

Resilient.

Farmers.

Investing to Overcome
the Climate Crisis

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THE WAY
THE WORLD
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The Busara Center for Behavioral Economics is an advisory and research organization focused on advancing and applying behavioral science in pursuit of poverty alleviation across Africa, Asia, and Latin America, with active operations in Kenya, Tanzania, Ethiopia, Nigeria, Uganda, and India. They work with organizations to understand individual and social behavior among customers and end-users, and to build behaviorally-informed solutions to help scale products, programs, and policies. Their methods have been applied across projects in financial inclusion, education, agriculture, health, policy, and governance. For more information, please visit: www.busaracenter.org.



Climate resilience is a state of being. It is a condition in which a person can anticipate climate-related threats, adapt to them where possible, absorb them as needed, and recover in a timely manner.



A Word from Acumen

ON MAY 6 I RECEIVED A PICTURE from Diego Benitez, the founder of an agribusiness in Colombia, of hail covering the fields. His text said that the farmers could not face quantifying the damage to their crops. When they finally did, 80% was lost and, without products to sell, both the farmers and the business were at risk.

From hail to droughts to floods, smallholder farmers are forced to navigate the consequences of climate change daily. Climate resilience — the ability to anticipate, weather, and bounce back from shocks and long-term deterioration — is increasingly a requirement for survival.

Agricultural platforms offer a wide range of solutions that can help smallholder farmers adapt to climate change, increase their productivity, and raise their incomes. But developing solutions is only half the battle; farmers not only need to see the value in a product, they also need to trust the provider in order to benefit.

Acumen partnered with the Busara Center for Behavioral Economics to hear directly from smallholder farmers and learn what they need from a platform. The findings of this research — funded by the United Kingdom Foreign, Commonwealth, and Development Office's Strengthening Impact Investment Markets for Agriculture program — outlined in this report, reflect farmers' perspectives and provide agribusinesses and investors with the knowledge to design inputs and services that help farmers build their climate resilience and sustainably increase their yields and incomes.

At Acumen, supporting agribusinesses that help smallholder farmers is central to our mission of tackling poverty. For 20 years, we have listened to the voices of smallholder farmers and invested in companies that meet their needs. With this report, we are once again centering the voices of those we seek to serve in an effort to enable deeper and more effective relationships between smallholder farmers and agribusinesses in order to unlock greater investment in building the resilience of farmers.

This work has given us greater insight into why a farmer may or may not engage with a specific agricultural service or company. It has shown us once again the power of long-term, risk-tolerant capital to offset the challenges that bedevil early-stage businesses and vulnerable customers. And it has reiterated that creative partnerships have always been, and will continue to be, a crucial element of a thriving and sustainable agricultural ecosystem.

We have done our best to internalize these learnings. The newly launched Acumen Resilient Agriculture Fund (ARAF) exemplifies this approach. As the first ever equity fund to focus on climate resilience for smallholder farmers, ARAF seeks to close the capital gap facing agribusinesses on their journey to scale and strengthen their efforts to build resilience among smallholder farmers.

To effectively navigate the climate crisis, we urgently need to invest in smallholder farmers' adaptation and resilience. We hope this report can serve as a resource for agribusinesses and investors alike.

CARLYLE SINGER
PRESIDENT, ACUMEN

Climate.

Change.



Executive summary

Climate change is not a risk for the world's 475 million smallholder farmers. A risk is the threat of a future event; climate change is here and becoming resilient to its effects is imperative for farmers' livelihoods. A new crop of agricultural platform companies aim to facilitate climate resilience by connecting farmers with integrated offerings of inputs, financial services, training, and markets. But to be successful these companies must first understand how farmers conceptualize climate change, and how they perceive offers that could enable resilience.

To further this understanding, Acumen, funded by the United Kingdom Foreign, Commonwealth, and Development Office's (FCDO) Strengthening Impact Investment Markets for Agriculture (SIIMA) program, collaborated with the Busara Center for Behavioral Economics and eight agricultural platforms in sub-Saharan Africa. Together, we interviewed 360 smallholder farmers in Ethiopia, Kenya, Nigeria, and Tanzania.

We found that farmers associate climate change with extreme heat, a lack of rainfall, and high winds. These cause droughts and soil erosion, and can lead to sick livestock, low crop yields, and an increase in poverty and hunger. To offset these challenges, farmers pursue two main strategies: they pray to God or Allah for help, and they apply

agricultural chemicals, even in droughts where overuse of chemicals may exacerbate the damage. Farmers generally believe these approaches to be successful and avoid more complicated strategies such as crop rotation or adaptive financial services.

Farmers then told us that they appreciated platforms offering high-quality fertilizer and seed, as well as access to training and expert advice. Some farmers welcomed the ability to buy on credit; others worried about obligations they could not repay. All farmers were eager for more training, sometimes more than platforms could provide.

"In the case of our previous farming processes, it wasn't research-based, and there was no support...but now experts are coming to us and telling us about what we need to do and how."

MALE FARMER FROM ETHIOPIA

At the same time, farmers struggled when platforms' contract terms or quality standards were not clear, or when input delivery was not on schedule. Unclear terms and uncertain deliveries create ambiguity, and farmers were deeply averse to having any more ambiguity in their lives. Even farmers who heard about bad experiences secondhand were less willing to experiment with platform offerings.

"We don't understand how they reject part of our products, and these rejections are impacting our income."

FEMALE FARMER FROM ETHIOPIA

Summary and recommendations

This report illustrates the uphill battle that smallholder farmers and agricultural platforms face, and the tight margins in which they are forced to operate. Data from Acumen's agricultural investments corroborate these challenges of funding extension work and scaling high-touch, low-margin models. However, this report provides recommendations for agricultural platforms and investors on how to overcome these barriers and design solutions for smallholder farmers that help them build their climate resilience.

For companies:

- **Build trust** with farmers by supporting their current practices, before pursuing longer-term behavioral shifts.
- Find the **right partnerships** that enable training and consistent service delivery for climate-resilient products and services.
- Endeavor to deliver inputs **timely and consistently**, then be proactive when delays inevitably happen.
- Be upfront with farmers about the terms and risks of your offerings.

For investors:

- **Be patient.** Experience shows that investments in agricultural companies may take time to show returns.
- Develop or leverage tools **to identify platforms** that enable farmers to become resilient to climate change.
- Explore more nuanced metrics to track **beyond top-line growth** numbers.
- Help **deepen the evidence base** around agricultural platforms and their effectiveness at enabling climate resilience.



The Acumen Resilient Agriculture Fund (ARAF) is our attempt to put these recommendations in action. ARAF invests in early-stage agricultural platforms that enable climate resilience. It uses a scorecard to identify effective climate resilient models, leverages a first-loss layer to unlock private capital for those models, and uses a technical assistance facility to help cover the costs of farmer training.

These recommendations (building the evidence base, increasing investment to scale end-to-end solutions) also align closely with the emerging Action Agenda for the '[Transforming Agricultural Innovation for People, Nature, and Climate](#)' campaign co-chaired by FCDO and the CGIAR Research Program on Climate Change, Agriculture, & Food Security (CCAFS).

Meeting the Sustainable Development Goals around food and climate will require ambition, innovation, and vastly more capital than has been allocated. That money will remain unavailable unless companies can design services that meet farmers' needs, deliver them consistently, and reach scale while retaining users. Growing deeper roots takes time, and smallholder farmers have not a moment to lose.



Resilient.

Agriculture.

**A new era for
smallholder farmers
and agribusinesses.**

HAFSAT HAS BEEN A FARMER FOR SEVEN YEARS.

She enjoys being one of the 20 or so women farmers in her area; women are not often seen as farmers and she takes pride in it. A couple of years ago, Hafsaf wanted to farm rice because it has a good profit margin and is tolerant to the increasing heat and rainfall she sees in her part of Nigeria. She wanted to start with two hectares, but Hafsaf did not have the money for seed, fertilizer, or pesticides. Then one day a friend recommended she speak with a company operating in her area, called Thrive Agric.

For a small deposit, Thrive provided Hafsaf with enough high-quality inputs to grow a hectare of rice, and when her harvest came in they paid a premium over prevailing market prices. Thrive recovered its loan from the proceeds from selling that rice and returned Hafsaf her share; when the next season came, she doubled her area of cultivation. Unfortunately, that year did not go as planned. Poor rainfall and rice butterflies combined to significantly reduce her crop, causing Hafsaf to lose approximately three-quarters of her yield.



Climate change represents an existential threat for the world's 475 million smallholder farms.¹ Rising temperatures and unpredictable rains are steadily intensifying the already formidable risks of smallholder agriculture, while weather-related disasters such as droughts, floods, insects, and disease take an increasingly frequent toll on farmers' yields. Becoming resilient to both long-term climate shifts and short-term shocks will require rapid access to, and adoption of, climate-resilient agricultural products and services. This includes not only technologies such as irrigation or drought-resistant seeds, but also timely information about weather patterns and imminent risks, as well as the training needed to take advantage of these services, amplify technologies, and connect farmers with high-value markets.

Private enterprise aids farmer resilience

Thrive is one of a new crop of private companies that are helping farmers adapt to the reality of climate change, and in doing so to become resilient and more productive in the face of its effects. These companies are seeking to ally themselves with smallholder farmers like Hafsat across Africa and around the world.

The SIIMA program, funded by the FCDO, was created to transform the agriculture sector and livelihoods of low-income smallholder farmers — like Hafsat — by building a pipeline of high-impact businesses — like Thrive Agric — that deliver innovative, climate-smart products, as well as improving the investment and impact measurement solutions needed to scale those businesses. SIIMA aims to help address the \$170 billion gap in smallholder financing that must be closed in order to meet the world's Sustainable Development Goals by 2030.²

As part of this program Acumen, together with the Acumen Resilient Agriculture Fund (ARAF), partnered with the Busara Centre for Behavioral Economics to conduct research that would allow us to understand smallholder farmers' experience and perception of climate change, how it influences their beliefs and behaviors, and the factors that drive them to adopt or reject new agricultural solutions that would help them to manage the impacts of climate change.

Helping investors and agribusinesses to enable smallholder resilience

The lessons from this report are meant to help agribusinesses refine their operating models and build local partnerships to better cater to smallholders' needs and realities. They are also meant to assist investors in identifying businesses that offer strong value to smallholders and have the operating models and partnerships in place to sustainably reach them, as well as informing investor decisions around the type of capital needed and best modes of support.

Acumen and patient capital

For the last 20 years, Acumen has deployed “patient capital” into social enterprises that are tackling problems of poverty, such as the need for climate resilience. For Acumen, patient capital means *philanthropically-backed* investments (such as debt or equity) in early-stage companies serving poor customers. But patient capital is more than that. It helps to create markets and build new sectors for social impact. It is an investing approach that does not sacrifice the interests of end customers for the sake of shareholders, but still demands accountability in the form of a return on capital. Patient capital has three key characteristics:

Patience

Acumen often waits 7-12 years to exit investments, giving companies time to find the right model and route to scale.

Impact-Focused

Patient capital maximizes social, not financial returns. Impact comes first.

Pioneering

Philanthropic capital enables us to invest in higher-risk ventures, filling the funding gap for social innovations where commercial capital is unable or unwilling to invest.





Existential. Threat.

Climate change has a ruinous impact on smallholder farmers.

SMALLHOLDER FARMERS ARE UNIQUELY VULNERABLE to the effects of climate change. While there is no universal definition of smallholder farmers, they are most commonly defined as farmers who cultivate land that is less than two hectares in size. Per this definition, in 2016 there were approximately 475 million smallholder farmers worldwide, largely located in tropical countries in South and Southeast Asia, and sub-Saharan Africa. Most of those are subsistence farmers who depend on rainfed agriculture.³

In developed markets, there is still a sense that climate change will disrupt lives in the future. For smallholder farmers, that threat has already arrived. Temperatures are rising,

and rainfall is dropping. Increasingly severe droughts are reducing grain yields, especially in lower-income countries,⁴ and disrupting livestock production.⁵ Natural disasters caused crop and livestock losses of more than \$108 billion in poor countries between 2008 and 2018, with the majority linked to weather-related events caused by climate change, such as droughts, floods, and insect infestations.⁶ The frequency and severity of these disasters has increased dramatically since the 1970s and 1980s, coinciding with a global rise in temperatures.⁷ Heat also makes forests and other areas more susceptible to crop fires⁸ and creates heat stress on farm laborers, particularly in Africa and Asia.⁹ Rainfall variability caused by increased temperatures also poses a serious challenge, reducing food security and impacting farmer's livelihoods.¹⁰ More indirectly, climate change is also exacerbating conflict and fueling migration.¹¹

These climate shocks are growing in both frequency and intensity. In 2018, for example, a tropical cyclone across the Arabian Peninsula and East Africa created the perfect breeding grounds for desert locusts and, from 2019 to 2020, a severe locust outbreak destroyed crop production in many East African countries, leading to widespread food insecurity.¹² Sub-Saharan Africa, where agriculture contributes one-sixth of the region's GDP¹³ and employs more than half of all employed people,¹⁴ is particularly vulnerable to these climate impacts.

Weathering the storm

Defining Resilience, Adaptation, and Climate Change

As temperatures rise and weather patterns shift, smallholder farmers are being forced to alter the way they farm, and even the way they live, to maintain their livelihoods. This collective response to a changing climate brings to the fore two concepts

which are critical to understanding the role of agricultural platform companies: *resilience* and *adaptation*.

Resilience can be thought of as a desired state, where a person is able to anticipate risks, adapt to them, absorb their impact, and bounce back quickly. In the case of climate change and agriculture, climate resilience is the ability of affected people, communities, and systems (in this case farmers, agricultural communities, and value chains) to maintain or improve their status in the face of climate change.

A resilient farmer can anticipate threats, such as the increased frequency of severe droughts, through information services and training. They could then adapt through a combination of strategies such as drought-resistant seed, irrigation, rainfall-indexed insurance, and diversified income. When a drought did occur, these adaptive strategies could allow them to maintain a sufficient level of income, and bounce back using some combination of insurance payout, savings, and input financing for the next season. Each of those steps (anticipate, adapt, absorb) is a capacity; together they equal resilience.¹⁵

Adaptation, as is shown in this example, is adjustments to systems in the face of challenges that create resilience. The UN Framework Convention on Climate Change describes climate adaptations as “changes in processes, practices, and structures to moderate potential damages or to benefit from opportunities associated with climate change.” Adaptation is a necessary process, while resilience is a desired state of being. One leads to the other, but ongoing resilience may require multiple cycles of adaptation.

Unfortunately, climate resilience is far from reality for most smallholder farmers. Too many smallholders rely on increasingly unpredictable rains; just 1% of cultivated land in Africa is irrigated.¹⁶ Use of drought-resistant seed is rare: in one study of six

African countries, the median national take up rate was below 20%.¹⁷ Access to credit remains a vital problem for many smallholders,¹⁸ while microinsurance policies are persistently underused. The products and services that are most needed to enable climate resilience seem to lack effective business models for reaching smallholders.

New crop of ideas

Fortunately, new innovations and technologies are being developed and bundled together in innovative business models to help farmers become more resilient to the effects of climate change.

By 2030, the African Development Bank predicts Africa's agribusiness sector will be worth \$1 trillion.¹⁹ Agribusinesses have been expanding across the continent, largely thanks to rapid advances in technology. Entrepreneurs in recent years have launched businesses to address critical gaps in production and distribution, developing products and services to provide farmers with everything from access to markets to on-demand soil testing services.

Many agribusinesses have begun bundling key products and services together to decrease costs and increase scale, while offering farmers a one-stop-shop for their critical needs. In this report, we call these types of bundled business models “**platforms,**” as they connect buyers and sellers of goods and services (such as fertilizer, input finance, and produce). ISF Advisors and the Rural and Agriculture Finance Learning Lab define an agricultural platform as a business that “creates value by enabling interactions among multiple users.” We expand on this by including businesses that offer multiple agricultural products or services themselves. The term “platform” may be initially confusing, as it evokes a purely digital service, but we believe it is the most accurate to capture the nuance of these businesses.

Such platforms offer farmers access to a variety of climate-resilient products and services. Adapting a framework from the Overseas Development Institute (ODI),²⁰ products and services reinforce climate resilience if they satisfy one or more of the following criteria:

- **Learning** increases a farmer's ability to gain information on climate change and adaptation strategies and deepens their awareness of the risks or threats faced.
- **Options** provide farmers with choices, such as purchasing drought-resistant seeds or even changing physical locations if natural disasters and/or weather variability affect output.
- **Flexibility** enables farmers to withstand and recover from climate shocks.

Many platforms provide farmers with training and advice, which facilitates learning. Some platforms offer agricultural loans, increasing the options available to farmers. Agricultural loans can also provide flexibility if they are used to help farmers better withstand climate shocks, such as purchasing irrigation systems or inputs for intercropping.

Types of Platforms

After reviewing the existing platforms across East and West Africa, we grouped them into four categories based on their primary offerings:

- 1. Agriculture technology platforms** offer farmers a suite of products and services centered around locally adapted technology solutions, such as irrigation or drought-resistant seed, often bundled with training to encourage proper usage.
- 2. Agriculture finance platforms** provide financial tools to help farmers address liquidity gaps and mitigate risk, such as input credit that allows farmers to purchase high-quality inputs and make payment after harvest, or agricultural insurance.



3. Vertically integrated platforms source high value crops directly from farmers while providing inputs, training, and credit for activities within specific value chains, then sell the crops primarily in regional or export markets.

4. Land aggregation platforms lease land from smallholder farmers within a specific region, then aggregate the farmland so it can be farmed more efficiently under a single management entity.

Same farm, new tools

Even though these platform offerings have the potential to improve farmers' yields and increase their resilience to climate change, significant factors are inhibiting platforms from scaling. On the supply-side, there are substantial funding and infrastructure gaps. Agriculture SMEs in sub-Saharan Africa face a debt financing gap of approximately \$80 billion a year, while the agriculture sector in sub-Saharan Africa has attracted less than 10% of all impact capital invested in the region.²¹ Meanwhile the infrastructure needed to scale their solutions (quality roads, local processing, widespread irrigation, and electricity) is often lacking.

On the demand side, past research has revealed that, in general, many farmers possess behavioral characteristics that can impede adoption of new products or services. For example, in their literature review of behavioral factors that affect the adoption of sustainable farming practices, Dessart et al. (2019) cite several studies of European countries that describe how **present bias** deters technology take up and use. Farmers who are present biased will disproportionately forgo investments in machinery where the benefits occur in the future, but the costs must be paid immediately. Duflo et al. (2011) found this holds true for farmers in Kenya, who procrastinate purchasing fertilizer, as this purchase entails immediate costs with uncertain longer-term benefits.

In addition to present bias, past research has established that **ambiguity aversion** factors into farmers' decisions to take up and use new technologies. People generally prefer known risks and outcomes over the unknown. We will accept a certain degree of risk, provided the risks are well-established. Ambiguity aversion can spur technological adoption, if it removes more ambiguity than it creates.²² But it can also deter people from adopting new technology: a study of agricultural insurance in Kenya and Malawi found that ambiguity aversion influenced take up of the product among farmers. Payouts were contingent upon irregular rainfall, but the probability of irregular rainfall was unknown to farmers. Farmers who were averse to ambiguity did not take up insurance, uncomfortable with what they did not know.²³

Lastly, poorer smallholder farmers, and poor people in general, labor under a heavier **cognitive burden**. It is exhausting to be poor and requires significantly more decision-making and prioritization around money matters. This mental load has been shown to actually increase risk aversion.²⁴ Farmers

have demonstrated worse decision-making capacity before harvest (when they lack money) versus after (when they have it).²⁵

At the same time, there are behavioral forces that *encourage* smallholders to engage with, and even use long-term, new technologies and services. **Social proof**, or information about how others are behaving, can have a powerful influence on how community members act, inducing a **bandwagon effect**. Most of us want to be included, to be on the winning side, and are likely to defer to a perceived wisdom of the crowd. These are inherent characteristics which can lead people to “hop on” to new trends.²⁶ Lastly, when companies behave morally and demonstrate social responsibility, this has been shown to create a **noble edge effect** that can lead to consumer respect and increased profits.²⁷

Beyond the behavioral aspects, Tam et al. (2015) found that four practical factors must be in place to facilitate adoption of new agricultural technologies or services: **awareness, advantage, affordability, and access**. Put simply: farmers will not use methods they do not know about, are not available to them, cannot afford, or do not think will add value.

Infrastructure and delivery challenges can make these factors difficult to achieve and maintain. But physical infrastructure is not the only barrier: Inadequate mobile connectivity, high data costs, and low digital literacy levels prevent farmers — women and elderly farmers most of all — from accessing digital products and services.

Any one or a combination of these physical and behavioral factors can influence a farmer's decision to adopt a new company's offerings. Investigating which of them hold the greatest influence, and therefore must be addressed by platform companies, was the overarching goal of this research.

A photograph of a farmer in a striped shirt and brown pants working in a vegetable field. The field is organized into raised beds with black plastic mulch. The farmer is bent over, tending to the plants. The background shows lush green trees under a clear blue sky.

Farmer.

Research methodology and framework.

OUR RESEARCH AIMS TO IDENTIFY those demand-side enablers and barriers to platform adoption among smallholder farmers in East and West Africa, focusing specifically on platforms that help farmers adapt and become more resilient to climate change. We used cognitive mapping and life cycle modeling to determine farmers' mental models of climate change and the specific ways it impacted their decision-making as well as their overall livelihoods. We then identified specific enablers and barriers to adoption of products and services that can enable adaptation to climate change.

With these findings, we aim to provide practical advice to platform companies and their current or potential investors. This advice can help to stimulate demand for platforms that strengthen climate resilience, and address behavioral and structural challenges that keep smallholder farmers from accessing the products and services that they need.

Perspectives.

Platform partners

Acumen and Busara chose eight companies to accompany us on this research. Each of them offer more than one climate-resilient product and/or service, based on the ODI definition above. The eight companies are spread across four different markets: Ethiopia, Kenya, Nigeria, and Tanzania; see *Table 1*.

Working with these companies to identify customers, we conducted a total of 152 in-depth interviews, focus group discussion, and cognitive mapping exercises across four countries: 25 in Ethiopia, 64 in Kenya, 38 in Nigeria, and 25 in Tanzania. Our complete sample consists of 360 farmers (100 of whom were women) and 12 company employees or agents.

The 360 farmers were broken up into:

- **Youth farmers**, between ages of 15 and 24.
- **Leader farmers**, either heads of local farming associations or farmers cultivating larger-than-average farms. They are likely to be wealthier than their peers and have higher social standing.
- **Mid-tier farmers**, who are not leaders of farming associations and whose landholdings are roughly equal to the average in their area.

Roughly one-third were customers of platform companies, one-third were aware of companies but did not use their services, and one-third were unaware of these companies. For a full breakdown of the sample, please see the Appendices.

The following sections present the findings of this research, followed by analysis and recommendations.

TABLE 1: Types and locations of agricultural platforms who partnered in this research

	Ethiopia	Kenya	Nigeria	Tanzania	Total
Agriculture Finance		2	1		3
Agriculture Technology		1			1
Vertically Integrated	1		1	1	3
Land Aggregation		1			1
Total	1	4	2	1	8





Adaptation. Strategies.

Research findings and analysis.

A MENTAL MODEL IS A PERSONAL EXPLANATION OF HOW A THING WORKS.

If you see the price of a taxi rise during rush hour and interpret that as the result of surging demand, you are applying a mental model of “supply and demand” to an everyday phenomenon. Our mental models are the frameworks that guide our decision-making and underpin our preferences, actions, and beliefs.²⁸

A critical part of our research was to understand farmers’ mental models around climate change and its effects. When rain patterns and temperatures changed, or when harmful pests and diseases affected their livelihoods, what mental framework did they use to interpret those events? How did those models guide their responses? And, most important for companies that want to serve these farmers, how would those mental models encourage or inhibit the adoption of climate-resilient agriculture practices?

To answer these questions, we conducted cognitive mapping exercises with farmers, which created visual representations of cause and effect. To create the maps, we asked several farmers to help us identify all variables involved in making climate-related decisions from their perspective. We then asked separate groups of farmers to categorize those images into causes of climate change, impacts of climate change, adaptation strategies, and outcomes, then explain their decisions and provide examples. Lastly, we analyzed the maps to identify commonalities and develop a shared mental model. Through this exercise, we were able to detail how farmers think about and react to climate change, beginning with the causes, continuing to how climate change influences their farming activities, and ending with the perceived outcomes of these activities. The result is the cognitive map in *Figure 1*.

Findings

The farmers in our sample experience a variety of climate shocks and irregular weather patterns, which they deem to be atypical and unpredictable. About three-quarters of farmers believe these climatic changes are man-made and extend beyond normal seasonal changes. When farmers think of climate change, they primarily think about lack of rainfall, extreme heat, and strong wind. They identified carbon emissions from industry, deforestation, and bush burning as key causes of these extreme changes in temperature and rainfall.

These changes lead to droughts, dried-up streams and rivers, and soil erosion. These, in turn, can dry out crops, ruin pasture land for livestock, and bring insects and pests that destroy crops, such as scorpions, locusts, and weevils. If these effects are not addressed, they can have disastrous outcomes for smallholder farmers:

- Livestock become less healthy, lose weight, and are more vulnerable to disease.
- Dried-up crops, infertile soil, insects, and flooding can all reduce yields.
- Food shortages lead to hunger, poverty, and sickness.

To avoid these outcomes, most farmers use several main strategies:

- Whenever yields suffer, regardless of the cause, most farmers perform two activities; approximately 45% of farmers in our sample pray to Allah/God to increase their yields, and about 50% of farmers in our sample apply fertilizer.
- In response to insects and pests specifically, farmers spray insecticides.
- To manage dryness caused by lack of rainfall and extreme heat, farmers irrigate in a variety of ways, including watering crops manually; using drip irrigation; storing water in tanks; and digging ditches, furrows, and canals to collect rainwater.

Overall, farmers perceive these adaptation strategies to be successful. They consider prayer, fertilizer, and irrigation all effective ways to keep crops healthy despite droughts, extreme heat, and soil erosion. Insecticides eliminate pests, improving crop health. Together, these strategies help farmers maintain or even increase yields. Although many farmers had stories of crops ruined by lack of rain or insects, for the most part they were able to adapt and keep themselves and their communities from going hungry.

Analysis

Two main findings emerge from this exercise.

First, farmers apply fertilizer whenever there is any sort of problem on their farm, which can lead to fertilizer overuse and exacerbate the effects of climate change.

The consequences of excessive chemical fertilizer seeping into groundwater and running off into waterways include polluted water sources and water scarcity, as well as damaged aquatic plants and animals. Fertilizer overuse can also worsen climate change by releasing greenhouse gases into the atmosphere and further depleting the ozone layer.²⁹

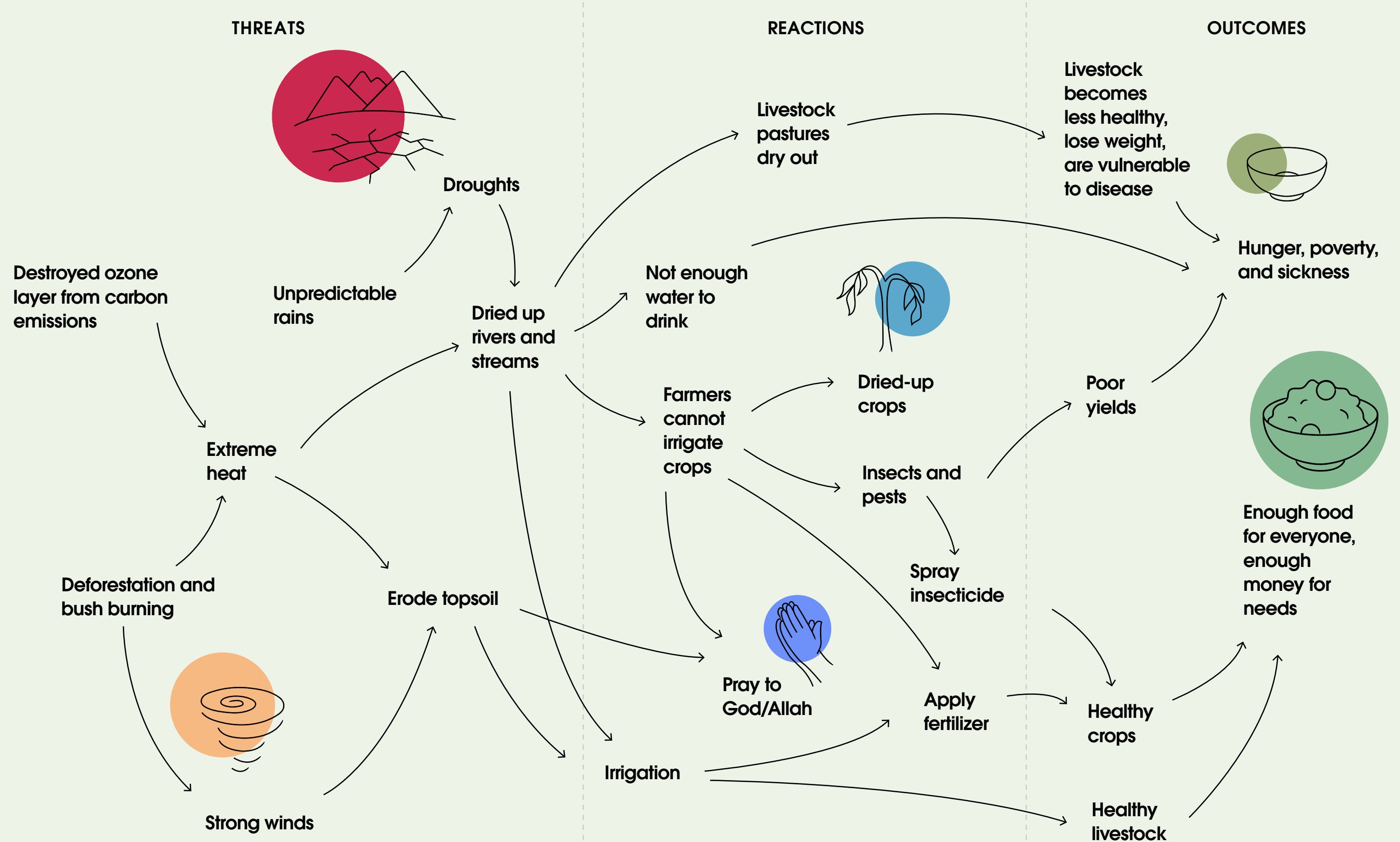
Second, farmers implement relatively simple climate change adaptation strategies — such as applying agrochemicals, implementing various irrigation techniques, planting drought-resistant seeds, and searching for alternative water sources —

rather than more effective, but complex, adaptation. Few farmers discussed diversifying crops or practicing intercropping, both of which are effective adaptation strategies that many platforms can support. Similarly, financial instruments such as loans and insurance were not critical to the farmers' shared mental model, even though they are the primary adaptive services offered by the agriculture finance platforms in our sample. This may relate to a general discomfort with credit, which is discussed below.

Lastly, farmers' first response to threats was often prayer. This may not fit within our traditional lens for analyzing a business, but no one serving smallholders should ignore the deep importance of faith in their lives. Working with religious organizations can be helpful to understand users' lives and concerns.



FIGURE 1: Cognitive map of smallholder farmers' perceptions of, and reactions to, the effects of climate change





Life cycles

During the interviews and discussions, we asked farmers to detail the steps they follow when cultivating crops or raising livestock. We then asked them to describe which steps climate change is impacting, the effects that climate change has on each step, and how they respond. We analyzed their responses and identified commonalities among the life cycles to create generalizable farming life cycles that are not specific to one crop or animal. This helped us better understand the farming practices of users and potential users of platforms and gave us a nuanced view of how farmers perceive climate change is impacting their activities.

The farmers in our sample cultivate a wide variety of crops (such as maize, coffee, tomatoes, or rice) and nearly all the farmers in our sample also raise livestock (e.g. poultry, cows, or sheep).

Figure 2 shows the common steps involved in crop cultivation and Figure 3 shows the steps involved in animal rearing. Certain steps, such as applying fertilizer, are repeated multiple times throughout the cycle.

FIGURE 2: Steps in the crop cultivation life cycle

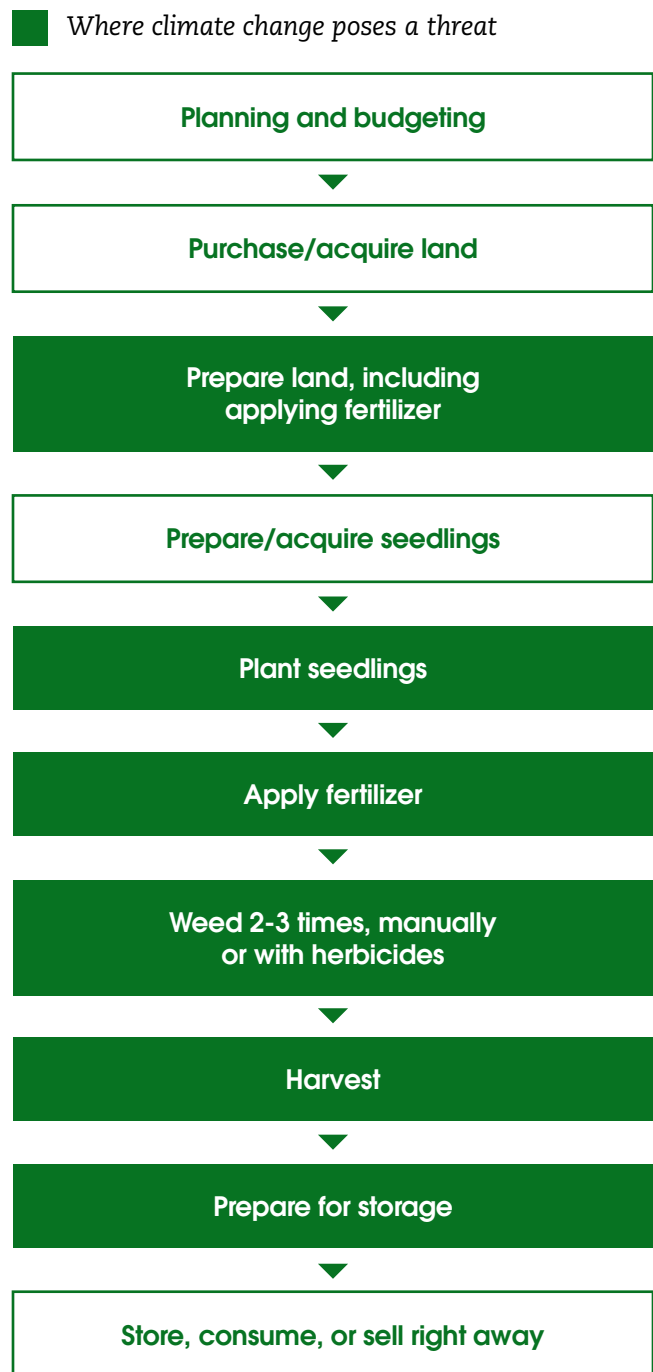
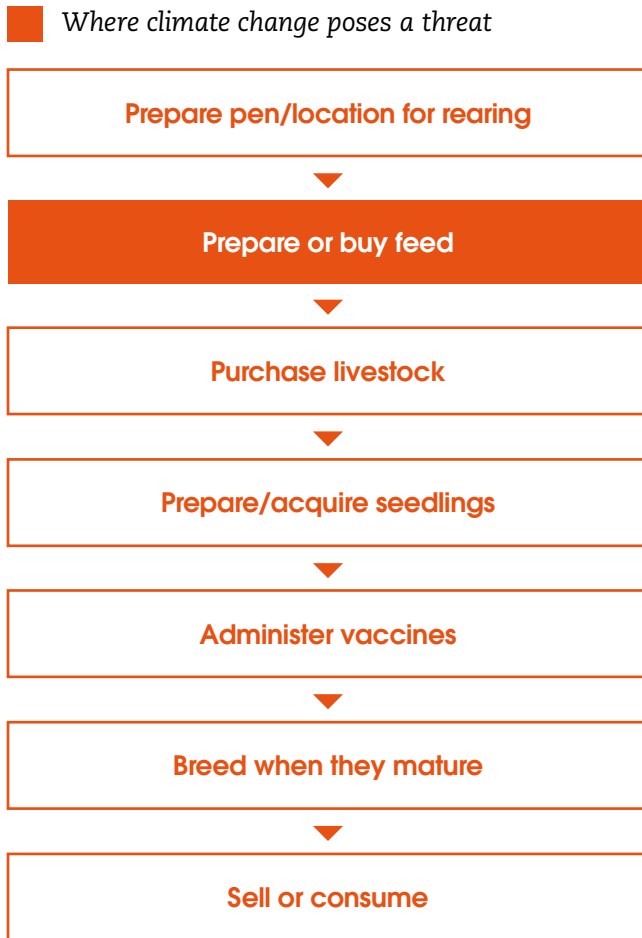


FIGURE 3: Steps in the livestock farming life cycle

As you can see, climate change poses a significant challenge for farmers at key points in the cycle:

- Lack of rainfall dries out and kills grass, which is a main source of livestock feed.
- During planting season, unpredictable rainfall can wash away or dry out seeds.
- Whenever farmers apply fertilizers and herbicides, unpredictable rainfall can either wash away or dry out agrochemicals, rendering them ineffective.
- Irregular rainfall rots or dries out crops, leading to poor yields at harvest.

- Farmers implement various strategies along each of these steps to adapt to the effects of climate change, which include:
 - When planting, farmers use drought-resistant seeds that can withstand extreme weather conditions.
 - To manage lack of rainfall, some farmers use irrigation techniques, including mechanized irrigation systems, and digging ditches and furrows to store water.
 - Farmers use similar strategies to manage heavy rain, digging furrows and canals in addition to building dams, to protect their crops from flooding.
 - As we saw in the mental models, whenever there is any sort of problem, regardless of cause or step within the cycle, farmers apply fertilizer to try and boost yields.



Enablers.

Barriers.

Examining farmers' experiences with agricultural platforms.

ONCE WE HAD UNDERSTOOD FARMERS' MENTAL MODELS of climate change and the specific ways it affected their agricultural cycles, we began asking how agricultural platform companies had succeeded or failed in helping farmers to become more resilient to the effects of climate change. We asked platform-specific questions, such as: "How did you get to know about [platform]?"; "Could you describe the requirements for becoming a user of [platform]?"; and "What services does [platform] give you?"; etc.

Based on the responses, we identified four key steps in a farmer's experience with a platform. If all goes well, the steps look like this:

- 1 | Attract**
Farmers learn of the platform and are attracted to it.
- 2 | Take Up**
Farmers sign up and are onboarded onto the platform.
- 3 | Use**
Farmers engage with the platform and the climate-resilient products and/or services offered on it.
- 4 | Continued Use**
Farmers choose to continue using the platform over extended periods of time.



TABLE 2: Summary of farmers' experiences with agricultural platforms

However, these steps are also places where issues can arise, perceptions can be altered, and customers can be lost. Analyzing farmers' responses, we identified enablers and barriers at each of these steps — factors that encouraged or discouraged farmers to continue interacting with a given platform.

We discovered that some of these enablers and barriers were factors that the farmers do not have direct control of, such as infrastructure and platform offerings. We called these structural factors. Behavioral factors, on the other hand, were enablers or barriers that included beliefs, perceptions, and biases, and we identified these factors by applying theories from behavioral science.

See Table 2 for summary of farmers' experience with platform companies offering climate-resilient agricultural services.

		Attract	Take Up	Use	Continued Use
Enablers	Structural	<ul style="list-style-type: none"> • Prospect of improved livelihoods • Providing: <ul style="list-style-type: none"> - Consumable inputs - Financial services - Training 	<ul style="list-style-type: none"> • Easy application process 	<ul style="list-style-type: none"> • Providing: <ul style="list-style-type: none"> - Consumable inputs - Training - Proactive support - Expert advice 	<ul style="list-style-type: none"> • Perceived effectiveness • Providing: <ul style="list-style-type: none"> - Consumable inputs
	Behavioural	<ul style="list-style-type: none"> • Social proof • Bandwagon effect • Satisfaction from understanding farmers • Noble edge effect 	<ul style="list-style-type: none"> • No hassle factors 	<ul style="list-style-type: none"> • Reduced physical and cognitive burdens 	<ul style="list-style-type: none"> • Trust • Eagerness to prove themselves
Barriers	Structural	<ul style="list-style-type: none"> • No buying or price guarantees • Impolite platform implementers 	<ul style="list-style-type: none"> • Registration requirements • Ineffective "grassroots" community outreach 	<ul style="list-style-type: none"> • Supply constraints 	<ul style="list-style-type: none"> • Supply constraints • Lack of understanding of terms and conditions
	Behavioural	<ul style="list-style-type: none"> • Distrust and resentment 	<ul style="list-style-type: none"> • Ambiguity aversion • Fear of not fulfilling platform demands 	<ul style="list-style-type: none"> • Ambiguity aversion • Mistrusts from opaque off-taking agreements • Present bias 	

Attract

Enablers

Most of the platforms in our sample offer a combination of **products and services that farmers find appealing**. Due to changing conditions and soil deterioration, farmers are becoming more dependent on fertilizer to achieve the same yields as previous years. One in five farmers were attracted to platforms for access to affordable, high-quality fertilizer, as well as other key inputs, including seedlings and herbicides.

“The inputs the beneficiaries received were of high-quality. The seedlings produce high and quality yields, so do the fertilizers.”

MID-TIER, NON-USER, NIGERIA

Additionally, farmers are attracted to offerings that complement these inputs:

- **Access to finance:** Farmers value having access to loans with repayment schedules that allow them to borrow money at the start of the season to purchase inputs, then repay at harvest.
- **Education:** Farmers want to learn best practices for cultivating specific crops, new innovations in farming, and how to correctly use agrochemicals. Education and training on farming practices are factors that attract farmers to platforms.

Farmers believe these products and services — consumable inputs, training, and access to finance — will boost their yields and increase their incomes, allowing them to better **feed their families** and pay for school fees, improving their overall standard of living.

“From what we learnt, using it (the platform) is beneficial for both our household consumption and what we can sell at the market...”

FEMALE, USER, ETHIOPIA

Behavioral characteristics also attract farmers to platforms. Within a given community, successful platform users offer non-users a form of social proof and an incentive to take up and use platforms so that they can become successful as well. The bandwagon effect is also powerful; farmers want to use a platform because their friends and neighbors are doing so.

“...there were about four or five people who joined for the first time, and the number has been increasing ever since. That was how we joined.”

LEADER, USER, ETHIOPIA

Farmers are satisfied that platforms truly understand the challenges experienced by themselves and their peers. When platforms provide expertise and end-to-end support for the crops that are cultivated in a certain community, farmers get the impression that the platform **understands their needs** and experiences.

“What attracted me to (platform) is that the programs they brought (to the community) were good concerning farmers cultivating maize, soya bean, and rice, and that is what farmers do here. That made a lot of people happy.”

MID-TIER, USER, NIGERIA

Similarly, a third of farmers in our sample genuinely believe that most of these platforms are **doing good work for their communities**. They experience the noble edge effect, whereby they respect the platform’s mission, and as a result, they are attracted to the platform.

“Let me say (the platform) has uplifted (us) from the bottom to the top because we have learned many things, and they have assisted us as a community.”

FEMALE, USER, KENYA

Barriers

Although many farmers were initially attracted to the platforms for the products and services offered, others were put off by some of the terms and conditions for platform usage, as well as the **negative experiences of their peers**, who are platform users.

Selection criteria can also create distrust and resentment: A few platforms have requirements that farmers must satisfy to join, most commonly land size. Farmers who were rejected from a platform without being given an alternative began to question the platform's good intentions.

“They are providing (products and services) only to some farmers. We don't know what the problem of the organization is.... We don't know what is behind the organization and what its intentions are.”

LEADER, NON-USER, ETHIOPIA

Some platforms that encourage farmers to grow new crops (such as vanilla or green beans) and provide off-take solutions lack any sort of price guarantee for farmers, which makes them uneasy and triggers risk aversion. Before they invest in cultivating a new type of crop, **farmers want assurance** that they will earn a profit for their output. Without a price guarantee, they may understandably avoid the platform.

“...It is difficult because when you enter into a contract with someone, you will have a price that this item will sell, but if the price changes and they (the buyers) come up with a new price, you must just sell it to them (at the new price).”

YOUTH, NON-USER, TANZANIA

Platforms that are exporting crops require them to be of very high quality, and refuse to buy produce that does not satisfy their quality standards. This impacts platform users and influences prospective users, who are afraid that they will experience a similar situation.

“The (platform users)... say that the organization complains about the products, saying that it is crooked and the like, and they are rejecting their products. This issue seems risky to the farmers who want to join the organization.”

FEMALE, NON-USER, ETHIOPIA

Leader farmers are influential members of their communities and expect a level of respect. Impolite platform staff or agents can cause leading farmers to reject the platform, and others to follow.

“...but the experts (platform implementers) are not considerate, though they speak the same language as the community. They are not considering the requests of the farmers.”

LEADER, NON-USER, ETHIOPIA

Take Up



Enablers

Approximately 40% of farmers believed that registration processes were quick and easy, presenting no significant barriers to uptake. For some platforms, field staff even traveled to the farmers, so the farmers did not have to leave their homes or communities, **removing any potential barriers** posed either by lack of transportation or time required to travel.

“It is nice because you don’t go to them, they come to you. You can use your phone to call the field officers and tell them you have your farm and you wish to become a member. They come to you, take pictures, give you a membership identification number, and register you.

LEADER, USER, TANZANIA

Barriers

Despite the uncomplicated processes, registration requirements such as minimum land holdings or registration **fees can be difficult for many farmers** to overcome.

“For me, I would say yes (registration is easy). It’s just that I couldn’t afford the money needed to register. They needed members to deposit ₦8,000 (\$20).”

FEMALE, NON-USER, NIGERIA

Some platforms failed to deliver complete information or contact channels at the local level. Interested farmers had only a rough idea of the products and services platforms provide, and no idea how to access more information. Farmers even asked our moderators for details on the platforms’ offerings.

“I have just heard people talk about them, but I have never seen them. I wanted to follow up, but I did not know exactly where they are”

YOUTH, NON-USER, KENYA

Lack of complete information can trigger ambiguity aversion: Farmers do not want to register for platforms without understanding what they offer and any potential risks, particularly if the offerings involve credit, as formal financial services are new for many farmers. To counter this ambiguity, farmers in our sample stressed **the importance of training** and demonstrations that allow them to learn how platform offerings work. Even farmers that had received initial training

on platform offerings requested more, suggesting that ambiguity aversion strongly influences the take up decision.

“Yes, we had (initial) interest, but now we want some more light, more training so that we get to know more.”

LEADER, NON-USER, KENYA

Even when farmers have complete information, they may not take up a platform if they **are afraid of not fulfilling platform demands**. For example, farmers may fully understand the terms and conditions of input loans, but still choose to not take on debt they are not confident in repaying. No product or service will appeal to everyone; over time platforms will identify which offerings are resonant for which segments of smallholder farmers.

“On the issue of loans for farm inputs or farm machinery, let us say the weather changes and affects your farm. You will not recover all of the capital you had used, so you will run at a loss”

YOUTH, NON-USER, KENYA

Use

Enablers

Platforms help farmers become more resilient and make their lives easier in several ways:

First, platform usage helps reduce farmers' cognitive burdens. Interviewees explained that having guaranteed access to inputs at affordable prices and support with their farming activities makes them feel less stressed. Reducing cognitive burdens is important for an individual's well-being and can improve decision-making by **freeing mental space for better decisions.**³⁰

“The difference in my farming practice is that (platform) has reduced the serious stress I faced in farming. You don't even think about borrowing again... Everything is done by (platform). Your job is just to monitor the crops until maturity, and then you harvest.”

LEADER, USER, NIGERIA

Second, their products and services help reduce the physical effort that farmers must exert. Moving from hand-weeding to an herbicide sprayer decreases both the effort and amount of time required to remove weeds. Farmers often said that the products and services offered by platforms would give them a chance to rest.

“One of the potential benefits I am looking forward to getting from (platform) is the fact they will assist me with all the farming I do with them, and I will have time to rest from doing farm work.”

FEMALE, NON-USER, NIGERIA

Having guaranteed access to affordable, high-quality consumable inputs also motivates farmers to use what platforms offer. In the past key inputs would be out of stock or suddenly increase in price at key points in the crop cycle. Platform offerings help overcome these challenges.

Plus, platforms provide training on a wide variety of topics that complement their product offerings, including on proper agrochemical application. A third of farmers said they value this training, as it helps de-risk agrochemical usage by **educating them on its benefits** and the potential side effects of over-use.

Relatedly, farmers also use platforms for the advice and support that they provide. Platform implementers encourage farmers to seek their assistance proactively, which helps farmers manage small challenges before they become major issues. Farmers also have access to expert consultations **and value the research-based advice** that these experts provide.

“...what we are applying is what has been approved by research. In the case of our previous farming processes, it wasn't research-based, and there was no support from experts... but now experts are coming to us and telling us about what we need to do and how.”

LEADER, USER, ETHIOPIA

Barriers

There are several pain points in the platforms' offerings and operating models that pose barriers to usage. Most challenging for farmers are supply constraints, particularly **stockouts and delivery delays**. Farming activities revolve around seasons; if farmers do not have access to critical inputs exactly when they need them — whatever the reason — then they will proceed without using these inputs, leaving them vulnerable to climate shocks and negatively impacting their yields.

“Their challenge is timing; they usually come when we have already planted.”

LEADER, USER, KENYA

In addition to supply constraints, similar failures to communicate trigger behaviors that inhibit use:

- **Ambiguity aversion:** Platform users gravitate towards products and services that they are familiar with, often avoiding new and innovative offerings. This aversion is understandably stronger with financial services, such as loans and insurance. Demonstrations of their value will eventually provide comfort, and so may lower-risk ways of experimenting with these products.
- **Opaque off-take agreements** cause mistrust, making farmers reluctant to sell their produce to platforms. Farmers do not understand why some produce is rejected or bought at a lower price, meaning quality standards are not well-understood. One

platform stopped providing receipts for purchases, without offering any explanation. Not having a receipt of sale made the farmers uneasy, which led to several farmers dropping off of the platform.

“They say that some of (the crops) are broken, withered or gone bad... We don't understand how they reject part of our products, and these rejections are impacting our income. It seems that they are rejecting about 99% of our products and approving only about 1%.”

FEMALE, USER, ETHIOPIA

Finally, in alignment with the existing literature, we observed that **farmers in our sample are present-biased** regarding investments in agriculture technology. They mentioned the need for certain equipment to mitigate inevitable climate disasters, such as irrigation pumps to manage lack of rainfall. However, they ultimately decided to not invest in these pumps, even though it was in their best interest, because the equipment was too expensive in the moment. If platforms offer expensive machinery for rent or purchase, farmers may be hesitant to invest, despite large future returns.

“...you find that the cost of implementing those technologies (drip irrigation) is high, especially to a farmer trying to establish themselves. This makes it difficult to use this technology”

YOUTH, USER, KENYA

Continued Use

Enablers

Many farmers stay on the platforms for their offerings, particularly for access to high-quality consumable inputs, which they purchase frequently. Providing farmers with **a reliable and affordable supply of consumable inputs** keeps them on the platform for extended periods of time.

Plus, when platforms **deliver on what they promised** — access to inputs, on-time delivery, etc. — farmers continue using their products and services, as they build trust in the platform.

“...(platform) has given me the money we agreed, plus pipes, so their service is good, that is why I trust them. They can decide to charge me for other things, but they don’t. So, I believe they are legitimate.”

LEADER, USER, TANZANIA

Farmers also perceive platform offerings to be effective at expanding their skills, increasing their yields, and improving their livelihoods, which encourages continued use. This perception is particularly important among younger farmers, who said they like when their farms are more successful, as it gives them influence in their communities and positions them as **a leader among their peers**. They will use platforms so long as they are able to deliver results.

“You will get a lot of produce and other people will get a little; that is why (other farmers) will come and ask you what you used, so that he can use it next year...”

YOUTH, USER, TANZANIA

Barriers

We identified two key barriers to continued platform use. First, the **same supply constraints and opaque off-taking arrangements** make it difficult for farmers to justify using the platform in the long run. Instead, farmers find other, more reliable suppliers for their inputs and buyers for their produce.

Second, for platforms that offer financial services, farmers do not always understand **the terms and conditions of financial products**. Some farmers take on too much debt and fail to repay their loans, limiting their access to future credit. Other farmers grow frustrated when they do not receive insurance payouts when they believe they are eligible, and thus, they drop off the platform.

“(The platform) can insure someone, then the crops fail to yield, but they don’t get reimbursed. They start blaming you for it.”

LEADER, USER, KENYA



Analysis

Several key themes arise from our findings, showing the promise and the challenges of for-profit models that want to reach smallholder farmers at scale.

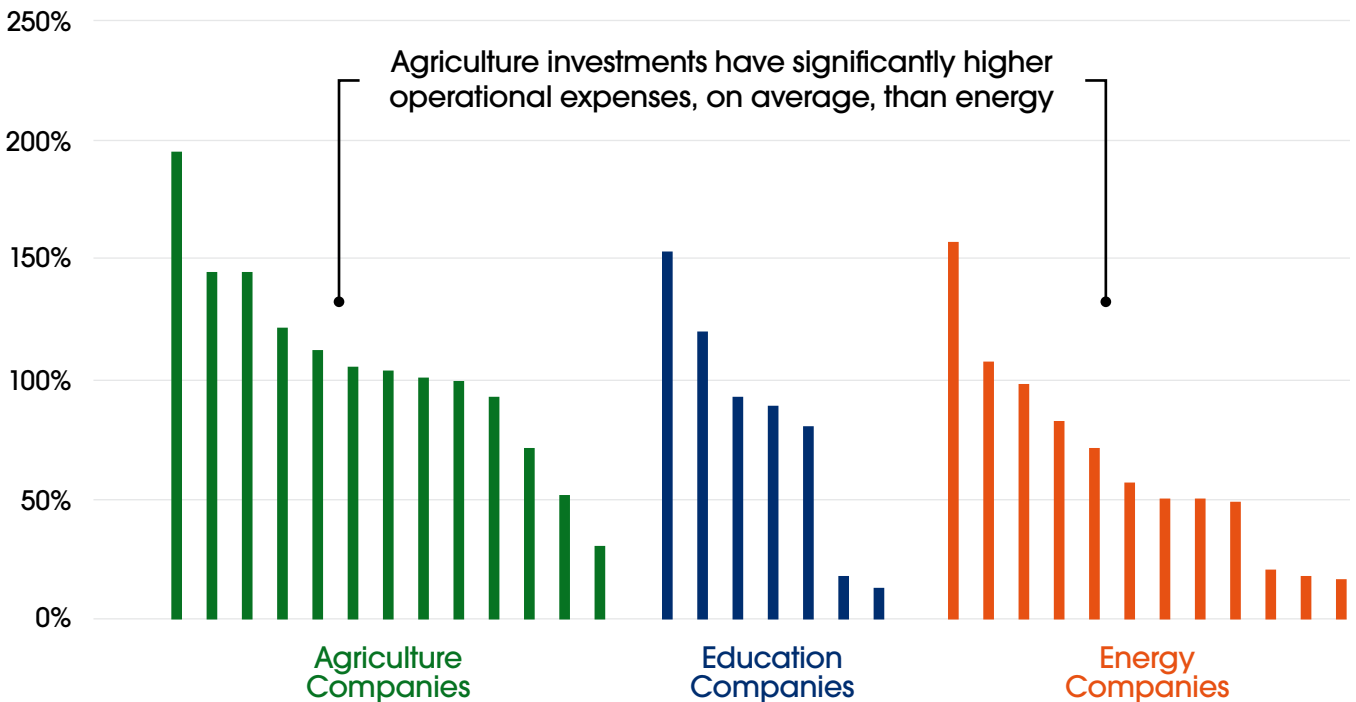
Farmers are attracted to platforms that offer high-quality inputs, especially agrochemicals, as these are a key component of farmers' climate adaptation and access to a reliable, high-quality supply is critical. Farmers also value the services that accompany inputs, such as input financing that can be paid post-harvest, training on best practices, and expert advice. They trust platforms which meet farmers where they are, understand their context, and help them to become more resilient to changing weather.

However, inconsistent delivery of inputs or (seemingly) unpredictable off-take arrangements can undermine that trust, inhibit use, and lead to drop off. Non-users who observe their peers struggling to receive inputs on time or get paid for produce are

unlikely to sign up. To encourage take up and long-term use, platforms should ensure that they can consistently deliver their offerings and that farmers understand the terms of any agreement. The farmers in our sample also demand extensive training from platforms on new products and services to fill information gaps. Consistent delivery and high-touch training can build trust between farmers and platforms, and overcome ambiguity aversion among farmers, spurring initial take up and facilitating sustainable growth.

Yet these improvements are easier written than implemented. Platforms serving smallholder farmers operate in environments with generally poor communications and transportation infrastructure, making it difficult to consistently deliver both products and information. To further complicate matters, most of the platforms we studied are early-stage social ventures, with limited access to capital, that are focused on maximizing the efficiency of every dollar. Long-term investments with uncertain returns (e.g. infrastructure or

FIGURE 4: Ratio of operational expenses to revenue for individual companies in different sectors of Acumen's portfolio



training) or less-efficient use of working capital (e.g. stocking excess inventory) are unaccounted for in their business models. This echoes findings from the Initiative for Smallholder Finance (2021) that “Platforms serving smallholder farmers often have no choice but to build...enabling infrastructure themselves—the cost and maintenance of which severely limits the viability of these business models.”

Evidence from Acumen’s portfolio supports this. We see much higher levels of operational expenditure as a percentage of revenue in agriculture than in education or energy (see *Figure 4*). Profitability ratios in energy (although still negative on average) are 20% higher than in agriculture .

These problems can be compounded by investors, who may push for what Tam et al. (2015) call ‘bad scale’, asking companies to prematurely expand to new geographies or customer segments in search of growth that may prove unsustainable. This contrasts with “good scale,” which is described as “defining core market and competencies, values, processes, market entry routines, hiring/training/managing employees, and

developing/institutionalizing the customer feedback and learning systems.” Bad scale is fast but rootless, and unlikely to endure. Good scale is slower, but more resilient.

In summary, farmers need the climate-resilient products and/or services that platform companies offer if they are to improve their livelihoods in the face of climate change. But within a traditional, scale-at-all-costs venture capital model, platform companies may struggle to maintain operational consistency and foster long-term farmer relationships. Therefore, two actions are critical:

1. For companies: design around farmers’ mental models as they are, before trying to effect long-term shifts in agricultural practices. This means achieving consistent operational delivery and high-quality training, which will likely necessitate local partnerships.

2. For investors: find the right platforms that design around their users’ needs and embrace partnerships; enable them to reach “good scale” with appropriate, patient investments.



A photograph of a person, likely a farmer, wearing a patterned dress and boots, holding a bundle of soil and plants in a field. The person is looking down at the plants. The background is a blurred green field.

Growing.

Solutions.

Recommendations for agribusinesses.

1. Meet farmers where they are by listening to them, building trust, and supporting their current adaptation strategies, before pursuing longer-term shifts in those strategies.

Agribusinesses in rural sub-Saharan Africa operate under the long shadow of exploitative markets and decades of failed development. The burden is on them (as well as investors and donors) to build trust with farmers who are, and should be, skeptical that this time will be different.

How do businesses rebuild trust? Start by listening to farmers and understanding their preferences, actions, and beliefs around climate change. From there, companies can offer products and services, as well as evidence and testimonials of their social mission, that align with existing mental models. Begin with farmers' current climate change adaptation strategies — fertilizer, pesticides, and accompanying training and financing — and show that these can be supported, before trying to effect change. Behavior shifts may follow but are unlikely without trust.

Lastly, radical transparency is the only way to ensure that farmers can trust your business. One of Acumen's portfolio companies, Azahar, provides detailed unit economics of the coffee they sell to the farmers on their platform. Farmers know how much they were paid, as well as Azahar's costs and profit.³¹ This is the level of disclosure that platforms may need to earn the trust of their customers.

2. Find the right partners and partnerships that enable training and consistent service delivery for climate-resilient products and services.

Platforms that offer bundled products and services can benefit from providing more training and adopting a longer-term approach to growth and customer retention, but the added costs must be borne by someone: investors, customers, or a third party.

Finding dedicated, mission-aligned partners with a local presence can fill the critical gaps in platform models. Some of the most successful agribusinesses that Acumen has invested in or observed have been those that leverage NGO or governmental extension networks (such as Kheyti and Promethean in India) or blend farmer revenue with grant funding to subsidize non-revenue services like training and agronomic extension (such as One Acre Fund in Kenya).

3. Endeavor to deliver inputs timely and consistently, then be proactive when delays happen.

Nearly all the platforms in our sample provide farmers with some sort of support for acquiring inputs. Farmers need these inputs in a timely manner, and failure to deliver may cause them to drop off the platform and discourage their peers from joining. However, platforms operate in uncertain environments and face a variety of challenges posed by poor infrastructure and climate change.

To minimize these risks, platforms could consider adopting even more vertical integration to give them control over their supply chain. Examples include growing seedlings in the company's own greenhouses across target areas and in-house delivery with motorbikes. They could also collect data on farmer activity, helping the platform improve demand management. This data could be used to help platforms become more agile, which is becoming more necessary, as farmers are modifying their activities to adapt to unpredictable and ever-changing weather conditions.

Though, inevitably, these efforts will still fall short at some point. When that happens, platforms that can proactively alert farmers of the delay and help them find other input sources will do the best at maintaining trust and retaining users.

4. Be upfront with farmers about the terms and risks of your offerings.

Lack of information triggers ambiguity aversion. As mentioned above, transparency in communication and training should address this aversion by focusing on proper usage of new products and services, as well as the potential risks, and the terms and conditions associated with usage. Educating farmers on the possible downsides of usage, as well as the terms and conditions of financial or off-take agreements, will set expectations, help them manage risks, and decrease drop off in the long run.

Recommendations for investors and donors.

1. Be patient: experience shows that investments in agricultural companies may take time to show returns.

Investors in climate-resilient agriculture face a difficult task of growing companies (and a sector) that is riskier and slower than typical return expectations allow. Since

2007, Acumen has invested comparable amounts in the energy sector (\$27 million in 26 companies) and agriculture sector (\$36 million in 30 companies). Over that time, our energy investees have attracted more than \$300 million in follow-on capital (11× our initial outlay). By contrast, our agricultural investees have raised \$114 million, or just 3× our initial investment. Investments in agriculture require more patient capital, with a higher risk-tolerance and a longer horizon for payback.

2. Develop or leverage mechanisms for identifying platforms offerings that enable farmers to become resilient to climate change.

This research demonstrates the value of mental models and life cycle analysis for companies considering which climate-resilient products smallholders are likely to adopt. Similarly, investors must build their own frameworks to screen potential investments, based upon their ability to enable climate resilience and eventually achieve profitability.

There are a growing set of tools to help investors evaluate companies. Lean Data and other surveys offer affordable mechanisms for gathering farmer feedback. Acumen has worked with Winrock International to create a screening tool for ARAF that identifies weather and climate risks to farmers, assesses whether a given company's offerings increase resilience to those risks, and tabulates a resilience score out of these and other variables. Busara Center has helped develop a scorecard that evaluates the number and type of products/services that companies offer which enable adaptation and/or resilience.

3. Explore more nuanced metrics to track beyond top-line growth numbers.

Investors cannot and should not abandon scale as a metric but must find ways to monitor and incentivize “good scale” as opposed to “bad.” One approach is to include

retention and intensity in their impact assessments in lieu of focusing solely on customer acquisition. Retention measures the number of farmers who stay on the platform for a given period of time and intensity refers to the depth of use, such as upgrading to a higher service or buying more quantity of the same service. If both retention and intensity grow, then the promised value proposition and desired impact are likely being delivered to farmers.³² Another mode is to track more nuanced operational metrics, such as the percentage of inputs or farmer payments that are delivered on-schedule.

4. Help deepen the evidence base around agricultural platforms and their effectiveness at enabling climate resilience, while developing more segmented insights.

We derived the insights described throughout this report using a relatively small sample of farmers; we posed open-ended, probing questions, allowing us to uncover a range of enablers and barriers, and explore underlying behaviors. One of the drawbacks of our method is that our small sample is not representative of the larger population of smallholder farmers across East and West Africa. A larger survey with a representative sample of smallholder farmers could determine whether these findings hold across the broader population.

A larger sample size will also enable more segmented findings. Smallholders are not a monolith; more data will allow us to detail how certain subgroups process and respond to climate change, as well as how they engage with platforms. These reactions will also likely vary by country and geography. We can develop these segments into personas, giving realistic examples of farmers within the target market for platforms, and help turn market statistics into humans.

5. Make long-term investments in infrastructure and ecosystems to remove the need for vertically-integrated models.

Stepping back to view the findings of this report, they revolve around the critical need for bundled agricultural solutions that help smallholder farmers to become climate-resilient in the short-to-medium term. But this need exists because of crippling infrastructure and ecosystem gaps, which companies must fill on their own.

There is a sector-wide demand for improved infrastructure, more effective training and extension services, and long-term capital with a high-risk tolerance. There is a common theme among these: in richer countries these services were, and often still are, public goods. In China agricultural extension services have been provided by the government, in one form or another, for over 2,000 years. A surge in spending on research and development, combined with a nationwide highway program, was crucial for growing agricultural productivity in the United States during the 1950s and 1960s.

Low-income countries are lacking in all manner of infrastructure, and their resources to address these issues are limited. This is where donors play an invaluable role. Through first-loss guarantees or junior tranches in debt funds, donors can help to unlock private capital for agricultural platform companies. Moreover, they can structure grants and technical assistance to help those companies overcome infrastructure barriers and integrate more robust advisory services. They can build the foundation of a robust agriculture sector, enabling the kind of specialization that creates rapid growth. See the Case Study on ARAF for an example of what a donor-enabled investment structure can look like.

The recommendations in this report align closely with the emerging Action Agenda for the [‘Transforming Agricultural Innovation for People, Nature, and Climate’](#) campaign co-chaired by FCDO and the CGIAR Research Program on Climate Change, Agriculture, & Food Security (CCAFS):

- Increasing investment in agricultural research and development and the sciences more broadly to deliver more climate-resilient and low-carbon technologies and practices, and take these to scale through tailored, multi-stakeholder implementation.
- Rethinking public agricultural research for development, allocating more public investment in ‘end-to-end’ solutions that help us meet the ambitions of the UN Global Goals on food and climate.
- Showcasing successful business models and developing public-private partnerships that help deploy technology at scale.
- Building consensus on evidence-based approaches and inclusive dialogue among key institutions.

Case Study: Acumen Resilient Agriculture Fund

Acumen is partnering with the Green Climate Fund, FMO, and other investors to launch the Acumen Resilient Agriculture Fund (ARAF), a 12-year, \$50+ million returnable equity fund. ARAF will invest in agriculture platforms that promote climate resilience, as well as ICT and financing companies that create the supporting ecosystem necessary to address many of the challenges raised in this report. Its mission is to disrupt the traditional role of smallholder farmers in the agricultural ecosystem — as low-productivity price-takers — through investment in precisely the types of services that the platforms in this report provide.

ARAF was structured with the goal of ameliorating the persistent challenges that agricultural platforms face. Two key components of ARAF stand out, that we wish to see replicated elsewhere:

- A first-loss pool of capital that will allow ARAF to have the necessary risk tolerance to invest in early-stage agricultural platform. If some of ARAF's investments cannot become financially sustainable, the fund itself can be resilient to those losses while continuing to support its other investments.
- A significant Technical Assistance Facility that is meant to help portfolio companies experiment with new technologies and outreach strategies including innovative farmer training, world-class technical advising, and gender-focused initiatives that drive long-term value for the portfolio companies, for ARAF, and for future investment in climate adaptation.

ARAF is at the beginning of its journey, having only closed five investments as of June 2021. Acumen and ARAF look forward to sharing lessons learned in the future.



A person wearing a blue cap, a blue face mask, and an orange life vest is sitting in a blue boat on the ocean. The boat is viewed from the front, showing two blue seats. The ocean is a deep blue, and the sky is a pale, hazy blue with some light clouds. The word "Catalyze." is written in large, white, sans-serif font across the top left of the image.

Catalyze.

Change.

TO FIND A WAY FORWARD for climate-resilient agriculture, we need more likeminded investors to acknowledge the risks but also the opportunity — to commit to standing with these companies as they deliver needed services to farmers. Without a combination of more patient growth expectations and additional support, critical agriculture platforms may struggle to provide the high-quality products and services that are necessary for smallholder farmers to be resilient to climate change. In that case, platforms may either need to scale down their offerings or target them towards more affluent market segments. Either way, the farmers most vulnerable to climate change are the ones most at risk of being left behind.

Endnotes

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Appendices

APPENDIX 1: Farmer demographics by demographic group

	Female	Youth	Mid-tier	Leader	Total
% female	100%	36%	45%	24%	29%
Average age	39 years	22 years	41 years	42 years	36 years
Average land size (hectares)	2.06	1.55	2.15	4.2	2.49
Crops cultivated	Arrowroot Avocado Capsicum Banana Barley Beans Carrot Cassava Cowpeas Green beans Groundnut Kale Maize Millet Onion Pawpaw Peanut Rice Soybean Sunflower Sweet potato Teff Tomato Vanilla Wheat Yam	Banana Beans Beetroot Benniseed Capsicum Cassava Chilli Coffee Green beans Groundnut Guinea corn Inset Jackfruit Kale Khat Maize Mango Millet Onion Passion Fruit Peanut Rice Soyabean Sugarcane Sunflower Sweet potato Teff Tomato Vanilla Wheat Yam	Avocado Benniseed Cassava Chilli Coffee Green beans Groundnut Guinea corn Inset Kale Maize Millet Onion Peas Potato Rice Sorghum Soyabean Sunflower Sweet potato Teff Tomato Vanilla Wheat	Agroforestry Avocado Banana Beans Benniseed Boma Rhods Capsicum Carrot Cassava Cattle grass Coffee Collard greens Cotton Green beans Groundnut Guava Inset Khat Lentil Maize Mango Millet Orange Peas Rice Sorghum Soyabean Sugarcane Sweet potato Teff Tobacco Tomato Vanilla Wheat Yam	Agroforestry Arrowroot Avocado Banana Beans Barley Beans Beetroots Benniseed Boma Rhods Cabbage Capsicum Carrot Cassava Cattle grass Chilli Coffee Collard greens Cotton Cowpeas Green beans Groundnut Guava Guinea corn Inset Jackfruit Kale Khat Lentil Maize Mango Millet Onion Orange Passion Fruit Pawpaw Peanut Peas Potato Rice Sorghum Soyabean Sugarcane Sunflower Sweet potato Teff Tobacco Tomato Vanilla Wheat Yam

APPENDIX 2: Number of interviewees and interviews conducted by demographic groups

		Female Farmers	Youth Farmers	Mid-tier Farmers	Leader Farmers	Platform Implementers	Total
User Groups	Number of users Interviews	30	27	27	31	N/A	115
	Number of non-users with platform exposure	34	31	33	27	N/A	127
	Number of non-users with no platform exposure	36	19	36	29	N/A	120
	Total number of farmers	100	77	96	87	0	360
Interview Types	Number of focus group discussions	24	21	24	21	N/A	90
	Number of in-depth interviews	4	7	4	7	12	6
	Number of cognitive mapping exercises	8	8	8	8	N/A	48
	Total number of interviews	36	36	36	36	12	152



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