



Lessons from the 2021 Conference

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Acronyms

ALDDN	Advancing Local Dairy Development in Nigeria
AMEA	Agribusiness Market Ecosystem Alliance Network
AVERP	AgResults Vietnam Emissions Reduction Challenge Project
CEO	Chief Executive Officer
CINSERE	Climate Information Services for Increased Resilience and Productivity in Senegal
COP	Chief of Party
COP26	United Nations Climate Change Conference
CQD	Cargills Quality Dairy
CRS	Catholic Relief Services
DNA	Dairy Nourishes Africa
DR	Dominican Republic
EQ	Export Quality
FSMA	Food Safety Modernization Act
FSP	Financial Service Provider
GHG	Greenhouse Gas
GSMA	Global System for Mobile Communications
HKI	Hellen Keller International
ICRW	International Center for Research on Women
ICT	Information, Communication and Technology
IESC	International Executive Service Corps
IFC	International Finance Corporation
IYF	International Youth Foundation
JOBS	USAID/Tunisia Jobs, Opportunities and Business Success
M&E	Monitoring and Evaluation
MFI	Microfinance institution
MIRA	Measurement Indicators for Resilience Analysis
MOD	Market Oriented Dairy
MSME	Micro, Small, and Medium Enterprise
NCBA CLUSA	National Cooperative Business Association Cooperative League of the USA
NGO	Non-Governmental Organization

PASP	Private Agricultural Service Provider
PSE	Private Sector Engagement
RFMS	Rapid Feedback Monitoring System
SCHEF	Supply Chain Empowerment Framework
SILC	Savings and Internal Lending Community
SME	Small and Medium Enterprise
SMS	Short Message Service
TVET	Technical and Vocational Education Training
UBALE	United in Building Life Expectations
UK FCDO	United Kingdom Foreign, Commonwealth and Development Office
US	United States
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
VSLA	Voluntary Savings and Loan Association
WE4F	Water and Energy for Food
YIMS	Youth Inclusive Market Systems

Foreword

Due to the COVID-19 pandemic, Connexus was forced to adapt and be resilient by hosting its first virtual *Cracking the Nut*® conference in 2021, which focused on “Building Resilient Food, Water, and Energy Systems.” The Advisory Committee selected this topic, as it has become increasingly important to identify smart and systematic ways to rapidly scale up resilient systems for food, water, and energy in light of the impacts of COVID-19 as well as the realities of climate change and conflict. Held over four half-days November 15-18, 2021, this learning event came on the heels of the United Nations Climate Change Conference in Glasgow (COP26). Unfortunately, COP26 failed to set sustainable goals to mitigate the negative impacts of climate change, accepting a commitment to “phase down” the use of coal (a non-renewable energy), instead of a commitment to a full “phase out.”

The *Cracking the Nut*® 2021 community included public, private, and civil society actors committed to addressing the systemic shocks that impede the progress of building resilient food, water, and energy systems. By targeting solutions that intersect at the food-water-energy nexus, *Cracking the Nut*® participants learned approaches that help these systems move beyond resilience and become “anti-fragile.” Building on the concept from Nassim Nicholas Taleb’s book “Anti-fragile: Things that Gain from Disorder,” Connexus’ Vice President of International Programs, Todd Crosby, posited that anti-fragile systems thrive on chaos and shocks so that they can be built back better, much like a muscle is built from stressors to the human body over time.

This year’s Keynote Speaker, Ms. Shira Ansky, Business Development Director of Netafim launched the conference. She spoke openly about difficulties in designing a fully private sector approach to support small farmers in developing countries who could benefit from Netafim’s technologies, especially its water-saving irrigation systems. This frank admission opened the door to discussions around the need for public private sector partnerships, as well as blended finance solutions. These are needed to buy down costs and reduce risks associated with serving the underserved, especially rural smallholder farmers, women, youth, and persons with disabilities.

Participant evaluations indicated that most agreed that we missed the face-to-face interactions of past *Cracking the Nut*® conferences. However, we appreciated the high quality content and open sharing that came through this year’s event. For that, I would like to thank all the presenters and participants for sharing thoughts, ideas, and solutions related to creating resilient and anti-fragile food, water, and energy systems. Through this high-level participation and collaboration, we can find scalable solutions that serve low-income households, not just at the village level, but across nations.

Sincerely,



Anita Campion
President and Chief Executive Officer (CEO)



Executive Summary

This year's *Cracking the Nut*® conference opened with an honest admission by Netafim of the challenges the private sector faces in being inclusive of rural, smallholder farmers. Discussions followed regarding the need for new business models, combined with public sector investment to support food, water, and energy systems. Keynote Speaker, Ms. Shira Ansky, highlighted how Netafim structured partnerships in ways that address the conference themes by applying technology and digital solutions; leveraging private sector and multi-stakeholder investment; and ensuring inclusion of women, youth, and the rural poor.

Theme 1: Applying Technology and Digital Solutions

A resounding message at this year's learning event was the need to keep things simple and not try to address all problems simultaneously. Instead, simple technologies and solutions are often best to improve the lives of the rural poor, especially smallholders. Below are some of the related lessons.

Lesson 1: User-centered design is key to transitioning from in-person to remote instruction. Through user-centered curriculum design, practitioners have developed solutions using technology to overcome distance and connectivity barriers, and bring participatory learning to clients, even those without significant experience with information technology. Benefits of remote learning techniques include increased effectiveness, with clients learning at their own speed, as well as improved efficiency, because of time saved by not having to travel from site to site, allowing staff to reach more clients.

Lesson 2: Developing technological solutions at the nexus of energy-water-agriculture requires a clear understanding of user-focused design principles and local ecosystems. Technology solutions that are designed with end users in mind have shown potential for addressing climate change, population growth, and food insecurity. These solutions also require understanding the interrelated components of local market systems, such as product awareness, affordability, availability, demand, and funding in order to develop the right business models to take solutions to scale.

Lesson 3: Digital agricultural tools can help smallholder farmers and agribusinesses overcome systemic shocks and become more resilient. COVID-19 highlighted food system vulnerabilities in developing countries, which impact farmers at every stage of the agricultural cycle. Digital solutions (such as financial, advisory, procurement, and sales tools) can promote resilience by working closely with telecom and ag-tech communities to develop business models with the potential to create long-term sustainable positive impacts on food systems and to benefit smallholder farmers.

Lesson 4: Avoid the “hype curve” by designing digital solutions around the user to promote value add and impact in support of food, water, and energy systems growth. The spread of mobile technology offers unprecedented opportunities for increasing access to information at scale and very low cost. However, ensuring the effectiveness, suitability, and scalability of information and communication solutions requires listening to clients to understand their needs and willingness and capacity to pay.

Lesson 5: Farmers are more willing to pay when they receive multiple complementary digital services. Digital information sharing and data collection platforms can efficiently distribute climate information, agricultural advice, access to insurance and finance, and commercial opportunities for farmers. Incorporating user experience through product validation and willingness to pay analysis are critical for establishing a sustainable business model.

Lesson 6: Machine learning and artificial intelligence can be used to predict negative impacts of shocks and stressors and identify appropriate responses to support resilience. In Malawi, for example,

CRS used machine learning to identify the characteristics that make households and communities more resilient, such as proximity of agricultural fields to flood plains, gender of head of household, etc.

Theme 2: Leveraging Private Sector and Multi-Stakeholder Investment

There is a growing consensus that food, water, and energy are commodities with commercial value, but they are also public goods. Public and private sector stakeholders can partner with each other and with civil society to ensure that food, water, and energy systems are highly functional and serve the masses, including the rural poor, by applying the following lessons.

Lesson 7: Private sector actors are naturally incentivized to invest in food systems to support improved access to agricultural products that meet their quality and quantity requirements. IESC offered examples of how they used market information and technical assistance to entice agribusinesses to invest in upgrading, helping them benefit more from market opportunities related to horticultural exports in the Dominican Republic (DR) and underserved dairy markets in Sri Lanka.

Lesson 8: The public sector can use Pay-for-Results approaches, such as prize competitions, to incentivize the private sector to invest in sustainable and inclusive food, water, and energy systems. In Vietnam, for example, AgResults used prize competitions to incentivize the private sector to train farmers on climate-smart rice farming technologies and reduce greenhouse gas emissions.

Lesson 9: Blended finance mechanisms can be used to ensure food, water, and energy systems are resilient in times of crisis. United States Agency for International Development's (USAID) Water and Energy for Food (WE4F) initiative is supporting blended finance approaches that serve innovations at the food, water, and energy nexus. Connexus' Access to Finance team on USAID/Tunisia Jobs, Opportunities and Business Success (JOBS) demonstrated how they used blended finance to support resilience of enterprises negatively impacted by COVID-19, encouraging local financial institutions to expand lending when most were contracting.

Lesson 10: Policies that support urban agriculture can strengthen food, water, and energy systems. Sahel Consulting and Nourishing Africa highlighted how urban development policies and architectural plans can support the expansion of edible green spaces, including rooftop gardens with water-efficient irrigation systems and renewable energies, such as solar power and hydroponics.

Lesson 11: Multi-stakeholder partnerships can be designed to be market-led, while supporting smallholders and women. Working with the Global Dairy Platform, Land O'Lakes Venture 37 and Bain & Company designed and pilot tested a public-private partnership called Dairy Nourishes Africa (DNA) that is serving a large number of smallholder dairy farmers in Tanzania, with plans to replicate in neighboring countries. To empower women and girls in cocoa growing communities of West Africa, Cargill has invested approximately \$11M over the past decade in its partnership with CARE, addressing important community issues, such as child labor, water, sanitation, and hygiene.

Theme 3: Ensuring Inclusion of Women, Youth, and the Rural Poor

Resilient (anti-fragile) market systems are characterized by broad diversity and inclusivity in the kinds of people and businesses that operate within them. The creativity that is foundational to innovation depends largely on accessing a broad diversity of perspectives and approaches. However, ensuring that market actors, including finance institutions, governments, and lead businesses, engage a diverse range of people, including women, youth, and others is not always easy or straightforward. This section discusses projects and initiatives that are creating new tools and approaches to successfully address the significant barriers

faced by women, youth, and other marginalized people to allow for more equitable participation in value chains and other market systems.

Lesson 12: Increasing women’s participation in commercial food systems is a powerful way to enhance the delivery of nutritious food and increase household incomes. National Cooperative Business Association Cooperative League of the United States (NCBA CLUSA) and Helen Keller International (HKI) presented strong evidence that lowering barriers to women’s participation in the commercial food system is leading to increased income and improved household nutrition within families of participating women farmers.

Lesson 13: Innovative public-private partnerships between donor agencies and multi-national firms can help companies create more inclusive global supply chains to engage and positively impact more women, youth, and persons with disabilities. PepsiCo and Resonance International demonstrated their systematic framework and specially designed tools to improve the roles of women, youth, and people with disabilities in their supply chains. They showed how this approach is not only improving the well-being for PepsiCo-affiliated farmers, but is also helping PepsiCo secure supplies of produce for its production operations around the world.

Lesson 14: Getting more smallholders involved in commercial agriculture is a joint effort among private sector firms, donor agencies and government actors, each with a role to play in improving the dynamism and anti-fragility of local and regional markets. Connexus’s Feed the Future *Nafooore Warsaaji* Senegal team showed how using horticulture hubs bring together the private sector, government agencies and producer organizations in private sector engagements to improve smallholder participation in commercial horticulture and create anti-fragility in horticultural value chains.

Lesson 15: Effective Last Mile strategies are a powerful way to lower barriers so that more smallholders can participate in commercial horticulture. CRS presented data from their programs showing that private agricultural service providers have increased rural smallholder access to quality inputs and services and have provided unique opportunities to engage women and youth in commercial agricultural support services.

Lesson 16: Persuading market system actors to invest in youth requires a clear value proposition and strong business case. International Youth Foundation and Genesis Analytics illustrated the importance of engaging private firms in a co-created “discovery process” to help them understand and experience the value of youth in providing new skills and innovative perspectives to their business operations.

Lesson 17: Addressing women’s economic empowerment in market systems requires a comprehensive, holistic approach that goes beyond conducting isolated gender activities and works with an array of ecosystem actors to address gender barriers to participation at the household, community, and market levels. TechnoServe, CRS and Tolaro Global showed how they retooled the *BeninCaju* project’s approach to improving women’s roles in cashew farming, processing, and trade by making gender activities less stove-piped and more integrated across the value chain, leading to much greater participation of women in commercial cashew production.

Conclusion

This learning event was rich in technical content and intellectual capital. As a community, we demonstrated our resilience and ability to pivot in the face of difficulties, shifting from traditional in-person learning to an online event due to COVID-19. In fact, we moved beyond the traditional view of resilience as “returning to the previous status quo” and began to embrace the concepts of “anti-fragility.”

I. Introduction

This year's *Cracking the Nut*® conference launched with a call for more holistic, business-minded solutions to the development of dynamic food, water, and energy systems. Keynote Speaker Shira Ansky, Business Development Director at Netafim, highlighted the need for a new business model in water and energy to support food and agriculture. While Netafim has experience with various business models in water and agriculture, Ansky described strong challenges to adopting and adapting the comprehensive business model that Netafim thinks is needed for the future.

Ansky focused on inefficiencies in how we use land, water, and energy resources to support agriculture. For example, 70% of the world's water is dedicated to agriculture but only 20% of total cultivated land is irrigated. Netafim, the first company to invent and commercialize drip irrigation technology, was born out of necessity in Israel to develop agriculture in the desert. Israel is a good case study in climate change as the country has continuously dealt with shortages of water and land. Israel has transformed crisis into opportunity, recognizing that scarcity goes beyond physical scarcity of water source availability, or even economic scarcity, but includes scarcity in management and mindset. The answer lies in cutting edge innovation, technology, and long-term planning. Netafim's technological leadership in micro-irrigation, which maximizes water resources, has helped Israel develop robust vegetable production despite limited land and water, poor soils, and costly energy sources. Currently 90% of land in Israel benefits from drip or micro-irrigation. Drip irrigation has helped increase agricultural yield – both quality and quantity – while reducing the use of water and other inputs in agriculture. In fact, Israel is the world's leader in treating and reusing water, with 93% treated and 86% reused.

But the success of the Netafim drip irrigation model has not been widely adopted around the globe. In fact, the world's average adoption rate of precision irrigation is circa 7%. Why? One reason for Israel's success is that its political leaders have nationalized water and treat it as a commodity with a market monetary value. Further, noted Ansky, drip irrigation can be expensive and complex to operate and maintain, and requires a change in mindset.

The challenge in adopting and scaling the use of drip irrigation is particularly acute with individual smallholder farmers. Individual smallholders are a challenging target market segment for Netafim. Globally, smallholder farmers account for 20% of all farmland, and 70% of all food produced in Sub-Saharan Africa and Asia. Consequently, individual smallholders must be part of the solution for more efficient use of water, land, and energy in agriculture and food production. Yet the more widespread implementation of modern irrigation by individual smallholders is held back not only by small parcel sizes but also by:

- Limited water infrastructure
- Lack of access to finance, as smallholder farmers are not “bankable”
- Lack of education and access to technical know-how
- Limited market linkages for agricultural produce
- The continued perceived risk associated with agriculture

Netafim has come to the understanding that it is not enough to simply provide a technology. Rather, the new emphasis is on introducing technology within the context of an entire solution – or, an ecosystem. Solutions should include the technology, but also the knowledge, finance, insurance, risk mitigation, and markets that allow smallholders to make it profitable.

The way forward is through a holistic, end-to-end model that brings a “business state of mind” to the agricultural community and creates sustainable, profitable growth. For Netafim, this means adopting more of an ecosystem lens in which broad public private partnerships, including with governments and donors,

are part of the solution. Netafim is therefore looking to work within larger ecosystems of actors including governments, donors, non-governmental organizations (NGOs), and private sector partners to provide a “circle of confidence” that allows individual farmers to adopt the technology and make it a profitable business.

Netafim has worked in several ways that support resilient food, water, and energy systems, which also reinforced Cracking the Nut’s 2022 core themes:

Theme 1: Applying technology and digital solutions. In China, Netafim supported the Agro Plato Voltaire project’s 800-hectare field of solar panels to reduce dust, which was hindering their ability to generate electricity. By offering its micro-irrigation technology to cultivate goji berries, Netafim improved the field’s micro-climate and reduced dust accumulation, allowing the solar panels to maximize clean energy production.

Theme 2: Leveraging private sector and multistakeholder investment. In Rwanda, agriculture is an important part of the country’s economic development strategy. Netafim signed a joint venture with the Government to support Agri-Business Hubs to increase agriculture-focused economic growth, food security, and employment. The objective is to build the infrastructure necessary to attract foreign investment and increase exports – benefiting both the local community as well as multinational investors.

Theme 3: Ensuring inclusion of women, youth, and the rural poor. In Niger, a partnership with International Finance Corporation (IFC) helped create a community irrigation and solar water pumping model to reach 900 farmers, with more than half of them female. Results included higher yields and higher revenue, achieved with less water.

Each of these country models has achieved success to some degree, but not in a fully commercial way that is widely inclusive of individual smallholder farmers. To tap the world’s full potential in terms of food, water, and energy systems, there is a continued need for development assistance, public-private partnerships and funding.

II. Applying Technology and Digital Solutions

When thinking of systems to improve food security and reduce risk, it is tempting to think in terms of complexity, including solutions that address all root causes of the problem. A resounding message at this year's learning event was the need to keep things simple and not try to address all problems simultaneously. Instead, simple technologies and solutions are often needed to improve the lives of the rural poor, especially smallholders.

Lesson 1: User-centered design is key to transitioning from in-person to remote instruction

With the onset of COVID-19, practitioners across the globe were faced with the challenge of transitioning from in-person interaction with their clients to remote engagement. Picture Perfect and Land O'Lakes Venture 37 found that moving coaching to a remote model opened new possibilities for farmers and coaches, improving effectiveness, efficiency, and client satisfaction. Through a process of user-centered curriculum redesign, they were able to increase local level engagement and create a digital remote training and coaching methodology that clients preferred to the prior in-person coaching facilitation related to best practices in dairy farming. From this experience, Picture Perfect and Land O'Lakes Venture 37 learned that appropriately designed remote training can use technology to overcome barriers of distance and connectivity and bring participatory learning to farmers without significant experience with information technology. This approach has helped them build strong partnerships with six national cooperatives, three cooperative unions, and one apex organization reaching a total of more than 1,000 local-level cooperatives.

Although undertaking a top to bottom revision of the training to a more user-driven curriculum required a high upfront investment, both Picture Perfect and Land O'Lakes Venture 37 felt that the outcome was a significantly stronger program and was worth the time and resources. Benefits included increased effectiveness, with cooperatives learning at their own speed as individuals and as a group and being able to review training material at their own pace. Moving to a remote learning model also increased efficiency; with time saved by not having to travel from site to site, coaches were able to reach more cooperatives, increasing the potential for reaching scale. According to Land O'Lake's Kari Onyancha, coaches were skeptical at first, but once engaged in the redesign process they came around. "I never thought in a million years we could do this. Turns out there are many possibilities on how to do things – we should be open to new ideas." See Box 2.1 for a description of the digital training tools they developed.

A key take-away from this experience is that moving to remote learning was not only feasible, but desirable. In the end, both coaches and cooperatives preferred the remote methodology to the prior in-person coaching. Because of the strong upfront emphasis on tailoring content to the local context and promoting local ownership, there was an increased sense of connection with the training content and increased agency on the part of cooperatives in solving their own problems. Farmers also gained experience and confidence in using new technology, seeing for the first time the relevance and power of having technological connectivity to their work and empowering for the future. Remote training also had a positive impact in shifting existing power dynamics between clients and providers and within client groups. The new curriculum put farmers, rather than coaches, in charge of the learning process. It also changed the dynamic within cooperatives themselves, including quiet voices, pulling forward hidden leaders, and increasing skills and confidence.

Box 2.1: Using Remote Technology for User-Centered Learning

When the pandemic first hit, Picture Impact and Land O'Lakes Venture 37 were faced with the question of whether it was possible to redesign their coaching program to a remote learning format in a country context with limited Internet, high illiteracy, and limited technology infrastructure and still be able to implement a participatory, user-focused coaching program. Coaches engaged in a two-month design sprint to revise the curriculum using adult-learning principles and user-centered methods to develop remote training tools and methods. From this co-design process, they developed a reformulated training methodology and a coaching package including tools such as group activities, supporting illustration and worksheets, pre-recorded video, and audio guidance. Also included in the package were a tablet, with pre-recorded training sessions, a projector, speakers, a printer, and snacks.

Lesson 2: Developing technological solutions at the nexus of energy-water-agriculture requires a clear understanding of user-focused design principles and local ecosystems

Technology solutions at the water-energy-agriculture nexus – ranging from solar water pumps and cold storage to remote monitoring of water use and soil quality – have shown potential for addressing climate change, population growth, and food insecurity. But designing these solutions must begin with the end user in mind. Tetra Tech's Mikael Matossian, Carolina Barreto, and Richard Choularton described their collaboration with DevWorks to address the challenges to promoting innovation at the nexus of water, energy, and agriculture by applying [USAID's Principles for Digital Development](#). DevWorks presenter Nicolas Lorne offered an example of their experience developing and launching a water pump in Nepal and the lessons from the design process, including the challenges to reaching sustainability and scale.

Each step in the agricultural production process, from access to inputs to end user markets, offers potential opportunities for innovation. Many of the technological solutions developed to take advantage of these opportunities, such as solar water pumps and energy efficient cold storage, have been around for years. The innovation promoted by Tetra Tech and DevWorks is to apply the Principles for Digital Development to create more appropriate, sustainable, and scalable solutions designed with the end user in mind. The USAID Principles for Digital Development are:

- Design with the user
- Understand the existing ecosystem
- Design for scale
- Build for sustainability
- Be data driven
- Use open standards, open data, open source, and open innovation
- Re-use and improve
- Address privacy and security
- Be collaborative

Designing solutions at the water-energy-agriculture nexus also requires understanding the interrelated components of local market ecosystems, such as product awareness, affordability, availability, demand, and funding. This means not only bringing the right technology, but also the right business model to take the solution to scale. For example, the business model for solar technology for daily household electricity is entirely different than that of a solar water pump that is used only seasonally for irrigation. Financing these solutions, such as through pay-as-you-go models or seasonal loans, must be appropriate both for the technology and for the end users' income and business cycles. Focusing first on end users can also help avoid the pitfalls of building a business model based on a mismatch among demand, price, and willingness to pay for technology. (See Box 2.2 for how the principles were applied in Nepal.)

Box 2.2: Applying the Principles for Digital Development to Program Design in Nepal

DevWorks International helped Nepal-based aQysta introduce the [Barsha pump](#), an innovative water pump solution that allows smallholder farmers to irrigate their fields without using any traditional fuel or electricity. For the rollout of the Barsha pump, DevWorks and Tetra Tech tried to avoid the common pitfalls of introducing new technologies, by proactively addressing awareness, affordability, and availability. However, the pump was initially priced at an unaffordable \$4,000, financing mechanisms were not provided to customers, and the company lacked experience working with government and distributors. DevWorks helped aQysta apply the principles of understanding the ecosystem and designing with the user to lead an iterative process that eventually lowered the unit price to \$300 per pump by shifting manufacturing to South Asia. aQysta has since leveraged their work with users and the local ecosystem to redesign their business model around providing multiple input, finance, extension, and offtaking services to whole communities rather than just selling pumps, resulting in a more stable and sustainable business.

Lesson 3: Digital agricultural tools can help smallholder farmers and agribusinesses overcome systemic shocks and become more resilient

Digitizing agriculture can enable smallholder farmers and agribusinesses to be more resilient against shocks, such as pandemics, natural disasters, and climate change. The Global System for Mobile Communications (GSMA), a global trade association of more than 750 mobile operators, demonstrated how digital agricultural tools were especially important in responding to agricultural stakeholder needs during the COVID-19 pandemic because they do not require in-person contact to be deployed, are largely available via mobile networks, and are easy to adapt and scale to meet local needs. According to one of the GSMA's partners, Andrew Denu of SunCulture, "88% of Kenyan farmers indicated that they were worse off financially because of the COVID-19 pandemic, but 81% of their customers reported improving incomes," thanks to having access to SunCulture's short message service-based (SMS) weather information and solar-powered irrigation systems.¹

The GSMA described how its AgriTech Program brings together private sector actors in the mobile industry, along with agricultural sector stakeholders, innovators, and investors, to launch, improve, and scale impactful and commercially viable digital solutions for farmers in the developing world. The GSMA works closely with the broader agritech ecosystem and informs donors and investors of business models that have the potential to create long-term sustainable positive impacts on food systems. The GSMA provides technical assistance to various organizations, manages innovation funds, and supports scalable and commercial solutions, especially those that benefit smallholder farmers.

COVID-19 highlighted the vulnerabilities of food systems in developing countries, which impacted farmers at every stage of the agricultural cycle. Smallholder farmers were particularly impacted by travel restrictions and road closures, rising input prices, credit shortages, and reduced remittances. These issues made land preparation, cultivation, and storage more expensive and more difficult. Crop sales were negatively impacted as local markets closed or became inaccessible, and demand from the hospitality industry dropped. The GSMA categorized digital agricultural solutions into five use cases:²

1. Digital advisory services – Provide information on best practices, financial literacy, and specific technical advice depending on the crop or value chain involved.

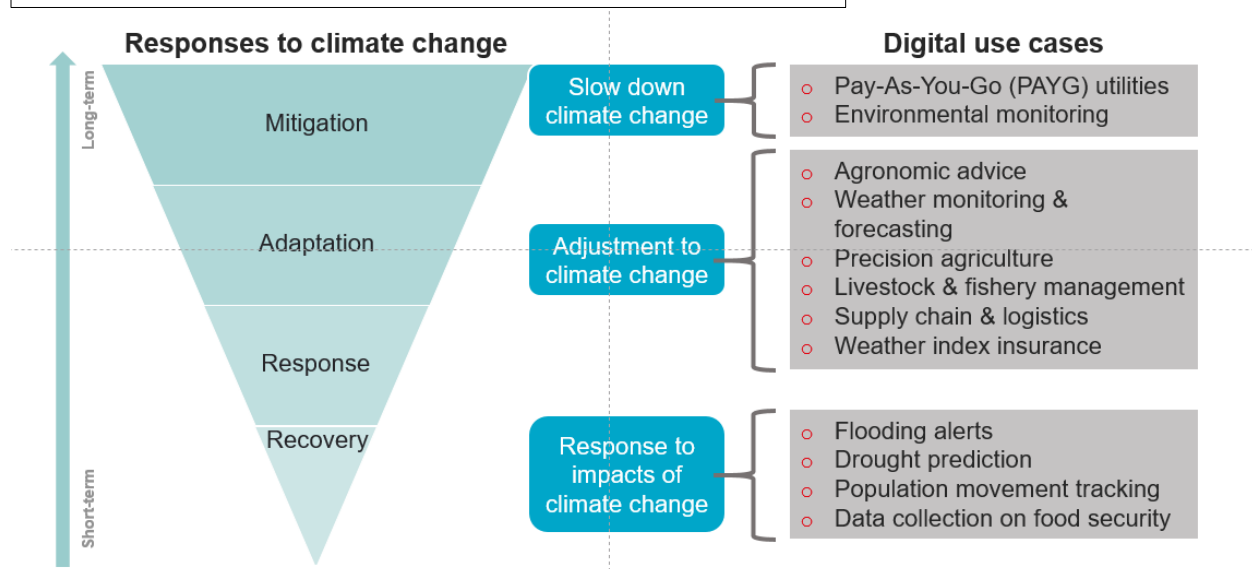
¹ <https://app.60decibels.com/covid-19/agriculture>

² Definitions of use cases on pages 86-87 of <https://www.gsma.com/r/wp-content/uploads/2020/10/GSMA-Agritech-Digital-Agriculture-Maps-2020-1.pdf>

2. Agricultural digital financial services – Facilitate financial inclusion of smallholder farmers by providing expanded access to financial services in rural areas, such as agriculture-specific financial products and services (including savings, loans, and insurance).
3. Digital procurement services – Facilitate smallholder access to markets by digitizing processes happening in the last mile of agricultural value chains and improving efficiency and transparency of agribusinesses.
4. Agri e-commerce – Develop and support platforms to enable online buying and selling of produce and inputs.
5. Smart farming – Use sensors, drones, satellites, and other tools to provide data and inform decisions related to climate smart agriculture.

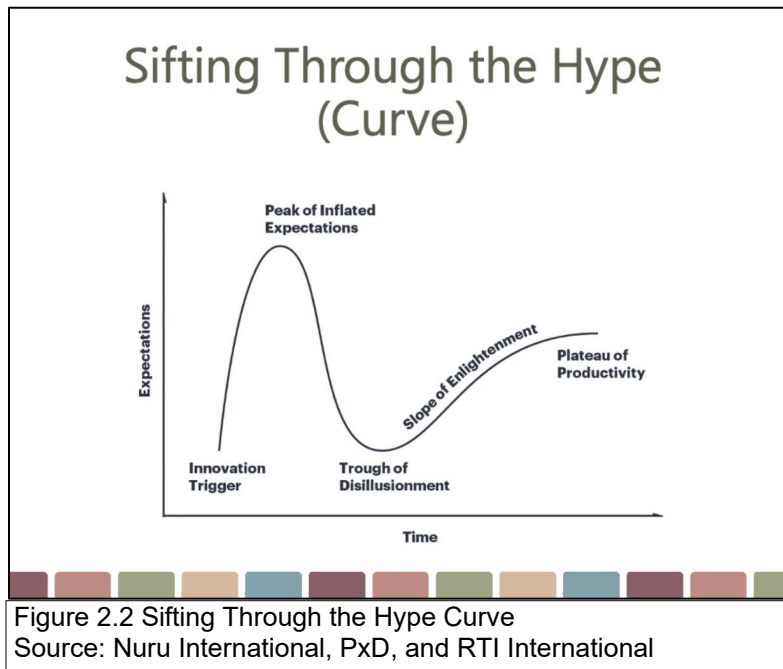
The GSMA also highlighted how digital agricultural tools can provide diverse solutions to help farmers mitigate the negative impacts of climate change, and thus adapt, respond, and recover. Digital technologies can help smallholders become more resilient to climate change, such as environmental monitoring and traceability services (e.g., to provide insights into land usage and reduce deforestation); digital weather and climate services (e.g., to support decision-making amid unpredictable climate conditions); and digital financial services (e.g., weather index insurance to provide a formal safety net to adverse weather events). See Figure 2.1. for a graphic representation of digital uses to improve resilience to climate change.

Figure 2.1 Digital Uses to Improve Resilience to Climate Change
Source: GSMA



Lesson 4: Avoid the “hype curve” by designing digital solutions around the user to promote value add and impact in support of food, water, and energy systems growth

Although early experience has shown the benefits of digital solutions, hard questions need to be asked about the effectiveness, suitability, and scalability of different information and communication technologies to amplify and achieve agricultural development goals. Are practitioners delivering on farmers’ demands or are they creating unrealistic expectations that will end in disillusionment? Casey Harrison from Nuru International, Niriksha Shetty from PxD, and Ciara Coughlin from RTI International described the “hype curve” of inflated expectations from innovation. They traced a curve that begins with innovation and over time moves from conception, to inflated expectations, and inevitable disillusionment, before entering the “slope of enlightenment” or learning and reaching the final stage of productivity and sustainability.



To avoid the hype curve, six criteria for appropriate design can be used to promote innovative technological solutions for agriculture. Developed by the Agribusiness Market Ecosystem Alliance Network (AMEA) through a literature review and participatory engagement with practitioners, these criteria are a practitioner-driven guide to good practice in agtech programming.

- Be endorsed by an AMEA member.
- Address proven demand.
- Offer value added.
- Add limited costs.
- Reduce inefficiencies.
- Be interoperable across technological boundaries

AMEA members also subscribe to USAID’s Principles for Digital Development.

The information revolution and the spread of mobile technology offer unprecedented opportunities for increasing access to information at scale and very low cost. However, to ensure the effectiveness, suitability, and scalability of information and communication technologies, these technologies must be centered around the user. An example of this is the locally led Senegalese farmer support organization, GIE Kissal Patim, which has developed digital systems for improving agricultural production with real time weather information, rainfall tracking, and other data. Through this platform more than 3,200 farmers group users are building their digital skills to receive extension services, purchase high-yielding inputs, and coordinate COVID-19 response efforts. Through better crop management and improved inputs, some farmers have been able to increase yields to an average of four-and-a-half tons per hectare.

Designing solutions around the user requires asking, “Whose problem are you trying to solve?” Ensuring that digital solutions are demand driven requires asking difficult questions about who will pay, and what is their willingness and capacity to pay. Designing with the user in mind begins with listening to clients, understanding their context, and developing easy to use solutions. Designers must remember that sustainable solutions are not about the technology, but rather about the user. Nuru Kenya engaged in a user centered problem-solving process to help bridge the digital divide faced by rural farmers in accessing technology. They developed a computer skills curriculum to build the capacity of farmer organization members through their Technical and Vocational Education Training (TVET) program. In strengthening

cooperatives to develop locally driven solutions, Nuru was able to increase crop yields by 38% over baseline and increase milk yields by 57% over baseline.

To successfully implement technological solutions requires iterative approaches to develop a mix of different solutions at different points in the growth curve. Development of scalable solutions can be implemented through partnerships with governments, non-profits, and private agribusinesses providing complementary services. Creating sustainable partnerships requires building trust through experience sharing and elevating local perspectives through multi-stakeholder networks. It also requires that ownership of the solution rests with the local community. [CropIn](#) offers tailored farm management technologies from a suite of end-to-end solutions to empower farmers with data-driven decision making. CropIn solutions are designed for accessibility, simplicity, and interoperability. CropIn digital solutions are benefiting four million farmers across 13 million acres globally producing 388 different crops across 52+ countries.

Lesson 5: Farmers are more willing to pay when they receive multiple complementary digital services

Digital information sharing and data collection platforms can efficiently distribute climate information, agricultural advice, access to insurance and finance, and commercial opportunities for farmers. Amy Kebe Ndeye of Jokalante and Jocelyn Farrington of Africa Experts Inc. described their experience in developing a digital information platform for farmers and fishers in Senegal. In rolling out and scaling the *Naf Moore* (Pulaar word meaning “add value to”) platform, Jokalante learned valuable lessons about the challenges of moving from a donor-funded project to a sustainable commercial service.

Jokalante built the *Naf Moore* platform with seed funding from USAID’s Climate Information Services for Increased Resilience and Productivity in Senegal (CINSERE) project. With project support, Jokalante originally offered climate information for free through the *Naf Moore* platform. Jokalante currently engages with more than 125,000 farmers and fishers through the *Naf Moore* platform. A survey of *Naf Moore* clients found that 88% said the climate information they received was relevant and useful, and 63% of farmers felt that climate information alone improved their productivity, but few were willing to pay for a service that had previously been provided for free.

As financial support from the project was ending, Jokalante reconceptualized the *Naf Moore* service model through a process of engagement with farmers and fishers to get a stronger sense of the kinds of services that they wanted and were willing to pay for, as well as testing different payment methods. Incorporating user experience and “willingness to pay” analysis during product testing was critical for establishing a sustainable business model. Through the product validation and testing process, Jokalante identified an effective demand for a package of climate information, agricultural advisory services, access to finance and insurance, and commercial linkages as a combined service. In addition, product validation and testing with users led to the integration of agricultural advisory services and development of a WhatsApp module, to allow sharing of video and pictures more easily and cost-effectively. (See Box 2.3 for a summary of their findings)

With its newly reconfigured information package, *Naf Moore* is now testing multiple subscription modalities to determine the most attractive to farmers and fishers to pay for on a fee basis. Options include: bundled subscription cost with crop insurance through the national insurance company; bundled costs with input purchases through cooperatives; and direct subscription using a mobile device. In addition, Jokalante built partnerships with local community radio stations to advertise and drive traffic to the platform.

Lesson 6: Machine learning and artificial intelligence can be used to predict negative impacts of shocks and stressors and identify appropriate responses to support resilience.

Resilience has risen to the forefront as a development priority and many donors are repositioning their strategies to embrace resilience. Under USAID's Resilience Framework, resilience pertains to the ability to mitigate, adapt to, and recover from shocks and stresses, and this is built through absorptive, adaptive, and transformative capacities. Yet to build resilience, these capacities must be tracked and quantified. Therefore, regularly measuring and monitoring resilience is needed to ensure local communities bounce back after a shock or stressor, whether related to climate change, conflict or the COVID pandemic.

Catholic Relief Services (CRS) found that many of the approaches to monitoring resilience lacked the frequency of data input to support timely, agile and actionable interventions. In 2016, CRS joined with Cornell University to develop the Measurement Indicators for Resilience Analysis (MIRA) approach to generate monthly resilience data, gathered by community-embedded enumerators with mobile phones to track common indicators associated with well-being and food security. Beginning in Malawi on CRS' United in Building Life Expectations (UBALE) project, MIRA was designed to empower local communities with access to comprehensive monthly dashboards showing data trends and a forecasting tool that helps to predict negative impacts from shocks, such as potential for future harvest losses and food insecurity.

Using machine learning, MIRA identified the characteristics that make households and communities resilient, such as proximity of agricultural fields to flood plains, gender of head of household (female headed households tend to be more vulnerable), etc. Early results from applying artificial intelligence to the MIRA data showed that food security can be predicted somewhat by type of shock. Overtime, MIRA was used to inform CRS programming by identifying the interventions that contributed to household resilience, such as participation in savings groups and farmers groups. By having access to the information at the community level, some issues were able to be addressed locally, such as by adding local policing to mitigate an increase in theft. Local communities also used the MIRA dashboards to develop disaster risk mitigation plans in preparation for different types of shocks, including drought, illness, livestock deaths, crop disease and rising food prices.

Later in Malawi on its Rapid Feedback Monitoring System (RFMS) project, CRS integrated MIRA with the World Bank's SWIFT approach to monitoring poverty impacts along with resilience data. So far, CRS' approach to resilience monitoring has been used to support 2200 households in 8 districts in Malawi. Based on its success, CRS is now deploying the concept in Madagascar and is selling the concept to other donors and government agencies. CRS used its systems to monitor the impacts of COVID, which found that both men's and women's incomes were negatively impacted in Malawi, especially in the case of short-term contract workers at a sugar plantation. In Madagascar, the system saw a major drop in food consumption linked in part to price spikes for imported rice, which the price of chicken crashed as poultry became unaffordable to many families. With the expanding databases of information, CRS is confident that the negative impacts of shocks can be predicted earlier and humanitarian responses can be implemented faster so as to support rapid resilience of rural households and communities.

III. Leveraging Private Sector and Multi-Stakeholder Investment

There is a growing consensus that food, water, and energy are a combination of commodities with commercial value, but also public goods, to an extent. Therefore, public and private sector stakeholders increasingly see the need to partner with each other and with civil society to ensure that food, water, and energy systems are highly functional and serve the rural poor. This section highlights some of the main lessons related to how these stakeholders can co-invest and work together to achieve maximum benefits for most people in developing countries.

Lesson 7: Private sector actors are naturally incentivized to invest in food systems to support improved access to agricultural products that meet their quality and quantity requirements

Market incentives, as part of a private sector-driven market systems approach, can improve trade and investment in agricultural value chains. IESC, a US-based nonprofit organization, offered examples from Latin America and Asia to demonstrate this universal truth.

In the DR, horticulture producers, packhouses, and exporters were missing an opportunity to serve lucrative United States (US) markets due to a lack of clarity on the compliance and enforcement requirements of the US Food Safety Modernization Act (FSMA). IESC's United States Department of Agriculture (USDA)-funded Export Quality (EQ) program helped clarify the compliance requirements, which incentivized horticultural value chain actors to invest in improved practices, traceability systems, and meeting international voluntary certification standards. IESC worked with 30 young exporters and facilitated contracts, shifting them from short-term thinking to seeing the longer-term opportunity to serve US markets. The DR's proximity to the US offered a comparative advantage, helping them compete with Costa Rican pineapple as well as other tropical fruits and "boutique" horticultural products. By working with packing houses and focusing on food safety plans, IESC built capacity related to clean water and food safety, supported farmer field schools, provided coaching to prepare for trade fairs, and facilitated financing for equipment and in-kind donations for cold storage and traceability systems. As a result, the EQ program leveraged \$4M in private sector investment and strengthened 120 packhouses, of which 34 became FSMA-ready by the end of the project. Kisha Rodriguez, the owner and Director of Services from Caralinda Agroindustrial, explained how EQ strengthened her pineapple production and exports, by teaching her how to manage finance and prepare for an investment, prior to purchasing a chlorinator machine to upgrade quality and export in larger batches, which is important to US buyers.

In Sri Lanka, IESC found the dairy sector to be highly fragmented and dairy processors were operating under capacity, causing the focus to be more on increasing product quantity over product quality. At the same time, local demand for fresh dairy exceeded supply, with imported milk powder being the main substitute. In response to these market signals, IESC's USAID-funded Market Oriented Dairy (MOD) project supported local entrepreneurs fill this gap by investing in improved dairy cattle feeds and artificial insemination services for small-scale dairy farmers. MOD provided training and technical assistance to address poor management practices and the lack of quality feed to meet dairy cattle needs year-round. IESC helped farmers and processors develop business plans and link to banks. As many farmers did not qualify

for loans due to lack of collateral or credit history, some of the processors offered interest-free loans to incentivize farmers to upgrade in ways that would maximize their milk production. As a result, MOD leveraged \$12.5M of private sector investment across the dairy value chain and increased fresh milk production by 64%. Box 2.1 describes how one private sector partner, Cargills Quality Dairies (CQD), co-invested with MOD to support dairy farmers. Mr. Uditha Dissanayake, Dairy Development Consultant to CQD, explained that “the benefit (of this assistance) was so high that it is mitigating the risk of side selling, building trust, and incentivizing farmers to invest in their dairy production.”

Box 3.1: CQD Investment in Dairy

- Extension services to 500 farmers
- Distributed quality fodder and seeds
- Established training center for best practice demonstrations
- Created silage production operation to ensure access to quality feed
- Introduced a Heifer Breeding and Exchange Center
- Offered \$1M in loans to farmers

Lesson 8: The public sector can use Pay-for-Results approaches, such as prize competitions, to incentivize the private sector to invest in sustainable and inclusive food, water, and energy systems

Public sector actors from governments and donors are increasingly looking for ways to attract private sector finance and investment to support and scale their development initiatives. One example is the WE4F initiative’s calls for innovation (see www.we4f.org). Another example is [AgResults](#), a \$152M multi-donor initiative, managed by Deloitte and funded by USAID, United Kingdom Foreign, Commonwealth and Development Office (UK FCDO), Bill & Melinda Gates Foundation, Australia Department of Foreign Affairs and Trade, Global Affairs Canada, and the World Bank. [AgResults](#) uses Pay-for-Results prize competitions to incentivize the private sector to invest in high-impact agricultural innovations that help achieve food-system goals by:

- Reducing food insecurity.
- Improving household nutrition and health.
- Increasing livestock productivity.

AgResults’ theory of change rests on the idea that the private sector, if appropriately incentivized, will create and/or scale new technologies to benefit smallholder farmers. By focusing payments based on results, AgResults is able to re-allocate funds in the case that total anticipated results are not achieved.

AgResults prizes fall under one of four categories:

1. **Research** – Understanding of new products and innovations that address development challenges
2. **Delivery** – Adoption of a solution or technology to improve distribution channels
3. **Advanced Market Commitment** – A market guarantee for the new product
4. **Outcome** – Achieving new outcomes or impacts

AgResults Vietnam Emissions Reduction Challenge Project (AVERP), now completed, scaled across two calendar years (four rice growing seasons) to engage more than 25,365 smallholder farmers and 11 competitors in Thai Binh Province in the final season. AVERP focused on testing and scaling climate-smart rice farming technologies and practices among smallholder farmers to drive the reduction of greenhouse gas (GHG) emissions. At the start of the project, several practices had already been identified that were effective in reducing rice emissions and increasing productive yields related to: crop residue management, fertilizer application, rice variety, water management, and planting density. However, farmers were not motivated to apply these practices.

AVERP was designed in two phases: Phase 1 for testing (1.5 years) and Phase 2 for scaling (2.5 years). In the first phase, AVERP issued a call for proposals from private sector competitors to propose a specific

Vietnam-centric approach to rice production practices and products to lower GHG emissions and improve yields. Eleven competitors were selected to pilot test their approach on a small parcel of land over two seasons and were awarded \$55,000 in prizes. Of these participants, six competitors were invited to participate in Phase 2, which required them to reach out to smallholder rice farmers and scale their solutions over four seasons. Four competitors opted to continue and were awarded interim prizes totaling \$500,000, proportionate to the results they achieved. At the end of the competition, three competitors won the grand prizes of \$750,000, \$400,000, and \$200,000 respectively. Although AVERP engaged the private sector competitors, the competitors were responsible for training the farmers.

The project produced strong results:

- Farmer incomes increased by 12% on average, mostly through more efficient use of inputs.
- Yields increased by 9% on average.
- Water use declined by 40%.
- Chemical run-offs dropped by 20% for both fertilizers and pesticides.
- Emissions reductions were up to three tons per hectare, although reductions depended highly on effective water management.

The project also helped strengthen value chain relationships between the competing private companies and smallholder farmers, building trust and leading to new business models. Final evaluations found that farmers were highly satisfied with the project and perhaps one of the most important impacts was the increased awareness of the efficacy of these climate smart practices, which supports Vietnam's commitment to becoming a net zero emission country by 2050.

Despite the positive results, the AgResults team learned to set more realistic targets for GHG reductions. The project originally expected to reach three times more smallholders (75,000) and 10 times the average emissions reductions (10 tCO₂e/season/ha). The shortfall in results was due to a switch from the Mekong Delta to the Red River Delta to avoid direct competition with a World Bank-funded project.

Monitoring and verification were also challenges. For example, the team did not realize the costs or limitations of satellite technologies for monitoring GHGs and multiple ways to verify results increased costs. Nonetheless, AgResults is committed to systematically capturing, analyzing, and disseminating learning around Pay-for-Results, and offers its step-by-step "[Prize Design Toolkit](#)" available for download.

Lesson 9: Blended finance mechanisms can be used to ensure food, water, and energy systems are resilient in times of crisis

Given the current climate crisis, COP26 identified the need to accelerate the work of investment funds to scale climate smart agricultural innovations. According to Dr. Ku McMahan, USAID's WE4F Team Lead, innovative approaches to blended finance can increase climate smart food production, decrease water consumption, and expand the use of clean energy, resulting in increased resilience for a developing country. Blended finance can also harness the power of the private sector to reach underserved groups. Blended finance can be an important tool for better matching risk and opportunity by adjusting the risk/return profile, crowding in private sector investors, and mitigating risks to encourage innovation.

David Mazaira, Climate Impact Specialist at responsAbility, argued that by bringing first loss capital and technical assistance funding, donors can support blended finance that serves the food, water, and energy nexus, and promote risk reduction approaches, such as currency hedging, insurance, loan guarantees, and outcome-based finance. Christine Roddy, Executive Director of AlphaMundi Foundation, explained that, "Local governments can also help de-risk and crowd in capital." Jiten Ghelani, CEO of Promethean Power, an innovator working on climate smart dairy in India, added that, "Financing by the public sector can

support the critical first mile infrastructure [for food, water, and energy systems], if seen as a public good.” All agreed that the key component in these investments is trust, but risk taking is needed, given the urgency of climate change.

In response to the COVID pandemic, Connexus’ Access to Finance team on the USAID/Tunisia JOBS project rapidly designed a blended finance mechanism to support vulnerable and negatively impacted micro, small, and medium enterprises (MSMEs) in Tunisia, including women, youth, and those living in rural and underserved areas. See Box 3.2.

Box 3.2: Connexus’ Use of Blended Finance to Facilitate Lending to Tunisian MSMEs amid COVID

With \$3M in emergency grant funding from USAID/Tunisia, Connexus, as a subcontracting partner to Chemonics International, solicited concept papers for a blended finance recovery loan program from its partner financial institutions. Two microfinance institutions (MFIs), Advans Tunisie and Baobab Tunisie, were selected as implementing partners based on their capacity and commitment to rapidly reach a large number of underserved clients and their willingness to commit their own capital to finance loans to MSMEs who were impacted by COVID. In less than nine months, JOBS partners reached 16,445 enterprises with \$35.7M in loans, creating and sustaining more than 32,500 jobs.

To capture impact and lessons learned, Ines Allouche, Connexus’ Access to Finance Team Leader explained how the JOBS team designed an efficient monitoring and evaluation system using a cloud-based reporting software for data entry, analysis, and information sharing, including georeferencing of client recipients. A tiered disbursement process and regular check-in meetings facilitated the rapid deployment of the grants in tranches, with increases in funding contingent on achieving key performance targets. By incentivizing the MFIs to reach vulnerable and underserved populations, Connexus rapidly scaled access to finance to a large number of enterprises negatively impacted by COVID, supporting their operational resilience at a crucial time.

With \$1M in grant funding from the USAID/Tunisia JOBS project, Islem Lahimi explained how Advans Tunisie supported job retention (12,590 retained and 383 created) in 4,800 microenterprises by lending \$11.3M of its own capital from December 2020 to August 2021, when most financial institutions were retracting due to COVID-19. By signing up to receive their first installment through their digital financial services platform, clients received an incentive payment of \$200, which expedited the time between loan application and disbursement to fewer than 10 days. Of the clients who benefited, 36% were female entrepreneurs, 30% were youth, and 57% were from rural and underserved regions. Approximately one-fourth of the businesses were related to food and agriculture.

With a \$2M grant from JOBS, Amira Ben Boubaker described how Baobab Tunisie committed \$24.4M of its own capital to issue loans to 11,645 microenterprise clients, sustaining 19,560 jobs. Of the clients who benefited, 39% were female entrepreneurs, 33% were youth, and 48% were from rural and underserved regions. Approximately 17% of the businesses were related to food and agriculture. One client, Naima Jebali, expressed her satisfaction by stating, “Thanks to this grant, I was able to cover operating costs during the period of lockdown and I was able to buy the raw materials I needed.” Unlike a traditional grant, blended finance funding from USAID/Tunisia was not a one-off opportunity, but instead intentionally leveraged additional private capital and forged stronger relationships between MFIs and clients by promoting business recovery and resilience at time when their need for support was greatest.

Lesson 10: Policies that support urban agriculture can strengthen food, water, and energy systems

To improve food security, most public and private sector development practitioners focus on developing rural agriculture. It is important, however, to consider the role of urban agriculture in improving food security. As global populations continue to shift toward urbanization and as women, youth, and other vulnerable populations lack land ownership rights, urban food systems and household level agricultural production are increasingly important contributors to food supply, employment, and income generation.

Aisha Hadejia of Sahel Consulting Agriculture and Nutrition Limited and Ify Umunna of Nourishing Africa highlighted ways in which urban food, water, and energy systems could be strengthened to improve food security in Nigeria, including:

- Public institutions, including primary schools and tertiary institutions, offer gardens and education programs to increase awareness of nutrition and a balanced diet, attracting young agri-preneurs into the sector and growing a wide range of crops.
- Urban development policies and architectural plans support the expansion of edible green spaces, including rooftop gardens dependent on water-efficient irrigation systems.
- Renewable energy electrification, using solar power and hydroponics, is incentivized to support a clean energy approach to agricultural food production, processing, and storage.

Sahel Consulting applies some of these concepts to their work. On the Advancing Local Dairy Development in Nigeria (ALDDN) project funded by the Bill and Melinda Gates Foundation, for example, Sahel Consulting is working to improve the urban dairy sector by providing smallholder dairy farmers, especially women, with innovative ways to use the land, labor, access to feed, animal health care, breeding services, and markets. Sahel Consulting helps farmers organize into co-ops and self-help groups, use solar power for bore holes to access water, and use artificial insemination to cross breed their dairy cows with higher yielding breeds. They also support activities to ensure that the financially excluded are included and are able to access financial services, which is “the pin that holds all the interventions together.”

Nourishing Africa, a knowledge and membership hub, serves as a platform for agri-food entrepreneurs across Africa to accelerate their work by connecting to funders, markets, and talent. The portal includes information and resources to enable entrepreneurs to scale their impact. Ify Umunna warns that “COVID will not be the last shock to agricultural communities in Africa” and believes that tools such as the Nourishing Africa Hub will help support resilience and anti-fragility of food systems in the future.

Lesson 11: Multi-stakeholder partnerships can be designed to be market-led, while supporting smallholders and women.

During the Keynote Speech, Ms. Shira Ansky described how Netafim operates at the nexus of food, water, and energy through partnerships with multiple stakeholders, including local governments, donors, and other private sector product and service providers. Netafim is working toward a model that will serve smallholders in a sustainable and scalable way. Working with the Global Dairy Platform, Land O’Lakes Venture 37 and Bain & Company designed and pilot tested a public-private partnership called Dairy Nourishes Africa (DNA) that is serving smallholder dairy farmers in Tanzania. With two teams, one for Project Implementation and the other for Donor Engagement, Land O’Lakes Venture 37 is now replicating DNA in Kenya, with plans to also serve smallholder dairy farmers and enterprises in Ethiopia, Uganda, and Rwanda (Box 3.3). Multi-stakeholder partnerships can also be used to empower other disadvantaged populations, such as women, as CARE and Cargill have done in West African cocoa producing communities (Box 3.4).

Box 3.3: The Dairy Nourishes Africa (DNA) Approach to Food System Strengthening

Todd Kirkbride of Land O'Lakes Venture 37 explained that while a significant amount of investment has gone into strengthening dairy in East Africa in the past, most investment focused on improving milk production, rather than addressing demand constraints. The DNA platform applies a market-led systems approach, where farmer-allied enterprises, especially dairy processors, drive optimal outcomes from dairy farmers with clear connections to end markets and consumers.

The concept behind DNA stems from the fact that dairy is highly effective in improving nutrition, especially for children under age five who are at risk of malnutrition and stunting. Unlike most agricultural crops, dairy provides year-round income for smallholders. DNA's theory of change centers around enterprise acceleration of dairy processors who act as market system anchors, sourcing milk from dairy smallholders and deploying distribution models tailored to low-income markets.

Four Steps to Enterprise Acceleration. Joachim Balakana, Chief of Party (COP) and DNA Project Implementation Lead, described the four steps of enterprise acceleration:

1. Diagnostic – This step is data-driven and sets strategic priorities for the enterprise.
2. Value creation plan – This step focuses on identifying incentives for enterprise growth and a critical path to add value through improved operating models.
3. Quick wins and pilots – This step builds buy-in from all stakeholders by identifying and supporting “quick hit” growth initiatives, which can then be evaluated and scaled.
4. Embedded change – This step includes the processes, metrics, and ways of working that can be permanently integrated into their systems.

An important element of accelerating these farmer-allied enterprises is for them to co-fund embedded extension services. For example, DNA has supported the development of training modules, sharing best practices via smart phones and mini-videos. Input providers also agree to provide embedded extension services through climate smart farmer trainings on demo plots linked to the purchase of quality inputs. Processors also offer embedded extension services related to raw milk quality, improving their testing and assurance processes.

Enterprise acceleration is also supported by promotional campaigns to stimulate demand, including through school milk promotions (serving 4,000 children with reasonable cost milk, co-funded by parents) and working with the Tanzania Dairy Board on radio campaigns during National Milk Promotion Week (reaching 275,000 consumers).

After one year, the initial results of the pilot were impressive with annualized revenues growing by 35% for dairy processors and by 57% for dairy farmers as a result of improved productivity. The quality of milk available on the market increased, as the milk acceptance rate at milk collection centers increased from 93% to 98% or higher. An additional benefit of applying sustainable intensification of milk production practices was a reduction in greenhouse gas emission intensity by 32% on average.

While an excellent example of proactive public-private sector partnership, one of the challenges of scaling DNA is the reality that the strategic objectives of corporate donors do not always completely align with the DNA approach, and that securing funding from the private sector to bring the pilot to scale is a time-consuming and resource-intensive process. Instead of issuing a competitive solicitation, DNA issues relationship-driven or ad hoc invitations to pitch the project, which requires managing relationships over the long term and continually adapting customized pitches to a wide array of potential customers. The team

has found that an agile way of working is essential to respond to evolving opportunities and incorporate emerging trends in the private sector.

As poverty continues to be the world’s biggest killer, females are at a particular disadvantage. Nearly 1 billion people around the globe live in poverty; approximately 60% of them are women and girls. Some of the impacts on women and girls are that they often eat least and last, are denied the chance to go to school, forced to marry early, and prevented from financial decision-making. While women produce approximately 50% of the world’s food, they only own 1% of the land they farm. For these reasons, CARE and Cargill have worked together for over a decade to address poverty and empower women and girls in cocoa-producing communities in Cote d’Ivoire and Ghana. As one presenter stated, “When women rise out of poverty, they bring their sons, daughters, and communities with them.”

The longevity of the partnership has allowed CARE and Cargill to make meaningful strides toward reducing poverty and supporting gender equality. Box 3.4 highlights the multiple ways in which CARE and Cargill have co-invested to support the empowerment of women and girls living in poverty, including strategies to engage men and boys in the promotion of women’s empowerment. Their programs are designed to interweave women’s voices, equity, and empowerment in cocoa-growing communities. The partnership addresses longstanding and deeply rooted gender inequities by:

- Bringing women into community action planning and linking them to government services/agencies.
- Empowering women as leaders and linking them to markets.
- Engaging communities in gender dialogues and engaging men to support women.
- Joining women together in farmers’ cooperatives and village savings and loan associations (VSLAs) to build social solidarity, savings, and access to credit.
- Providing access to sustainable agriculture training and business training.

Box 3.4: Empowerment of Women and Girls Living in Poverty			
Emergency Response	Food and Water Systems	Maternal and Child Health	Economic Empowerment, Education, and Work for Women and Girls
Disaster preparation	Water, sanitation and hygiene	Maternal & children’s health and nutrition	Girls’ education
Emergency response	Nutrition	Gender-based violence	Youth empowerment
Prorated crisis response	Hunger and famine	Family Planning	VSLAs & Microfinance
Gender in emergencies	Agriculture		Made by Women
Food and shelter	Climate Change		Income generation

Since 2008, nine programs have been implemented to address critical challenges faced by cocoa-farming communities, including cocoa production, harmful child labor practices, women’s economic empowerment, access to financial services, nutrition, and education. To date, these programs served 236,589 people (47% women) in 323 communities. CARE and Cargill supported the establishment of 275 community development committees and their implementation of community action plans, addressing issues important to the community, including child labor, education, water, sanitation, and hygiene. Cargill has invested

approximately \$11M in these programs out of a commitment to support community well-being to achieve a sustainable and thriving cocoa sector. The key to success in this partnership has been “strong relationships at the local level, with regular meetings to discuss issues and collaborate, and work with communities together.” The strength and resilience of this partnership was demonstrated during the COVID pandemic, as they were able to quickly integrate a solid COVID response into their programming efforts to cocoa communities across the partnership.



Figure 3.1
Source: CARE, 2021

IV. Ensuring Inclusion of Women, Youth, and the Rural Poor

Increasing inclusion, especially of women and youth, is becoming more automatically integrated into the design of development projects and activities. As we move toward a system-based focus, development practitioners can play a role in working with private sector actors to see the economic, social, and governance-related benefits of ensuring that systems adequately accommodate the specific needs and concerns of potentially marginalized populations. For systems to be fully functional, they should be designed to be as inclusive as possible. Below are some of the specific lessons associated with increasing inclusion in commercial markets and systems.

Lesson 12: Increasing women’s participation in commercial food systems is a powerful way to enhance the delivery of nutritious food and increase household incomes

In countries like Senegal, women are helping build better food systems geared to address hunger, malnutrition, and poverty. As an example, the USAID Feed the Future *Kawolor* project in Senegal, implemented jointly by NCBA CLUSA and HKI, is promoting a more resilient and effective food system capable of improving the health and wealth of local people. *Kawolor*’s primary strategy is integrating women’s economic empowerment with stronger roles for women in decision-making and leadership.

However, embedded cultural and political realities influence the ability of women entrepreneurs and businesspeople to flourish in their commercial activities. *Kawolor* is addressing the multi-faceted challenges of getting more women engaged in commerce by focusing on three main areas:

1. Lowering barriers to critical resources and capital including land, water, and agricultural inputs and services.
2. Enhancing women’s voices in decision-making within the household, the community, and the market.
3. Promoting women’s leadership at all levels in the food system to facilitate the first two objectives.

To lower barriers to investment in women’s agri-businesses, VSLA models provide both initial access to micro-loans for business start-up and a path to traditional loans from formal financial institutions using savings as collateral. Advocacy at the community and local government levels can expand women’s ownership of productive assets, such as land and access to water, which are fundamental to agribusiness success. Targeted training – to improve women’s business skills and technical capacity to increase the quality and quantity of their produce as well as expand their access to better technologies and support services – is also part of creating a supportive enabling environment for female agripreneurs.

In many countries, women are often pressed for time as they balance household responsibilities with their commercial activities. Therefore, using a systematic approach, such as *Kawolor*’s “*Nurturing Connections*” methodology, to promote focused dialogue and conscious decision-making can increase women’s voices in household decisions and free up women’s time from laborious household chores. The result is greater awareness and support from other household members that allows women to engage in more productive and lucrative commercial enterprises to the benefit of the entire household.

Increasing women’s leadership at all levels in the food system strengthens women’s voices and women’s empowerment, both economic and social. Promoting women’s entrepreneurship, business leadership, and leadership in other decision-making bodies like water user’s associations, producer groups, and professional associations can all lead to increased opportunities for women across the food system.

The *Kawolor* approach is delivering substantial results in Senegal. Within the past two years, more than 25,000 women have entered the local food system creating, on average, a doubling of participating women’s revenue from horticulture. Further, participating households have demonstrated large jumps in household income from \$1,700 to \$2,700, an average increase of more than 60% in two years. Because most of the project’s participants are women, these impacts are due to the enhanced participation of women in commercial agri-businesses, including commercial food production, processing, and agricultural services.

Lesson 13: Innovative public-private partnerships between donor agencies and multi-national firms can help companies create more inclusive global supply chains to engage and positively impact more women, youth, and persons with disabilities

Through a Global Development Alliance, USAID and PepsiCo co-invested in the partnership “Investing in Women to Strengthen Supply Chains,” which started in 2020. The objective of the project, co-managed by PepsiCo, USAID, and Resonance, is to prove the business case for women’s economic empowerment and demonstrate how elevating women’s roles in supply chains can support improved growth, sustainability, and profitability. By looking at PepsiCo’s supply chain operations in Colombia, India, Pakistan, and Vietnam, the project is working to identify a common and yet flexible process to improve women’s empowerment.



Figure 4.1
Source: PepsiCo

To help local and regional PepsiCo managers and buyers understand the realities of gender relating to their own specific supply chain, Resonance, along with project partner International Center for Research on Women (ICRW), has developed the Supply Chain Empowerment Framework (SCHEF) that helps regional supply chain actors assess changes in women’s empowerment across seven domains. The SCHEF includes a suite of tools that allows agricultural buyers to understand the gendered context of their supply chain; design relevant women’s empowerment activities; and measure progress in women’s empowerment. Once there is a broad, shared understanding of the outcomes of the assessment for women, PepsiCo managers can select women’s empowerment activities from a standard menu and adapt them to different contexts. Then, a set of indicators allows local managers to measure and compare their progress in a standard way.

PepsiCo’s global supply chains are diverse and are structured differently based on the context in each country. Consequently, across a global company like PepsiCo, the business case for women’s empowerment varies by supply chain and country. Further, there are different paths to empowering women and improving the supply chain by investing in women’s empowerment. For example, in countries where most supply comes from large commercial farms, improving the working conditions for women day laborers is a critical objective. In places where supplies are sourced from smaller farms, improving women’s roles in decision-making, improving their technical capacity, and expanding their access to quality inputs may be a higher priority. Nevertheless, there are some activities that generally result in better functioning supply chains to the extent that they increase the yields from women- and men-operated farms, improve the quality of women’s produce through better technical knowledge and post-harvest handling, and improve farmer loyalty to provide PepsiCo with the supply they need. These actions are translated into contextually-relevant indicators of success that country programs can use to measure progress.

This partnership builds on the successes of the Integrated Land and Resource Governance project, in which PepsiCo, USAID, and Tetra Tech have partnered to train and coach women potato farmers in West Bengal, India on agricultural best practices as well as on self-efficacy and advocacy to improve women’s leadership within the communities. As the project demonstrates that women’s empowerment is a valid way to improve productive yields and increase profits, other global companies will be willing to make the investment.

Lesson 14: Getting more smallholders and small and medium enterprises (SMEs) involved in commercial agriculture is a joint effort among private sector firms, donor agencies, and government actors, each with a role to play in improving the dynamism and anti-fragility of local and regional markets

Anti-fragile businesses and markets are those that get more dynamic and effective as they undergo stresses and shocks. Anti-fragile market systems are characterized by a variation of businesses, all collaborating together to increase the range of business options and innovations being tested and explored within local markets. These defining anti-fragile characteristics of variation, optionality, collaboration, and innovation all enhance the ability of market to learn and pivot by adjusting its orientation and realigning its resources to adapt to new threats or take advantage of emerging opportunities.

The Feed the Future *Nafore Warsaaji* (Gardens of Abundance) project, implemented by Connexus in Senegal, is an example of the private and public sectors coming together to build anti-fragile market systems through an approach called “horticultural hubs.” Horticultural hubs are regional concentrations of businesses conducting transactions around a specific set of value chains. The hub is built upon an initial anchor partnership among a group of producers, a buyer, and, in some instances, a finance partner to provide the investment capital and working capital to conduct some initial transactions and test a range of new products, services, or business models. Once solutions have been identified and tested, the anchor partnerships gradually solidify, scale, and diversify in terms of the number and types of businesses that participate in the ongoing transactions, increasing the flow of products and services and infrastructure in proximity to the hub and increasing options and opportunities for all hub actors.

While the private sector forms the backbone and ensures the long-term sustainability of the market system, donors and governments also play a critical role in helping catalyze and scale hubs by limiting the risk for initial exploration. Using “first loss” instruments, innovation grants, and blended finance, governments and donor agencies can help catalyze private sector investment in new technologies, in introducing new products and services, or in testing innovative business models.

When prioritizing interventions, special consideration should be given to hub actors that are essential to enabling further innovation at the hub and helping scale up hub activities. Examples of these “key actors” include finance institutions experimenting with new loan products for producers or traders or insurance companies helping develop new insurance products that will, in turn, further reduce the risk for other actors to explore new options and innovations.

Lesson 15: Effective last mile strategies are a powerful way to lower barriers so that more smallholders can participate in commercial horticulture

Smallholders often face significant challenges when trying to expand into commercial agriculture. Producing food at a commercial level requires timely access to finance to purchase inputs and equipment to expand operations; high quality seeds, fertilizers, and phytosanitary products; support services like crop spraying and equipment maintenance; and technical support to improve growing and handling techniques that improve quality and decrease post-harvest losses.

In Rwanda, Senegal, and Guatemala, CRS supports private sector networks of Private Agricultural Service Provider (PASP). PASPs are autonomous “fee-for service” entrepreneurs based in rural communities who work to expand access for local farmers to the solutions they need to improve home farm businesses. Beyond selling inputs on behalf of local suppliers, PASPs also facilitate finance and technical assistance to improve the use of the inputs. Finally, PASPs connect farmers to local markets to sell their produce. PASPs are often linked to Savings and Internal Lending Community (SILC) groups, to help group members gain access to formal finance for commercial agriculture by using their group savings as collateral.

After three years, a survey of PASPs and their customers in all three countries has concluded that PASPs are helping more smallholders adopt new technologies. The survey found that:

- 32% of farmers who bought inputs from a PASP in 2020 were buying those inputs from the PASP for the first time.
- 37% had never bought these inputs before, from any source, indicating that PASPs have expanded access to inputs for unserved farmers and increased technology adoption rates.
- 66% of the farmers interviewed were repeat customers – indicating satisfaction with the PASPs’ goods and services.
- 97% said the PASP was easy to reach during the input ordering process and that delivery was convenient for them.
- 99% said they would recommend their PASP’s services to a friend or neighbor.

While challenges remain – in particular, continuing to improve the quality of PASP technical assistance as well as the profitability of their businesses – the three-country study provides proof of concept that PASPs are lowering barriers for smallholders to improve their production and helping increase the adoption of technologies and solutions that will enable them to participate in commercial agriculture.

Lesson 16: Persuading market system actors to invest in youth requires a clear value proposition and strong business case

Young people make up more than 59% and 52% of all populations in Africa and the Middle East, respectively. Because of their forward thinking and embrace of new technologies, youth can be important catalysts for positive change within market systems, improving economic opportunity for themselves and other market actors. Despite the fact that youth-inclusive services can be marketable, profitable, and empowering of young people to create economic opportunity for themselves and others, many businesses and financial institutions perceive them as risky or time-consuming. Therefore, persuading market actors to engage with more youth must be seen as a discovery process that starts with existing market incentives that, over time through participatory evaluation and learning processes, can reveal the larger picture of increasing innovation and resilience and profitability for the businesses. The result can be a stronger business commitment to youth engagement.

IYF and Genesis Analytics are working together to implement and evaluate the “Youth Inclusive Market Systems” (YIMS) used in IYF’s previous “Pathways to Work” program in Tanzania, and Mozambique to get more youth involved with private sector firms via entrepreneurship, business mentoring, and youth employment. To overcome the initial hesitancy of firms and acquire buy-in from market partners, IYF/Genesis has learned that it is critical to align youth skill building with the urgent needs of the market, and thus make a strong business case by clarifying youth’s value proposition for a firm. Convincing value propositions can include youth strategies for expanding the actor’s market share, enhancing their brand visibility, improving partnership networking with other market actors, reducing service transaction costs, and promoting ICT innovation.

Consequently, it is important to engage the private sector in co-creation early in the design stage as well as to embed monitoring and evaluation into the activity to improve learning and adaptive management.

Participatory learning will help partners analyze and reassess their original assumptions about engaging youth, and will also help them learn from pilot activities before scaling up youth initiatives.

The lessons of the study are informing IYF’s ongoing “Zimbabwe: Works” YIMS program, six financial service providers (FSPs) partnered with IYF to design and test new youth- and gender-inclusive product innovations. These innovations were profitable for participating FSPs, all of whom continue to offer the products after the initial pilot. The innovations also increased the financial inclusion of 3,681 young Zimbabwean entrepreneurs (73% women), leading to incremental net profit of \$21,256,957 from business expansion and growth and \$2,899,852 earned as incremental income by employees of their businesses.

Lesson 17: Effectively addressing women’s economic empowerment in market systems requires a comprehensive, holistic approach that goes beyond conducting isolated gender activities and works with an array of ecosystem actors to address women’s barriers to participation at the household, community, and market level

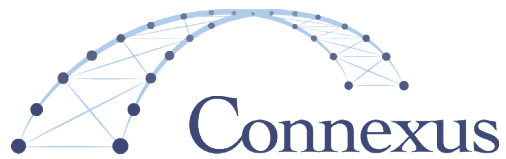
At the beginning of the *BeninCajù* program, a USDA-funded project that supports the cashew value chain in Benin, TechnoServe and CRS approached women’s empowerment primarily by focusing on creating women’s producer groups, promoting more cashew processing jobs for women, and delivering gender equality trainings to partners and beneficiaries. After two years, project evaluations discovered only limited impacts on women’s economic empowerment, compelling the project to reconsider its approach and adopt a more holistic strategy for gender equity and inclusion.

This more holistic “ecosystem” approach integrated gender across all levels of the market ecosystem including the household level, producer groups, civil society, market partners including major cashew processors like Tolaro Global, and policymaking federations and government agencies. Furthermore, by integrating gender more deeply into the project’s central Monitoring and Evaluation (M&E), contracting, and adaptive management processes, the project made gender a central concern of project actors. By integrating women’s participation as a primary performance indicator and by employing specific targets, benchmarks, and evaluations as part of the project partner requirements, *BeninCajù* project partners have become more coordinated and focused on achieving the target results in women’s economic empowerment.

Over two years *BeninCajù* made large strides in reducing major barriers to women’s membership in cashew producing cooperatives and to assuming leadership roles in policymaking bodies. Women’s membership in producer cooperatives increased 10-fold to include more than 20,000 women. Three women were elected to serve on the Board of Directors of the national cashew producers federation.

V. Conclusion

This year's *Cracking the Nut*® conference was rich in technical content and intellectual capital. As a community, we demonstrated our resilience and to pivot in the face of difficulties, shifting from our traditional in-person learning event to an online event due to COVID-19. The pandemic and the idea of “building back better” highlighted the need to move beyond traditional views of resilience toward the concept of “anti-fragility,” which will help us not just survive continual stresses and shocks but thrive in the face of uncertainty. Becoming anti-fragile means acknowledging that the world is becoming increasingly unpredictable, compelling us to re-think and retool our systems so that they can embrace and benefit from constant change by constantly adapting and renewing themselves to perform better. Connexus is committed to supporting the design of anti-fragile market systems and welcomes the *Cracking the Nut*® community to join in this endeavor.



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