Innovation Guide for Funders, Proximity Designs: The Solar Pump

a GPS-enabled smartphone app to help farmers map their fields and determine the right amount of inputs.[32]

Nigeria frequently experiences power outages. The country seems to be a strong candidate for solar-powered irrigation; however, there are surprisingly few solar products in the market, said Olúwatóyìn Emmanuel-Olubake, Associate Director for West Africa at Acumen.

"Smallholder farmers don't have the option of having irrigation because it needs to be powered," he said. "Their processing work is severely hampered because it's run by small petrol generators or they try to find manual workarounds. This impacts time, quality, and labor costs. It wipes out most of their margin."

In addition to irrigation, farmers can improve their productivity by replacing manual labor with agricultural machinery. This concept is known as "agricultural mechanization."

Founded in Kenya, **Hello Tractor** is making tractors more accessible to smallholder farmers through an Internet-of-Things (IoT) solution. A monitoring device is attached to tractors so their location and usage data can be tracked in the cloud. Then the tractors can be rented to farmers only when needed. The company is now working with farmers in Nigeria, Kenya, Mozambique, Bangladesh, and Pakistan.

Social entrepreneurs in the food and agriculture sector should prepare for long periods of testing and feedback, according to Adam Reineck, Global Design Director at IDEO.org.

[32] IDEO.org, Sensors, Smartphones, and Smallholder Farmers

"We did work on an efficient teff planter in Ethiopia," said Adam. "It's the smallest seed in the world and hard to plant evenly, so it has historically been done by hand."

"We built an early device that distributes the seed evenly without clumping," he said. "But there were three years of seasonal weirdness—there was too much rain or something went wrong and we couldn't get consistent data. Now we're just starting to scale up again."

Additionally, take note that agricultural inputs are only part of the equation for supporting smallholder farmers. Acumen learned this lesson from an early investment in MicroDrip, a company that sold smart irrigation solutions to smallholder farmers in rural areas of Pakistan.

Over a five-year period, MicroDrip only reached a few hundred farmers. At the same time, other agricultural input companies were struggling to secure farmers as customers.

Since entering the agriculture sector in 2008, Acumen has learned that smallholder farmers are reluctant to adopt new products because they could lose significantly if the product fails. Furthermore, farmers need a guarantee that their crops can be sold at a good price in the market. Otherwise, their investments in improved inputs will not pay off.

"There have been hundreds of millions or billions spent to improve farmer productivity," said Chris Mitchell. "But a farmer that grows a crop that they cannot sell is not increasing their income or getting further out of poverty."

Previously, you learned how **Tulaa** bundles credit for inputs, agronomic advice, and market linkages to support smallholder farmers. In the next section, you can learn more about this critical opportunity to create market linkages between farmers and buyers.

Driving the Adoption of Agricultural Innovations

"You have to understand that farmers and the food community are generally fairly conservative because the consequences of making a wrong decision are really dramatic," said Roy Steiner. "So it will be challenging to drive adoption of even the best technologies."

How can we encourage smallholder farmers to adopt agricultural innovations at scale? A study from Acumen and Bain & Company, "Growing Prosperity," broke down the challenge into four As: awareness, advantage, affordability, and access.

+ How can we raise a farmer's **awareness** of new products and services?
+ How can we communicate the **advantages** of adopting innovations (and reliably deliver on them)?
+ How can we ensure these innovations are **affordable** for farmers?
+ How can we provide easy and timely **access** to innovations?

Some agriculture enterprises have found success by seeking out early adopters with high social status who can model the innovation to their community. This approach is based on the "demonstration effect" or "social proof" in behavioral psychology.

ACCESS TO MARKETS

EVALUATING OPPORTUNITIES FOR INNOVATION IN FOOD AND AGRICULTURE

"One of the greatest challenges is the inability of smallholder farmers to meaningfully participate in markets," said Sunanda Madan. *"We need to replace the middlemen with transparent intermediaries so farmers get a bigger share of the pie. We need to bring about efficiency in the agribusiness value chain."*

Furthermore, many countries that grow a significant portion of the world's food are importing value-added products, rather than participating in processing locally.

Creating market linkages between farmers and buyers—and helping farmers transition from subsistence into profitable and productive businesses—is one of the most important opportunities in the food and agriculture sector.

You can think about these "access to market" models in three categories: **aggregators**, **processors**, and **vertically integrated brands**.

ACCESS TO MARKETS

Aggregators

EVALUATING OPPORTUNITIES FOR INNOVATION IN FOOD AND AGRICULTURE

These companies aggregate a large volume of produce from farmers and then sell to local and global buyers. Through this model, farmers enjoy more consistent demand for their products and avoid the exploitation of working with middlemen.

In Kenya, more than 75% of the population makes all or part of their income from agriculture. Although the sector is significant to the economy, the supply chain is complicated and inefficient, which results in low margins for farmers, high prices for consumers, and food spoilage.[33]

"A banana in a Nairobi supermarket costs more than a banana in London, while the average income of a consumer in the U.K. is 30 times compared to Kenya," said Peter Njonjo, co-founder of Twiga Foods, in an interview with Bloomberg.[34] Many residents of Nairobi spend 45% of their disposable income on food, he added.

Twiga Foods was founded in 2014 to connect farmers and buyers in Kenya's fruit and vegetable market. By streamlining the efficiency of the supply chain, the company can provide reliable prices to farmers, as well as affordable and quality food to vendors.

The company sources produce from farmers and manages the delivery and payment logistics through a digital platform. Farmers register on the platform, drop off their produce at a nearby collection center, and collect payments within 24 hours through M-Pesa. Similarly, vendors place their orders and pay on the platform.

Twiga Foods is more than a digital marketplace, however. To reduce the spoilage of bananas, for example, the company collects only green fruit from farmers. The bananas are transported to Twiga's packhouses, where they are ripened and stored in cold rooms. Once ripened, the bananas are delivered to vendors the next morning by Twiga's fleet of trucks.[35]

[33] GSMA, Twiga Foods: Improved market access for farmers and a reliable supply for vendors

[34] Bloomberg, Kenya Fresh-Produce Platform Aims to Disrupt African Retail

[35] Twiga, The Journey of Twiga Bananas: From Farm to Vendor

Today, Twiga Foods is working with about 17,000 farmers and thousands of urban vendors in Kenya.[36] But in a continent with tens of millions of farmers, how might this promising social enterprise continue to scale?

Sourcing from smallholder farmers is inherently challenging. Farmers might be in remote locations that are difficult and expensive to reach. They might have low or inconsistent productivity levels. They might also switch crops unexpectedly in response to market prices or weather patterns.[37]

Additionally, some fruits and vegetables are better suited for aggregation than others, according to Kagwiria Koome of the Rockefeller Foundation's YieldWise Initiative. YieldWise works to reduce food loss and repair broken links between farmers and markets in Kenya, Nigeria, and Tanzania.

"Aggregation doesn't work across all value chains, especially for products that are bulky, such as mangoes," said Kagwiria. "There are high transportation costs from farm gates to aggregation centers. So it is still common for buyers to travel to different farm gates and purchase from there."

Although their role in the value chain is criticized, middlemen are often knowledgeable and willing to travel the extra mile to reach smallholder farmers, Kagwiria said.

"There are different cultural norms that prevent aggregation from becoming the instrumental component we expected," Kagwiria added. "For example, if the mangoes have already been harvested, many buyers think they have been harvested for someone else. Or they believe the mangoes are not as fresh. Processors for dried fruit and juice might purchase mangoes that have already been harvested, but not the large traders."

As they grow, social enterprises like Twiga Foods will need to drive adoption among farmers and vendors who may be resistant to change. They must adapt to local infrastructure challenges, such as power outages in Nigeria that increase the cost of cold storage. Along the way, they will also need to hire skilled talent, a common challenge for social enterprises in the agriculture sector.

Finally, there is a real trade-off to acknowledge between sourcing from smallholder farmers and providing fair prices to consumers in developing regions, according to Chris Mitchell.

"An increase in income for a smallholder farmer means less disposable income for an urban consumer in Kenya," he said. "Unproductive smallholder production is not good for urban consumers. We don't want them to have to spend 45% of their income on food. So the key is productivity and efficiency—both on the farm and beyond."

[36] Bloomberg, Kenya Fresh-Produce Platform Aims to Disrupt African Retail

[37] TechnoServe, Diversification and Value Addition as Strategies to Improve the Long-term Viability of Smallholder Sourcing

ACCESS TO MARKETS

Processors

EVALUATING OPPORTUNITIES FOR INNOVATION IN FOOD AND AGRICULTURE

In the food and agriculture sector, "adding value" refers to the transformation of a raw commodity—such as coffee cherries, sesame seeds, or peanuts—into a more economically valuable product.

In the journey from growing peanuts to processing peanut butter, for example, the most value is added in the latter end of the value chain. Smallholder farmers take home only a tiny share of the final price.

By bringing this processing or "value addition" locally, farmers can capture a greater percentage of the final value. They can reduce food spoilage by increasing the shelf life of produce. Furthermore, they can meet the growing demand for value-added products.

In the post-conflict region of northern Uganda, where more than half the population is below the poverty line, **Gulu Agricultural Development Company** (GADC) is processing crops from smallholder farmers and connecting them to global markets.

Founded in 2009, GADC is the only commercial cotton ginnery in northern Uganda. The company sources cotton from more than 80,000 farmers through a network of community-based buyers. Then GADC gins the cotton—a process by which the cotton fibers are separated from their seeds—and sells it to international cotton merchants.

To reduce the risks of depending on one crop, GADC is expanding to process maize, sesame seeds, sunflower seeds, and chilies in its facilities. By sourcing new crops from its existing farmers, GADC can build loyalty and reduce "side-selling" to other buyers, a common challenge that results in unpredictable supply. GADC has also pursued other strategies to add value and increase margins, such as organic certification.[38]

In Nigeria, there is massive consumption of tomato paste, which is used daily in dishes from rice to stews. Nigerian farmers are the largest producers of tomatoes in Sub-Saharan Africa.

[38] TechnoServe, Diversification and Value Addition as Strategies to Improve the Long-term Viability of Smallholder Sourcing

Therefore, it may be surprising to learn that Nigeria is also the largest importer of tomato paste in the world. How did this happen?

Nigerian tomato farmers often lose about 40% of their yield to spoilage, a result of poor storage and broken supply chains. Furthermore, they have no access to processing facilities that can transform the tomatoes into quality paste to meet consumer demand.

In 2014, the social enterprise **Tomato Jos** began partnering with smallholder farmers in northern Nigeria to help them grow and harvest tomatoes more efficiently. They offered seeds, fertilizer, and education to contract farmers.

Like many agribusinesses, the team encountered tomato viruses, water shortages, equipment failures, and security challenges that threatened yields and the growth of the company. With each harvest, they learned and adapted.[39]

Today, Tomato Jos is operating the largest open-field tomato farm in the country. Once the farm has reached a sustainable level of production (30 tons of tomatoes per hectare at a cost of $124 per ton), the social enterprise will begin the next phase of processing tomatoes into tomato paste for the domestic market.[40]

Social entrepreneurs in the agriculture sector should expect this delayed timeline, according to Adam Reineck, Global Design Director at IDEO.org.

[39] Tomato Jos, Company History

[40] Harvard Business Review, Planting the Seeds of Positive Growth

"Things are slow on the farm," he said. "You don't have multiple iterations—you have one crop cycle in a year and that's your chance. If you're a startup trying to get data to learn if something is working, and it's a dry season and your crops fail, you won't get the data you need."

In many Indian states, the government has already introduced infrastructure for processing fruits and vegetables, according to Sunanda Madan.

"The problem with these processing facilities is that they are underutilized for the most part," said Sunanda. "A large-scale mango processing unit will only be used for three months in a year when mangoes are available."

"There is an opportunity to introduce modular and small-scale processing," she said. "A smallholder farmer could not immediately afford it, but there are different possibilities. Maybe a farmer collective could purchase it. You could also introduce modular warehouses and storage solutions."

In regions with more advanced processing capabilities, new technologies could bring greater efficiency to processing, as well.

"Sorting is an important part of primary processing—for example, sorting potatoes based on their size, quality, and appearance," Sunanda said. "This is usually done by hand on a conveyor belt visually and manually. Entrepreneurs are creating AI-based software and hardware systems that can sort different kinds of fruits and vegetables and automate primary processing."

ACCESS TO MARKETS

Vertically Integrated Brands

EVALUATING OPPORTUNITIES FOR INNOVATION IN FOOD AND AGRICULTURE

Vertically integrated brands capture the most value by aggregating supply, processing the raw commodities, and then packaging and selling the products under a brand.

In other words, these companies encompass the journey from growing peanuts to processing peanut butter and packaging it for grocery store shelves.

One example of this approach is **Cacao de Colombia**. Founded in 2009, Cacao de Colombia sources cacao from rural locations that are affected by Colombia's long history of armed conflict, drug trafficking, and particularly high rates of poverty.

The falling cocoa prices in recent years have resulted in a downward spiral for smallholder farmers: low incomes leading to low productivity and even lower incomes. Cacao de Colombia is a rare actor in the cocoa value chain that fairly and reliably compensates farmers.

Cacao de Colombia trains farmers on sustainable agroforestry to improve climate resilience and reduce the destruction of forests for farmland. By compensating farmers fairly, Cacao de Colombia is also introducing an alternative to illicit coca production and environmentally destructive monocultures like palm oil.[41]

After sourcing the cacao, Cacao de Colombia produces premium chocolate and markets it directly to consumers under the brand Cacao Hunters. Additionally, Cacao de Colombia supplies fine cocoa grains to chocolatiers, such as Dandelion Chocolate, that use the grains to produce their own chocolate bars.

[41] Inter-American Development Bank, Study of Social Entrepreneurship and Innovation Ecosystems in the Latin American Pacific Alliance Countries—Case Study: Cacao de Colombia, Colombia

How Farmer Ownership is Disrupting Food Systems in Latin America

In Latin America, Acumen's portfolio team is experimenting with a promising new model to share wealth: **farmer ownership**.

"In this model, we are co-creating companies with producer associations," said Jorge De Angulo, Associate Director for Latin America at Acumen. "We identify a promising producer association in a post-conflict area of Colombia. Then we partner with them to build a company that will add value and allow the association to commercialize."

"As the newly created company becomes cash positive, they are able to repurpose the shares from Acumen," said Jorge. "When Acumen exits, the premise is that we are leaving a functioning company that is 100% or majority-owned by the farmer association."

More than 550,000 smallholder farmers in Colombia depend on coffee farming as their primary source of income. To help Colombian farmers benefit from the growing market for premium coffee, Acumen established the **Gigante Central Wet Mill**, a world-class coffee processing facility that is operated by a local farmers' association.

Wet mills are used in coffee production to remove the coffee cherries' fruit and pulp so that the remaining bean can be washed, dried, and roasted. Most Colombian smallholder farmers do this post-harvest processing by hand. Without access to proper drying facilities, the resulting beans are lower quality and sold to middlemen at lower prices.

The wet mill and drying infrastructure allow farmers to collectively produce coffee at the volume and quality ("AAA quality") demanded by global buyers. Gigante Central Wet Mill purchases directly from the farmers' association at regular intervals and fair trade prices, and then sells the sustainably produced beans to companies like SKN Caribecafe, Nestle's primary exporter in Colombia.

Today, the farmer cooperative owns just under half of Gigante Central Wet Mill. However, as the processing facility becomes profitable, the farmers' share will grow—and the Gigante Central Wet Mill ownership model can hopefully be replicated throughout the country.

"This is a way to bring economic opportunities to really remote areas," said Jorge. "But it is early-stage and a truly different level of risk. We are able to do it because we operate with philanthropic capital. If we had to respond to investors, this would be difficult to undertake."

FOOD LOSS AND SPOILAGE

EVALUATING OPPORTUNITIES FOR INNOVATION IN FOOD AND AGRICULTURE

In developing regions, more than 40% of fruits and vegetables spoil before they can be consumed. These post-harvest losses reduce the income of smallholder farmers by 15%.[42]

In addition to decreasing the saleable harvest of smallholder farmers, food spoilage is a waste of scarce resources and a contributor to methane emissions. Food loss also threatens food security and prevents nutritious foods from reaching consumers.

In countries where nearly half of the food grown is lost to spoilage or pests, social enterprises can repair broken links in the supply chain and introduce affordable post-harvest storage, preserving, and packing technologies.

[42] The Rockefeller Foundation, Food

FOOD LOSS AND SPOILAGE

Supply Chain and Market Linkages

EVALUATING OPPORTUNITIES FOR INNOVATION IN FOOD AND AGRICULTURE

The Rockefeller Foundation launched YieldWise Food Loss in Kenya, Nigeria, and Tanzania, where up to half of all food grown is lost.[43] The program is focused on four value chains: maize, mangoes, tomatoes, and cassava.

"By 2050, we knew we needed to feed 9 billion people," said Kagwiria Koome, Program Associate for YieldWise Food Loss. "At the current production rate, we couldn't reach that number. Everyone was focused on increasing production, but we saw a gap. In some value chains, 40–50% of the food was being wasted."

One element of the program's strategy is fixing broken links in the chain from farms to markets. What exactly is the relationship between access to markets and food loss?

Imagine that you have grown a crop of tomatoes, but you cannot find an interested buyer. Or perhaps your tomatoes must be sold through several levels of intermediaries. The tomatoes might even spend days in transit on bumpy dirt roads. Your tomatoes would likely spoil before they reached a consumer.

YieldWise is working with nonprofit, private sector, and government partners to train farmers, aggregate their supply, and facilitate buyer agreements with processors and multinational companies.

To learn more about providing access to markets—including business models for aggregators, processors, and vertically integrated brands—refer to the section earlier in this brief.

[43] The Rockefeller Foundation, YieldWise Food Loss

FOOD LOSS AND SPOILAGE

Post-Harvest Storage, Preserving, and Packing

EVALUATING OPPORTUNITIES FOR INNOVATION IN FOOD AND AGRICULTURE

In addition to providing market linkages, YieldWise is helping smallholder farmers access post-harvest solutions to reduce food loss.

According to Dashiel Douglas, Director of Agribusiness at PYXERA Global, there are four categories of proven and affordable solutions:[44]

+ Storage bags
+ Cold storage units
+ Solar dryers
+ Reusable plastic crates

"There are simple solutions, like hermetically sealed bags that prevent the destruction of maize and many other crops," said Roy Steiner. "That alone could reduce food loss by 50%, if we can figure out how to get them to farmers. We have also had a lot of success with fruit fly traps that are cheap and reduce the spoilage of mangoes."

"It's not always the most expensive technologies that are most impactful," added Kagwiria Koome. "For mangoes, it's the fruit fly traps that cost $2. For tomatoes, it's the zero-energy cooling chambers. And for maize, it's the PICS bags that have been transformational."

In Iringa, Tanzania, YieldWise has partnered with Alliance for a Green Revolution in Africa (AGRA) to support smallholder maize farmers. Farmers often lose 30–40% of their stored grains. To protect from pests, some farmers store their maize with chemical pesticides, which expose farmers to long-term health risks.

Hermetic bags, such as Purdue Improved Cowpea Storage (PICS) bags, can protect grains from pests for up to one year and reduce grain losses by over 90%. AGRA works with local agro-dealers to sell the PICS bags and demonstrate their effectiveness to farmers.[45]

[44] PYXERA Global, Avoiding the Slings and Arrows of the Food Chain

[45] The Rockefeller Foundation, Reducing Food Loss in the Maize Value Chain: Bringing Agro-Dealers on Board

Kagwiria cautioned that farmers may not immediately see the value of the products.

"We went in with the message that you could store grains longer," said Kagwiria. "But the maize farmers think about the bags as health purchases. That's an interesting challenge for the sellers of the bags—what's the value proposition of this product?"

"It requires human-centered design and sitting down with farmers," she said. "What is their most pressing need? In the maize value chain, the farmers see the correlation between increased cancer and the chemicals they use for storage."

Now that studies are proving these solutions are effective at reducing food loss, how will they scale? Agro-dealers need credit to increase their stock of post-harvest technologies, while smallholder farmers need a way to afford them.

"We haven't cracked finance yet," said Kagwiria. "In two to three years, we haven't seen an affordable solution that provides finance to all the value chain actors."

For many farmers of fruits and vegetables in low-resource regions, the only option for cooling is to store freshly harvested produce in the shade. Because of high costs and unreliable electricity, cold storage equipment is inaccessible for most communities.

Micro cold storage units are a solution to reduce post-harvest losses and increase the shelf life of fruits and vegetables.

For example, **Ecozen** developed a small-scale, solar-powered cold storage unit that is sold or rented to farmers in India. The technology allows farmers to store their produce for weeks, rather than sell immediately after harvest for a lower price. Furthermore, because the units are portable, farmers can collectively purchase and share the product.

To increase adoption of the product, Ecozen educates their farmer customers through workshops and in-person visits, and provides after-sales support. Farmers can lease the product on a quarterly basis, including a free trial period. The business model is partially funded through a partnership with state governments and donor agencies.[46]

Although less effective, zero-energy cooling chambers (ZECC) can be constructed with local materials by smallholder farmers.

More recently, **InspiraFarms** introduced solar-powered cold storage and processing facilities for regions where electricity is unreliable and diesel-powered generators are expensive. The social enterprise is operating in Kenya, Mexico, South Africa, and India.

Today, InspiraFarms offers two financing options for its cold storage: a three-year payment plan to purchase on-farm cold rooms, or "pay-as-you-chill," which allows farmers who live near a cold room to pay only for the volumes chilled.[47]

Finally, another common approach to increase the shelf life of produce is drying fruits and vegetables in the sun. This method exposes the produce to dust, pests, contamination, and spoilage.

Solar dryers can be constructed at low-cost to support one farmer or an entire collective. These affordable solutions can reduce food loss and increase access to nutritious foods at the community level; however, the quality and quantity is often not suitable for larger buyers.

To learn more about connecting smallholder farmers with markets through processing,[48] refer to the "access to markets" section earlier in this brief.

[46] World Bank Group, Private Sector Solutions to Helping Smallholders Succeed

[47] InspiraFarm, Financing

[48] PYXERA Global, Avoiding the Slings and Arrows of the Food Chain

STOP + REFLECT

After reading this section, you have a better understanding of the challenges and opportunities for innovation in the food and agriculture sector. Now, which of these opportunities are you most inspired and prepared to address?

- ☐ Access to finance for smallholder farmers
- ☐ Digital technologies for loan payments, credit scoring, and insurance
- ☐ Education on farming practices and data for decision-making
- ☐ Improved agricultural inputs and mechanization
- ☐ Access to markets (aggregators, processors, and vertically integrated brands)
- ☐ Reducing food loss through post-harvest storage, preserving, and packing

Reflect on these questions:

+ Why are you excited to address this challenge?
+ Why do you believe this challenge is still unresolved?
+ What unique skills and experiences do you bring to this challenge? What skills do you need to develop?
+ What social enterprises and experts are leaders in this field? How can you build off their experience and iterate on their approach?
+ What are the gaps in your knowledge? What are your next steps to fill those gaps?

5. BUILDING PARTNERSHIPS IN THE FOOD AND AGRICULTURE SECTOR

"It all starts with the people who are engaged in the supply chain: the farmers, the traders, and the retailers," said Roy Steiner. *"It is critical to engage with them."*

Beyond these important actors, this brief introduced several stakeholders that could become partners or customers of the business model you create.

Agricultural Colleges and Research Institutions

"Colleges and research universities in Africa often have a deeper understanding of the realities on the ground," said Roy Steiner.

"For the participants in the Student Social Innovation Challenge, I recommend partnering with other students in agricultural colleges who can give a reality check," he said. "Even just a Skype collaboration is helpful—there are students and universities who would love to help."

5. BUILDING PARTNERSHIPS IN THE FOOD AND AGRICULTURE SECTOR

Governments
Ministries of agriculture could become partners in introducing crop insurance, which require risks to be spread across a large population.

Additionally, governments in Africa, India, and Latin America recognize the threat of climate change to agricultural production and food security. Therefore, they could also be partners in developing policy and private sector initiatives to support climate resilience.

Foundations and Innovation Funds
Foundations often fund and lend expertise to social enterprises. For example, The Rockefeller Foundation partnered with Stanford University professors to launch Atlas AI, a social enterprise that develops data products to support international development.

Additionally, traditional investors are hesitant to fund initiatives that support smallholder farmers. Social enterprises in the food and agriculture sector could seek funding from organizations like the Alliance for a Green Revolution in Africa, which do not anticipate high rates of return.

Corporations
One of the greatest opportunities for transforming the agriculture sector is integrating smallholder farmers in supply chains. For example, in Colombia, the Gigante Central Wet Mill is working with a farmer's association to process coffee and sell to Nestle.

Although not explored in this brief, there is also an opportunity to introduce traceability and build ethical supply chains. Social enterprises could partner with corporations to develop solutions for challenges like reducing child labor in the cacao value chain.

STOP + REFLECT

When we interviewed experts for this sector brief, we heard a few recommendations again and again:

Be humble. Listen to farmers. Get in the field. Do your research.

How can you begin building powerful partnerships in the food and agriculture sector? For each of these stakeholders, identify an opportunity to reach out and learn more:

+ Smallholder farmer associations
+ Agricultural colleges and research institutions
+ Governments and ministries of agriculture
+ Innovation funds and foundations
+ Companies that source from farmers

ADVICE *from* EXPERTS *in the* FOOD AND AGRICULTURE SECTOR

ROY STEINER
Managing Director for the Food Initiative,
The Rockefeller Foundation

Imagine the future food system you want to help build.

"You can see that, all over the world, the food system is a major contributor to global warming and greenhouse gases. Where the food system doesn't function well, conflict flourishes. We also see health problems, both from the wrong kinds of foods and undernutrition. So, food and agriculture is fundamental to a peaceful and flourishing society."

"We've optimized our food system for two things: profit and production of calories. We have not optimized it for nutrition, environmental sustainability, culture, and community. Our food system needs to optimize along all six of those factors."

"So, what would that actually look like in your region? What would it mean for land use? What would it mean for the kinds of crops that are being grown? What would it mean for the distribution system and employment, given that artificial intelligence and automation are going to change everything?"

ADAM REINECK
Global Design Director, IDEO.org

Introduce regenerative farming practices to restore soil health.

"The top soil is degrading. They say there are only 57 harvests until we run out. There is a huge movement toward changing farming practices around soil health, but it will require tricky behavior change and systems change."

"In the 1950s, farming practices were based on pumping synthetic fertilizers into the soil. The soil life dies and it increases the amount of water you need to use, as well as susceptibility to diseases. There is also a lot of nitrogen run-off that is poisoning aquifers."

"Many countries have already experienced this and ruined their environments. The global shift is about trying to introduce regenerative practices, like cover crops to feed nitrogen to the soil."

OLÚWATÓYÌN EMMANUEL-OLUBAKE
Associate Director, Acumen (West Africa)

Know your crops before founding a business.

"I have been surprised by the approach that many people have taken to investing in agriculture. For example, I have seen quite a few cases in the cassava value chain where, because Nigeria is the largest producer, people have tried to capture additional value."

"Often people just don't do the right amount of research. Hundreds of thousands or millions are spent getting land, building a processing facility, and hiring a team. In one situation I saw, only after all of that was done, they realized the site for the facility was entirely unsuitable."

"They weren't close enough to a water source. Cassava has a 48-hour window for harvesting and it has to be processed if it's going to be used for anything food grade. So the facility never operated."

Engage with farmers because theory will only take you so far.

"My biggest advice is to get out there and get involved. Because this is one of those sectors where, on paper, a lot of things will work. If you're targeting smallholder farmers, it will be next to impossible to get it right without engaging them."

"You have to understand how a smallholder farmer thinks, what is driving them, what they do, and how they do it. Whatever changes you want them to adopt will require a lot of relationship building. Don't sweat the theory too much and get out there."

KAGWIRIA KOOME
Program Associate, YieldWise Food Loss,
The Rockefeller Foundation

Know that transforming the agricultural value chain requires patience.

"Do you have the patience as a business to actually start building a new supply chain? Or do you just want to sell? Because working in this industry requires more than the core mandate of buying and selling. You need transparency and accountability. You need to be conscious about ensuring that the farmer is making the largest margin."

"If you're VC funded, they will want consistent growth. The truth is that many social enterprises will then focus on the easiest pathway, rather than the most difficult pathway, which is creating value chains."

SUNANDA MADAN
Agriculture Lead for India, Acumen

Start with small pilots and focus on product-market fit.

"It's very difficult to crack the pieces of this puzzle. You need a lot of patience to create a meaningful dent. Technology will play a big role in transforming the sector. Young people have the drive and wherewithal to create small pilots."

"Keep in mind the regional nuances of agriculture, because it's very different in India and Kenya and Colombia. Technology is an important enabler, but finding the right product and market fit is of absolute importance. Your product will need to be tailored to the specific needs and requirements of the target market. One size does not fit all."

CHRIS MITCHELL
Partner at Bain & Company and
Co-Author of Growing Prosperity

Respect the decision-making abilities of farmers.

"People say that farmers are risk averse. Actually, they're just incredibly thoughtful and sophisticated decision makers. They're constantly making trade-offs: how much land, how much into crops vs. livestock, what are the cash flow cycles, what are the expenditures, like school fees … It's not that they're illogical. You just might not understand yet."

Understand the agriculture sector from a systems level.

"We need a greater recognition that farmer-level interventions on their own are not enough. We need to approach agriculture as a system. We need the private sector, in particular, to create the demand that pulls the supply from farmers."

"There have been hundreds of millions or billions spent to improve farmer productivity. But a farmer that grows a crop that they cannot sell is not increasing their income or getting further out of poverty."

"We need a variety of actors that are aligned and coordinated and the private sector has an important role here. From corporates, large retailers, and consumer products at the end of the chain, to all of the SMEs, the processors, the logistics companies, and the agricultural input dealers."

Recognize the harsh realities of smallholder farming.

"We shouldn't romanticize smallholder agriculture. For many farmers, their number one desire is to not be farmers. It is backbreaking, onerous, and unpredictable as a livelihood. Therefore, we should really be encouraging many smallholder farmers to move into other forms of livelihood."

STOP + REFLECT

Congratulations! By finishing this sector brief, you have gained a strong foundation in the food and agriculture sector.

So, what are your next steps? Here are a few questions to get started:

+ How would you summarize the problem you want to solve in one sentence?
+ Who is your target customer? What is your value proposition for them? How might you calculate the size of this market?
+ Where can you learn more about the business models featured in this sector brief? How do they earn revenue and strive to become financially sustainable, while maximizing their social impact?
+ How can you start building relationships with partners in the field?
+ What important lessons and advice from experts do you want to take forward?

To address these questions and develop your social venture idea, we recommend that you explore two more resources from Acumen: "Lean Startup" and "Business Models for Social Enterprise."

Good luck—we're excited to see what you build!

Reading List

RESOURCE	ORGANIZATION	DESCRIPTION
One Great Idea | To Transform the Cacao Industry	Acumen	This video introduces Cacao de Colombia, an Acumen investee that sources and processes cacao from indigenous farmers.
One Great Idea | To Empower Women Through Beekeeping	Acumen	This video introduces Under the Mango Tree, an Acumen investee that shares beekeeping skills with women in rural India to improve agricultural productivity.
One Great Idea | To Protect Small Farms from Climate Change	Acumen	This video introduces Kheyti, a social enterprise co-founded by two Acumen Fellows that has created a greenhouse-in-a-box for India's smallholder farmers.
One Great Idea | To Feed a Country	Acumen	This video introduces Ethiochicken, an Acumen investee that produces disease-resistant chickens and sells them to smallholder farmers in Ethiopia to improve nutrition.
From the Ground Up: This Entrepreneur is Dedicated Her Life to Rebuilding Kenya's Farmland	Acumen	Meet Marion Moon, an Acumen Fellow that has dedicated her life to healing soil degradation in Kenya through her enterprise Wanda Agriculture.
What Do We Owe Smallholder Farmers? Everything.	Acumen	Acumen shares what the organization has learned about investing in the agriculture sector since 2008.
A Year in the Lives of Smallholder Farmers	CGAP	CGAP studied 270 smallholder families for one year to understand the lives of farmers in Mozambique, Tanzania, and Pakistan.
Private Sector Solutions to Helping Smallholders Succeed: Social Enterprise Models in the Agriculture Sector	World Bank Group	This report catalogues more than 100 social enterprises into nine business models that have supported the integration of smallholder farmers into the formal agriculture value chain.
Growing Prosperity: An Executive Summary	Bain & Company, Acumen	What does it take to get smallholder farmers to adopt products like drought-resistant seeds or microdrip irrigation systems? Acumen researched pioneer firms in agriculture to understand the keys for growing sustainably.
YieldWise Food Loss	The Rockefeller Foundation	Read the latest blog posts from YieldWise Food Loss, an initiative to reduce food loss in Kenya, Nigeria, and Tanzania, where 40–50% of food spoils before it reaches the consumer.
YieldWise Food Waste	The Rockefeller Foundation	Read the latest blog posts from YieldWise Food Waste, an initiative to reduce food waste in the United States and strengthen food security.

This sector brief was prepared for participants in ***The Rockefeller Foundation-Acumen Student Social Innovation Challenge.***

ra.acumenacademy.org

About Acumen

www.acumen.org

Acumen is changing the way the world tackles poverty by investing in companies, leaders and ideas. We invest patient capital in businesses whose products and services are enabling the poor to transform their lives. Founded by Jacqueline Novogratz in 2001, Acumen has invested more than $120 million in 119 companies across Africa, Latin America, South Asia and the United States. We are also developing a global community of emerging leaders with the knowledge, skills and determination to create a more inclusive world.

About The Rockefeller Foundation

www.rockefellerfoundation.org

The Rockefeller Foundation advances new frontiers of science, data, policy, and innovation to solve global challenges related to health, food, power and the expansion of US economic opportunities. As a science-driven philanthropy focused on building collaborative relationships with partners and grantees, the Foundation seeks to inspire and foster large-scale human impact that promotes the well-being of humanity throughout the world by identifying and accelerating breakthrough solutions, ideas and conversations.

Author

Written by Lauren Caldwell of Acumen, 2019.