MILKEN INSTITUTE

WFP World Food Programme

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# AGRITECH IN AFRICA:
## Why an AgriTech Innovation Competition?

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# About the Milken Institute

The Milken Institute is a nonprofit, nonpartisan think tank focused on accelerating measurable progress on the path to a meaningful life. With a focus on financial, physical, mental, and environmental health, we bring together the best ideas and innovative resourcing to develop blueprints for tackling some of our most critical global issues through the lens of what's pressing now and what's coming next.

# About Milken Institute Innovation Competitions

Milken Institute Innovation Competitions offer exciting and effective tools for partners interested in sourcing or scaling innovative solutions. As a think tank and research institute, the Milken Institute sees each competition as an important opportunity to landscape a given field, incentivize new ideas and innovators, create and analyze data, and prime new markets and entrepreneurs for success. Ranging from seed money and achievement awards to large-scale global competitions, we tailor competitions and awards to maximize the impact and goals of our partners. The Milken Institute Innovation Competitions team is part of the Institute's Center for Strategic Philanthropy, which advises philanthropists and foundations seeking to develop and implement transformative giving strategies.

# About the World Food Programme

The United Nations World Food Programme (WFP) is the world's largest humanitarian organization saving lives in emergencies and using food assistance to build a pathway to peace, stability, and prosperity for people recovering from conflict, disasters, and the impact of climate change. The WFP Regional Bureau for Eastern Africa provides strategic guidance and support to WFP operations and activities in 10 countries in East Africa: Burundi, Djibouti, Ethiopia, Eritrea, Kenya, Rwanda, Somalia, South Sudan, Sudan, and Uganda. In 2022, WFP supported more than 43 million food-insecure people in East Africa with food and nutrition assistance. Located at the WFP Regional Bureau in Nairobi, Kenya, the IGNITE Innovation Hub for East Africa supports food systems innovations in Africa and facilitates collective learning on innovation across WFP and with partners with the ultimate objective of contributing to bringing about more sustainable, inclusive, and locally led food systems in Africa.

# CONTENTS

# INTRODUCTION: THE PROMISE OF AGRITECH

*AgriTech has the potential to vastly improve agricultural supply chains "from seed to sale," increasing prosperity for farmers—particularly smallholder farmers—while also increasing food security for whole societies.*

Exacerbated by the continuing impacts of the COVID-19 pandemic, Russia's invasion of Ukraine, and other ongoing stresses to global supply chains, rising food costs are driving millions of people around the world into hunger. According to the Food and Agricultural Organization (FAO) Food Price Index, food prices reached their highest levels ever in 2022, and the economic and trade uncertainty are unlikely to be resolved quickly.[1] In this context, calls for improving agricultural productivity and strengthening food systems are increasingly urgent.

In Africa, revitalizing the agricultural sector is also essential to advancing the Sustainable Development Goals (SDGs) and creating broad-based economic prosperity. In at least 24 African economies, representing about 800 million people, the agricultural sector constitutes 20 percent or more of gross domestic product (GDP), compared to an Organisation of Economic Co-operation and Development (OECD) member average of just 1.4 percent.[2] Across the sub-Saharan African region, the agricultural sector represents more than $330 billion in annual economic activity and employs roughly 53 percent of the labor force.[3] Yet the sector is sapped by massive inefficiencies and a lack of investment.

AgriTech, the use of emerging technologies to help farmers become more efficient and profitable, promises to help revitalize and potentially revolutionize the sector. Successfully developed and deployed, AgriTech innovations can significantly increase farm yields, decrease post-harvest loss, and develop stronger markets to link growers and buyers. In other words, AgriTech has the potential to vastly improve agricultural supply chains "from seed to sale," increasing prosperity for farmers—particularly smallholder farmers—while also increasing food security for whole societies.

The Milken-Motsepe Prize in AgriTech was designed to make progress toward these goals. This innovation competition offered $2 million to inspire tech-based solutions that increase economic value for small and medium-sized farms in Africa, with a $1 million grand prize for the winning team and $1 million in additional prizes. Registration opened in April 2021, and in February 2022, a panel of five expert, independent judges selected 25 finalist teams.

The purpose of this report, co-authored by the Milken Institute and the World Food Programme (WFP), is three-fold: first, to describe the AgriTech landscape in Africa; second, to review the design of the Milken-Motsepe Prize in AgriTech; and third, to document some of what has been learned so far. Major takeaways from the report include the following:

- African governments and development partners recognize AgriTech's potential to revolutionize the agricultural sector and create new economic opportunity for the continent's vast youth population. The private sector also sees this potential, and venture capital funds injected $480 million into African AgriTech in 2021, a record-setting year. Despite high levels of public and private investment, major funding gaps remain.

- Innovation competitions are a proven tool for unlocking transformative approaches to what might appear to be intractable problems and for cultivating new entrepreneurial ecosystems. To design a competition structure that would genuinely advance the African agricultural sector through the deployment of fourth industrial revolution (4IR) technologies, the Milken-Motsepe Prize team conducted over 200 hours of interviews with more than 50 key opinion leaders across various industries and regions. The competition design also included multiple opportunities for participating teams to strengthen their entrepreneurial skills and networks throughout the program.

- A rigorous judging process selected 25 finalist teams from nearly 300 applicants. These finalist teams represent AgriTech solutions that span the agricultural cycle, from increasing crop yields, to improving post-harvest storage and transportation, and on to connect farmers more profitably and transparently with buyers.

The report concludes with high-level recommendations on what is required to continue to build the AgriTech sector in Africa.

## THE MILKEN-MOTSEPE INNOVATION PRIZE PROGRAM

The Milken-Motsepe Innovation Prize Program is a multiyear initiative to focus global innovators and entrepreneurs on developing technological solutions that accelerate progress toward implementing the SDGs, with a spotlight on the African continent. The program is generously underwritten by the Motsepe Foundation and operated in partnership with the Milken Institute.

The Milken-Motsepe Prize in AgriTech was the inaugural prize in this series of innovation competitions. It launched in 2021, with $2 million in prize money available to teams from anywhere in the world that could develop effective technologies to increase economic value for small and medium-sized farms in Africa. A second competition, the Milken-Motsepe Prize in Green Energy, was announced in 2022, also with $2 million in prize money. This competition aims to reward innovators who expand access to reliable, affordable, and sustainable off-grid electricity in Africa. A third Milken-Motsepe Prize will be announced in 2023.

# THE AGRITECH LANDSCAPE IN AFRICA

*Governments across the continent recognize the catalytic effect AgriTech can have on scaling food production and achieving strategic food security objectives, and many have played a significant role in incubating and scaling the AgriTech sector.*

Many young Africans still view agriculture as a job for an older generation. In Rwanda, for example, the average age of farmers is 55, while the average age across the whole population is only 20.[4] One of the reasons the growth of AgriTech is important is that it helps attract a younger generation in need of productive work to agriculture.

Despite various challenges, the African AgriTech sector has shown the ability to transform the way in which food is grown, harvested, packaged, and transported. Innovators in the sector are utilizing and integrating 4IR technologies such as FinTech, clean energy, artificial intelligence (AI), blockchain, and other new technologies, often with a focus on supporting small-scale farming. As described below, these developments have been bolstered by both government intervention and private-sector investment, and they have a direct relationship with the need to address the consequences of climate change.

## The Role of Government, Development Banks, and Other Multilaterals

Governments across the continent recognize the catalytic effect AgriTech can have on scaling food production and achieving strategic food security objectives, and many have played a significant role in incubating and scaling the AgriTech sector. These efforts have included introducing new policy frameworks and allocating state capital flows to the development of the AgriTech sector.

Examples span the length and breadth of the continent. For instance, in western Africa, the Nigeria Digital Agriculture Strategy presents a 10-year plan to improve the efficiency and competitiveness of Nigeria's agriculture sector using digital technologies. To the east, Rwanda's Development Bank, through its Green Fund FONERWA deploys a range of mechanisms to mitigate risk and support AgriTech supply chains. Additionally, programs funded through overseas development assistance—such as Water and Energy for Food, WFP Ignite, Energy and Environment Partnership, AgriTech and Energy Catalyst, and Enterprise Zambia Challenge Fund—have committed hundreds of millions of dollars over the past decade in grant and risk capital to develop AgriTech business models and services.

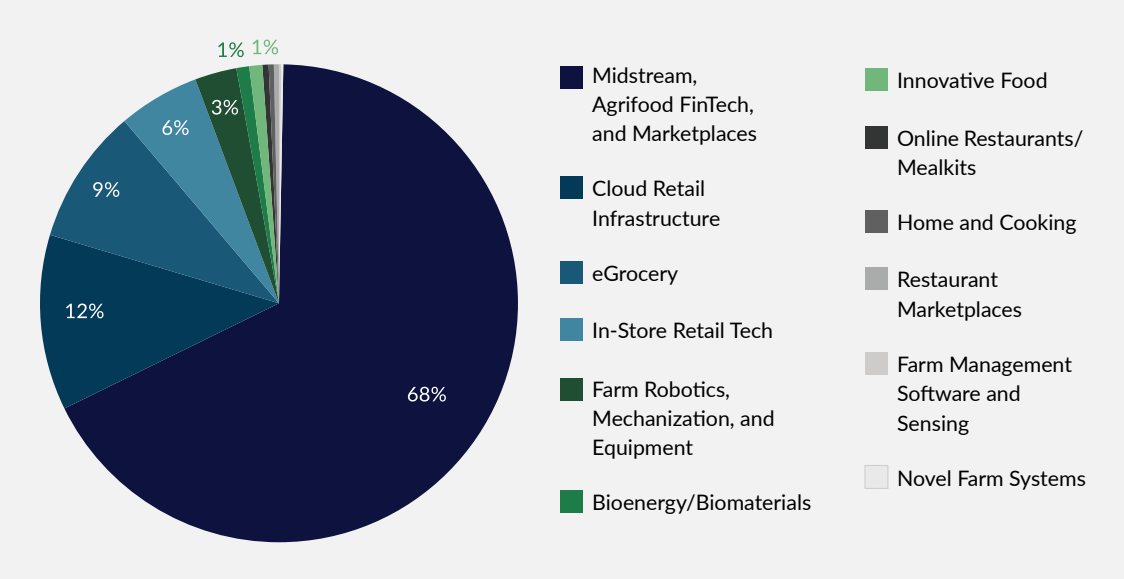
For later-stage AgriTech companies and projects, development finance institutions have provided blended financing support and technical assistance to developers and investors. Examples include the European Development Finance Institutions' Agriculture Financing Initiative (AgriFI), a €120 million facility focused on supporting smallholder-based value chains. The US International Development Finance Corporation recently launched a small and medium-sized enterprise (SME) climate adaptation fund, providing up to $1 billion in financial instruments for intermediaries and SMEs, intending to expand access to AgriTech, energy, and water, and nature-based solutions that support climate-smart agriculture.

All of these efforts have been important in de-risking and maturing the AgriTech sector, and investors have taken notice. 2021 was a record-breaking year for investment in AgriTech for Africa, with 2022 set to eclipse it as final data are reported. Still, major funding gaps remain.

## Private-Sector Investment

Data from AgFunder, a venture capital firm, shows that African AgriTech firms raised more than $480 million in venture capital in 2021.[5] As shown in Figure 1, the bulk of this funding, over two-thirds, went to firms in the midstream tech, Agri-FinTech, and agribusiness marketplace segment of the sector. These firms are engaged in financial inclusion, logistics/distribution, processing, and infrastructure challenges across the value chain, often simultaneously.

***FIGURE 1: VENTURE CAPITAL INVESTMENTS IN AFRICAN AGRITECH, 2021***




***Source:*** *Milken Institute (2023), based on Africa AgriFoodTech Investment Report 2022, AgFunder (2022)*

In 2022, African AgriTech firms raised $400 million in investment capital in the first half of the year.[6] Agrifinancing and service providers such as Apollo and Wasoko in East Africa and Thrive Agric in Nigeria attracted more than $220 million in a combination of venture and non-dilutive capital.[7] Apollo's Series B equity investment was led by Softbank Vision Fund 2, which brought in mature firms such as Yara Growth Ventures, Endeavor Catalyst, British International Investment, and the Chan Zuckerberg Initiative, alongside existing investors Anthemis Exponential Ventures, Flourish Ventures, Leaps by Bayer, SBI Breyer Capital, and

TO Ventures Food.[8] Other key venture capital and private equity funds investing in African AgriTech included Helios, SilverStreet, Novastar Ventures, DOB Equity, FactorE, CreaDev, and Verod Kepple.

Although these investment trends are notable, serious gaps remain. Africa receives only 1 percent of global AgriTech investment (see Figure 1).[9] Moreover, according to estimates, there is a $170 billion annual financing gap for smallholder farmers, holding back the sector in Africa.[10] In other words, this investment gap is over 300 times larger than the record-breaking level of venture capital deployed into African AgriTech in 2021. Without attracting these larger amounts of investment, critical infrastructure and logistics support will remain undeveloped, and needed investments in equipment, inputs, market linkages, and green value-chain development will also go unrealized.

## Climate Connection

African economies have emitted almost none of the global greenhouse gases that cause climate change, yet the continent will bear the brunt of the impacts.[11] Africa is expected to heat up 1.5 times faster than the rest of the world and is home to 35 of the 50 countries that are most vulnerable to climate change.[12] In the agricultural sector, some estimates predict a 50 percent drop in crop yields across the region by 2050.[13]

The risks, though, could also represent an opportunity for AgriTech to support African and global food system resilience in the face of climate change, both through adaptation and mitigation. In particular, the Voluntary Carbon Market (VCM), where individuals, institutions, and corporations buy and sell carbon credits to offset their carbon emissions, is a promising way for vulnerable communities to develop and build climate resilience. Compared with other mitigation approaches, agriculturally focused projects offer several co-benefits that strengthen natural ecosystems and improve economic outcomes. These co-benefits include increased access to clean water and energy, greater biodiversity, and improved soil health and climate resilience, all of which are meaningful for achieving the SDGs.[14]

Far from isolated pockets of innovation, this climate focus is receiving endorsement and action from large players and institutions. At the international climate gathering COP27, a coalition of partners launched the Africa Carbon Markets Initiative (ACMI) to "drive a dramatic increase in the production of African carbon credits while ensuring that carbon credit revenues are transparent, equitable, and create good jobs."[15] In Kenya, President William Ruto, an ecologist and agriculturalist by background, has argued that Kenya's next significant export will be carbon credits.[16]

Common across many AgriTech carbon projects is the integration of the internet-of-things (IoT) and remote analytics, connecting directly to the distributed assets on the ground. Consequently, adoption and carbon-reduction potential can be verified accurately and in real time, supporting the issuance of credits with quality and integrity. Of note, while climate goals were not explicitly part of the Milken-Motsepe Prize in AgriTech, several finalists are advancing precisely this kind of IoT solution, and many of their projects contribute to climate change mitigation and adaptation efforts.

# DESIGNING THE MILKEN-MOTSEPE PRIZE IN AGRITECH

*Innovation competitions offer an infusion of human capital to solve a major challenge that is "stuck." They are not for incremental changes. Rather, they are built to overhaul systemic problems and catalyze new markets.*

As discussed above, building the AgriTech sector is crucial for a variety of pressing development goals, including increasing food security, creating new jobs for young people, and addressing the climate crisis. At the same time, the agricultural sector remains broadly inefficient and underfunded. Within this context, the Milken-Motsepe Prize in AgriTech launched in April 2021 with a global call for innovative solutions to increase economic value for small and medium-sized farms in Africa. To win the $1 million grand prize, teams were challenged to develop innovative technology solutions for any stage of the food system, "from seed to sale"—that is, for the planting stage, through harvesting, and onto the final sale of produce to consumers.

## Why Innovation Competitions?

As the Motsepe Foundation recognized, innovation competitions are a powerful tool to source and scale disruptive solutions to a defined problem that is either universally understandable or easily articulated. Innovation competitions offer an infusion of human capital to solve a major challenge that is "stuck." They are not for incremental changes. Rather, they are built to overhaul systemic problems and catalyze new markets.

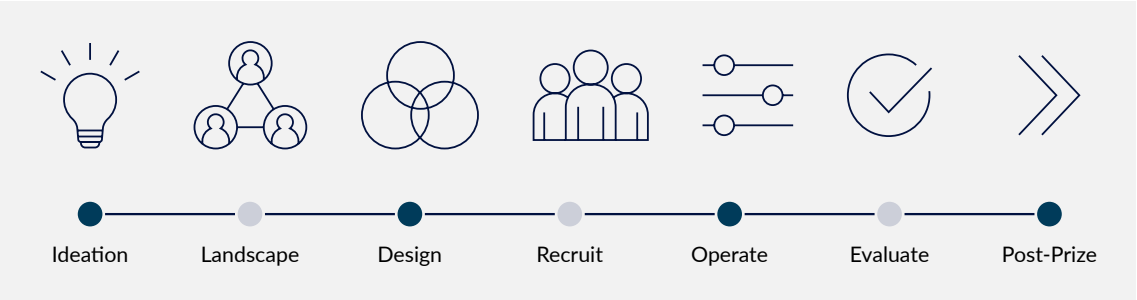
In their design and execution, innovation competitions recognize that talent is universally distributed but not universally fostered. There is a long history of innovation competitions inspiring new or unconventional innovators, revolutionizing industries, and creating new markets. Although monetary awards are given solely to teams that achieve validated results, the overall impact of the competition encompasses the collective work of all registrants. More than just a contest or award, innovation competitions strengthen the entrepreneurial ecosystem, maximize philanthropic impact, and facilitate data capture.

# Designing the AgriTech Competition

No two problems are alike, so no two competitions look exactly alike. Smart competition design always incorporates a careful formula of finding and defining the problem to be solved, offering an incentivizing financial reward to inspire participation, testing possible solutions, and connecting entrepreneurs to investors and other resources throughout the process to help them create sustainable, successful solutions.

In the case of the Milken-Motsepe Prize in AgriTech, the Milken Institute, as the competition operator, undertook an extensive ideation, landscape, and design process to advance the goal of the Motsepe Foundation, the prize sponsor, to achieve the SDGs in Africa using breakthrough technologies (see Figure 2). Given the centrality of agriculture to the first two SDGs— eradicating poverty and ensuring zero hunger—as well as the fact that the agricultural sector remains the least digitized of all major industries,[17] AgriTech was fertile ground for designing an inaugural competition for the multiyear, multimillion-dollar Milken-Motsepe Innovation Prize Program. Throughout the landscape analysis, the Institute workshopped prizeable areas in agriculture and technology in Africa and mapped out key experts and literature.

***FIGURE 2. THE MILKEN INSTITUTE'S INNOVATION COMPETITION PROCESS***




***Source:*** *Milken Institute (2023)*

The Institute consulted with more than 50 experts from five continents, representing 20 countries, with nearly 60 percent from Africa. These globally diverse, cross-sector experts represented agriculture, academia, policy, and technology and were interviewed for a total of 200 hours (see Appendix 1, Experts Consulted). Throughout the interviews, experts underscored the importance of increasing farm productivity in Africa, decreasing post-harvest loss, and improving farmers' access to markets. The key issues and market failures identified by experts are captured in Table 1 below.

*TABLE 1. KEY CHALLENGES FOR AFRICAN FARMERS, AS IDENTIFIED DURING EXPERT INTERVIEWS*

| Issue | Market Failure |
|---|---|
| Access to finance | Lack of access to credit and traditional financial inclusion for SMEs (particularly female-led), driven by information asymmetries across the value chain; high transaction costs; burdensome collateral requirements; and high perceived risk |
| Missing middle | Lack of access to financing bigger than microloans and smaller than major corporate farming |
| Predictable market access | Lack of control over aggregate purchasing and selling across agriculture |
| Training, education, and jobs | Lack of access to mobile-based agronomy and technical training for smallholder farmers and SMEs |
| Ag-energy-water nexus | Lack of access to affordable energy solutions paired with adaptable irrigation tools and resulting circular negative impacts on agricultural development and sustainability |
| Water scarcity | Poor access to water for soil health and better yields for smallholder farmers |
| Soil and seed health | Lack of adaptive tools to monitor and report on soil and seed health, leading to soil infertility and insufficient supplies of certified seeds for nutritious crops |
| Need for drought-resistant crops | Climate-driven devastation of crops, exacerbated by lack of access to drought-tolerant seed varieties |
| Food scarcity in urban areas | Lack of sustainable models to get fresh foods to increasingly populated urban areas |

***Source:*** *Interviews with more than 50 key opinion leaders, as conducted by Milken Institute staff (2020–2021)*

Throughout the interview process, the team sought to understand what was not working in the space, in spite of the significant growth and innovation in African AgriTech in recent years. Through synthesizing expert insights, the Milken Institute, in consultation with the Motsepe Foundation, determined that the focus of the AgriTech innovation competition should have three components. First, it needed to focus on increasing the prosperity of African farmers. Second, it should do so through accelerating innovations in either decreasing post-harvest loss or increasing farm yields. Finally, the competition should focus on smaller or medium-sized farms where most Africans engaged in agriculture are employed, as opposed to large-scale, corporate farms.

This landscaping and design work eventually led to a concise, direct challenge statement for the competition: ***Winning teams will increase net economic value to small and medium-sized farms in Africa by increasing productivity on the farm and/or decreasing post-harvest loss.*** This challenge statement guided participants as they submitted their designs, judges as they assessed proposed solutions, and finalists as they went out into the field to demonstrate the effectiveness of their innovations.

## The Benefits of Competing

The open, global nature of the Milken-Motsepe Prize in AgriTech was designed to encourage unconventional innovators and nontraditional voices to participate. To advance this vision, the Milken Institute introduced several capacity-building activities and additional benefits into the life cycle of the competition.

As soon as teams registered for the competition, they received access to the Milken-Motsepe Prize portal, which served as an online community for teams. Here, they could connect with entrepreneurs from around the world on the portal's matchmaking forum and build out their teams. They also received free access to exclusive webinars and a curated library of resources about innovation, startup business development, and agricultural technology to support them on their entrepreneurial journeys.

Once selected, AgriTech finalists received several benefits, not least of which was $10,000 in starter funding to field test their innovation.[18] Beyond funding, every finalist team was invited to participate in a tuition-free, experiential learning program offered by Global Innovation Catalyst in collaboration with Stanford Online and featuring the entire course content from Stanford University's Idea-to-Market entrepreneurship program. Upon finishing the program, teams received a Stanford Online certificate of completion, in addition to mentoring from industry experts and pitch feedback sessions. More than 40 finalist team members participated in the 13-week program from March to July 2022.

Finalists also had the opportunity to receive further one-on-one coaching to refine their pitches with industry experts in fall 2022 in advance of the launch of the Milken-Motsepe Prize Investor Showcase. This dynamic database helps investors engage directly with the finalists and sort through company information, pitch decks and videos, fundraising stages, countries of operation, and more. As the Milken-Motsepe Innovation Prize Program scales, this platform will feature participants across Milken-Motsepe Prizes.

Storytelling and content capture were also important to the competition design and execution. The Milken-Motsepe Prize provided free GoPro cameras and accessory kits to each finalist team to support their storytelling and content capture. Experts also provided detailed guidance on how to use the cameras, types of footage to capture, and how to use the content on different mediums. The Milken Institute also offered competitors the opportunity to contribute to the Stories from the Field interview series to share the inspiration and motivation behind their innovations. Finalists were also given the opportunity to participate in podcast interviews and trainings on the importance of storytelling to startup fundraising.

## Field Testing and the WFP Partnership

One of the distinguishing features of an innovation competition as compared to other philanthropic or development tools is that funding is deployed at the last stage of the process. Driven by the financial incentives of winning, teams must demonstrate that their compelling ideas actually work in the real world. In this spirit, to validate the viability, scalability, and transformative potential of their innovations, finalists in the Milken-Motsepe Prize in AgriTech were required to design and run rigorous field tests of the innovations in Africa.

In spring 2022, all finalist teams submitted detailed testing protocols to the Milken Institute and WFP. As specified in the competition rules, teams had to perform a field test of their design in real conditions on a small or medium-sized farm in Africa (defined as under 100 hectares) and collect quantitative data on its results. They were also required to collect the same quantitative data in a simultaneous control test in the same location using conventional farming methods. Teams were responsible for obtaining access to farms with appropriate facilities and conditions and for fully documenting their processes and results.

## KEY TAKEAWAYS FROM THE AGRITECH FIELD TESTS

Overall, WFP appreciated seeing innovators actively working on solutions that promise to improve farming productivity, reduce post-harvest losses, and better link produce to markets. In general, finalist teams succeeded in advancing their innovations through the field-testing process, and the AgriTech prize appears to have had a lasting impact on where the innovators find themselves today.

During the course of site visits to all competing teams, WFP documented two major takeaways:

- The field test requirement, in general, pushed teams to take innovative concepts from the design stage to actual execution at a more rapid pace than would otherwise have been the case.
- Requiring teams to test in Africa is a fundamental component of the overall success of the broader competition. In some cases, the tech may have been developed outside of Africa, but the field test requirement meant that teams had to demonstrate the ability to build local distribution networks and prove on-the-ground user engagement.

To ensure the highest quality process, the Milken Institute partnered with WFP to advise teams on their protocols, when requested by teams, and to physically visit all testing sites to verify testing activity. Between July 2022 and January 2023, WFP sent teams to the testing sites of all competing teams, spread across 16 African countries. These site visits extended over the course of two days and involved physical inspection of both testing and control sites, live demonstrations of the team's innovations, visits to the team offices to review data storage and analysis, and interviews with end users to gauge adoption potential.

WFP staff also documented their visits using an innovative image-authentication tool called TruePic.[19] After each site visit, WFP produced a detailed, standardized report for the Milken-Motsepe Prize judges that captured WFP's assessment of finalists' testing procedures. These reports were sent to teams for review on a rolling basis and were included in the final package of materials delivered to judges as they made their final decision.[20]

# AGRITECH INNOVATIONS FROM FINALISTS

*The finalists' innovations represent potentially transformative interventions that could improve efficiency across the agricultural supply chain, prevent post-harvest losses, and build better markets.*

More than 3,000 people registered to participate in the Milken-Motsepe Prize in AgriTech. As noted above, this group gained access to a knowledge library and invitation-only events and gathered into teams. When the submission window closed in December 2021, about 300 teams from this online community submitted full proposals for consideration.

Judges selected 25 of those teams to become finalists.[21] Taken as a group, their innovations represent potentially transformative interventions that could improve efficiency across the agricultural supply chain, from planting and harvesting crops, to preventing post-harvest losses, to building better markets to connect sellers and buyers at the right price.

## Increasing Farm Productivity

Crop yields fundamentally depend on three factors: the quality of their inputs, mainly seeds, soil nutrients, and irrigation; the absence of stressors, such as floods, weeds, and other pests; and the quality of the harvesting process, including the productivity of labor. The finalists in the Milken-Motsepe Prize in AgriTech advanced solutions across each of these three factors.

In terms of inputs, several teams are focused on improving farmers' ability to monitor and respond to crop conditions in near real time. For instance, FarmCommander takes an IoT approach to ensure timely irrigation, even in areas where water is scarce. Its devices monitor soil temperature and moisture levels, match those data with weather patterns, and then open irrigation valves at the exact time crops most need watering. Another example is the Tanzanian firm Automated Solar Powered Machines. The team deploys solar-powered, biopesticide and biofertilizer delivery machines to rural farms to help ensure high yields. In Malawi, MicroMek Flying Things builds low-cost drones from 3D-printed parts for use in crop health monitoring.

Another approach is to offer farmers a more tightly controlled environment that maximizes available inputs. The Rwandan firm NjordFrey, for example, provides farmers with advanced aquaponic equipment so that they can grow fish and vegetables together in the same closed loop, with increased yields in both categories. In Kenya, Safi Organics offers farmers portable equipment that converts crop residues to locally produced fertilizer blends with higher yielding results than traditional fertilizers or composting.

Next, a pair of finalist teams are focused on making farms more resilient in the face of common stressors. To mitigate the damage to crop yields caused by flooding, for example, IRRI-AfricaRice has used modern breeding technologies to develop a flood-resistant rice variety that can survive submerged under water for at least two weeks. Toothpick Project has developed inexpensive bioherbicides that destroy Striga witchweed, one of the most pernicious weeds on the continent, while protecting crops and other plants.

Finally, farm productivity depends on the productivity of the men and women working on the farms. Reliable equipment and access to electricity are key. To that end, the Ethiopian firm Hello Erf helps deliver better harvesting equipment to farmers through a digital platform that links farmers and farm machinery owners in a model comparable to that used by ride-sharing platforms. To address a lack of electricity, Koolmill offers a low-power rice mill that reduces energy needs by up to 90 percent compared to traditionally available mills.

To provide farmers with value-added training and real-time insights, finalist teams are using new digital tools to deliver information. Farmbetter, for example, has developed a mobile app that offers extension agents tailored, action-oriented, data-driven insights for the exact locations and crops of their clients. Likewise, Producers Direct provides in-person and digital training to smallholder farmers to improve knowledge about crop diversification, quality, and potential yields. The team also provides farmers with real-time weather data and insights on how to use this information.

## Reducing Post-Harvest Loss

Post-harvest loss and waste claim about one-third of all crops grown for human consumption.[22] In Africa, the losses are even higher, reaching about 40 percent of harvests brought in by Africa's small-scale farmers.[23] Despite these stark numbers, for most of the past four decades only 5 percent of investments in agricultural research has been directed toward reducing post-harvest loss in the sub-Saharan African region, according to the Rockefeller Foundation.[24]

Post-harvest loss not only has a negative impact on the amount of food that can reach the human population but also greatly disadvantages the economic opportunities for farmers, especially the majority who work on small farms. Finalists in the Milken-Motsepe Prize for AgriTech have pursued several solutions, including refrigeration, packaging, and repurposing of waste, to address these losses.

One of the most important factors in reducing post-harvest loss in hot climates is access to affordable, reliable refrigeration. To address that need, the Ivorian firm Cool Lion delivers "cooling as a service" by providing remotely operated, solar-powered cold storage containers under a leasing model. Likewise, Smart Villages Research Group, in addition to entrepreneurship training, offers farmers in Uganda access to cold and dry storage to preserve the quality of crops on their way to buyers.

Another approach is packaging. Two finalist teams, GreenPod Labs and Karpolax, have developed what are called active sachets that keep fruits and vegetables fresher for longer periods of time. GreenPod Labs has focused on using natural plant extracts to activate mechanisms that slow the ripening process in strawberries, grapes, mangoes, and avocados.

Similarly, Karpolax, which primarily focuses on mangoes but also provides sachets for bananas, apples, and oranges, has developed patented ratios of naturally occurring polymers that activate the same mechanisms.

Interestingly, several teams that advanced to the finalist stage are working to turn waste into useful inputs for the next crop cycle. As these examples demonstrate, there is often a connection between reducing waste and increasing farm productivity. In Tanzania, for instance, NovFeed is also repurposing farm waste to create a high-protein input for aquaculture. The Nigerian firm Bebeque Energy, on the other hand, repurposes agriwaste—in particular, rice husks—for biopower, and its generators then help power rice and cassava mills and other agriprocessing activities that also increase farm productivity. Taking another approach, the Rwandan firm Magofarm uses the larvae of black soldier flies to convert wasted food into organic fertilizer and protein biomass that farmers can use to increase the yield of the next crop cycle.

## Growing Markets

In the journey "from seed to sale," the final requirement is connecting farmers with the right buyers for their produce. Unfortunately, many small and medium-sized farms face fragmented supply chains, poor infrastructure, and price-gouging as they try to sell their crops. Many are disempowered by a lack of knowledge about buyer needs and opaque pricing mechanisms. As a result, these farmers earn less than they would in a well-functioning, transparent market. Two finalist teams have advanced solutions in this space, using digital, mobile-based matching platforms. In Ghana, Esoko has created a digital platform that aids farmers in aggregating crops into appropriate warehouses for value-added processing and then links farmers to higher value buyers. In a similar vein, the South African firm Kuronga has created a mobile app that uses AI to validate produce quality based on photos farmers take on their phones and then matches farmers and buyers according to that assessment.

# SUMMARY THOUGHTS AND RECOMMENDATIONS

Agriculture is central to productivity and employment across African economies and around the world. Unfortunately, the sector is often highly inefficient, which harms farmers and threatens the food security of the broader population. In this context, the market needs scalable AgriTech innovations that advance a variety of socioeconomic development goals, including job creation for young populations.

Achieving this progress will require the following:

- **Ongoing engagement from governments and development partners:** Current efforts are laudable, but national and local governments, as well as their partners in bilateral aid agencies and multilateral development banks, will need to strengthen their efforts to catalyze expanded activity in the AgriTech space through the use of policy incentives, financing, and technical support.

- **Catalyzing new flows of private-sector investment to close the investment gap:** Although government engagement is necessary, the scale of investment required can only come from private capital. All stakeholders should consider how they can help attract new flows into the African AgriTech sector and how that sector can be better prepared to receive and make good use of new funds.

- **Identifying solutions that work for smallholder farmers and rural communities:** The vast majority of Africans employed in the agricultural sector live in rural communities. These are the farmers who are most in need of innovative approaches to increasing farm yields and reducing post-harvest losses. Governments, development partners, and investors must remain focused on uncovering solutions that work for these communities and bringing them to market.

- **Bringing those solutions to scale so that millions can benefit:** As new approaches are proven in particular locations, the focus should shift to scaling those solutions to a broader network of similar farms across the continent. Doing so will require documenting successes and communicating how those innovations might be replicated in other jurisdictions.

The Milken-Motsepe Prize in AgriTech was designed to contribute to these overarching goals. By incentivizing innovation, the competition has helped discover new approaches to increasing the prosperity of small and medium-sized farms in Africa. The hope is that these innovations can benefit millions across the continent as they scale.

# APPENDIX 1: EXPERTS CONSULTED DURING THE DESIGN PHASE

| Name | Position | Company | Base |
|---|---|---|---|
| Iyinoluwa (E) Aboyeji | CEO & General Partner | Future Africa | Nigeria |
| Arthur Amadi | Founder, Head of Vision and Global Youth Mobilizer | Youth in Diaspora | Canada/ Nigeria |
| K.Y. Amoako | Founder and President | African Center for Economic Transformation | Ghana |
| Tosin Badeniyi | Professor | Durban University of Technology | South Africa |
| Aron Betru | Chief Strategic and Operating Officer | Trident | USA |
| Sriram Bharatam | Founder & Chief Mentor | Kuza Biashara Limited | Kenya |
| Priscilla Boiardi | Coordinator, Network of Foundations Working for Development and Centre on Philanthropy | Organisation for Economic Co-operation and Development | France |
| Jennifer Bravo | Project Director | Accelerate Resilience LA | USA |
| Grant Brooke | Co-Founder and Former CEO | Twiga Foods | USA |
| Angus Campbell | Director of Design and Deputy Head of School, Te Waka Tūhura, Elam School of Fine Arts & Design | University of Auckland | New Zealand |
| Wambui Chege | Supervisory Board Chair, Independent Consultant | Making Finance Work for Africa, African Development Bank Group | Kenya |
| Norah Clarke | Director, Entrepreneurship Development in Higher Education | Universities of South Africa | South Africa |
| Williem Clarke | CEO | Calebyte | South Africa |
| Erin Renner Cordell | Senior Policy Advisor to the OECD Chief of Staff | Organization for Economic Co-operation and Development | France |

| Name *(cont.)* | Position | Company | Base |
|---|---|---|---|
| Eric Desatnik | Founder | Synaptic | USA |
| Mabouba Diagne | Vice President, Finance and Corporate Services | Economic Community of West African States Bank for Investment and Development | Senegal |
| Adri Drotskie | Director of the School of Management | University of Johannesburg | South Africa |
| Beth Dunford | Vice President, Agriculture, Human and Social Development | African Development Bank Group | USA |
| Michael Dunford | Regional Director, Eastern Africa | World Food Programme | Australia/ Kenya |
| Sara Eckhouse | Executive Director | FoodShot Global | USA |
| Rob Floyd | Director, Innovation and Digital Policy | African Center for Economic Transformation | USA |
| Chris Frangione | COO | Veer.Voyage | USA |
| Mona Hamdy | Chief Strategy Officer | Sino Global Capital | Egypt |
| Ed Hsu | Senior Manager, Environmental, Social, Governance Consulting Solutions | PwC | USA |
| Amy Jamison | Co-Director, Alliance for African Partnership | Michigan State University | USA |
| Ammar Kawash | Head of the Smallholder Agricultural Market Support Unit | World Food Programme | Rwanda |
| Rachel Keeler | Project Manager | Dalberg | Kenya/USA |
| Boaz Keizire | Head of Policy and Advocacy | Alliance for a Green Revolution in Africa | Kenya |
| Simon König | Executive Director | Climate Focus, North America | USA |
| Lise Korsten | Co-Director of the DSI-NRF Centre of Excellence in Food Security | University of Pretoria | South Africa |
| Henry Musa Kpaka | Chief Technical Advisor to the Chief Minister, Office of the President | Government of Sierra Leone | Sierra Leone |
| Milton Lore | Head of Partnerships | Open Capital | Kenya |
| Matt Lurie | Senior Associate, Biodiversity Conservation | Washington Department of Fish and Wildlife | USA |

| Name *(cont.)* | Position | Company | Base |
|---|---|---|---|
| Naudé Malan | Senior Lecturer in Development Studies | University of Johannesburg | South Africa |
| Phetole Mangena | Senior Lecturer and Researcher in Plant Biotechnology, Department of Biodiversity | University of Limpopo | South Africa |
| Ed McNierney | Chief Technology Officer | Oneiro | USA |
| Richard Mkandawire | Africa Director, Alliance for African Partnership | Michigan State University | Malawi |
| Shadrack R. Moephuli | Research Fellow | University of South Africa | South Africa |
| Keo Motaung | Assistant Dean: Postgraduate Studies, Research, Innovation and Engagement, Faculty of Science | Tshwane University of Technology | South Africa |
| Gerardine Mukeshimana | Minister of Agriculture | Government of Rwanda | Rwanda |
| Christine Negra | Principal | Versant Vision LLC | USA |
| Ndidi Okonkwo Nwuneli | Co-Founder & Executive Chair | Sahel Consulting: Agriculture & Nutrition Ltd | South Africa |
| Folu Okunade | Co-Founder & COO | Hello Tractor | Kenya |
| David Perry | Consultant; Former CEO | Indigo Agriculture | USA |
| Jérémie Pigé | Commercial Director | Solight Composites | Kenya/France |
| Simone Pourier | Senior Advisor Benelux | Financing Agency for Social Entrepreneurship | Curaçao/ Netherlands |
| Bettina Prato | Senior Coordinator for the Smallholder and Agri-SME Finance and Investment Network | International Fund for Agricultural Development | Italy |
| Athena Rae Roesler | Associate Director, Center for Public Health | Milken Institute | USA |
| Frank Rubio | Senior Technical Advisor | International Fund for Agricultural Development | Peru |
| Brooke Smith | Sustainable Business Development Manager, Americas | Barry Callebout Group | USA |
| Charlotte Streck | Co-Founder and Director | Climate Focus | Germany |

| Name *(cont.)* | Position | Company | Base |
|---|---|---|---|
| Albert Strever | Senior Lecturer and Coordinator, Agri Innovation and Informatics | Stellenbosch University | South Africa |
| Ify Umunna | Founder | Kori Collective | Nigeria |
| Michael Von During | Technical Specialist, Smallholder and Agri-SME Finance and Investment Network | International Fund for Agricultural Development | Italy |
| Glenn Yago | Senior Director, Milken Innovation Center | Jerusalem Institute for Policy Research | Israel |

***Note:*** *Titles used here are current as of the time of publication.*

# APPENDIX 2: FINALISTS IN THE MILKEN-MOTSEPE PRIZE IN AGRITECH

| Team Name | Description of Innovation | Home Country |
|---|---|---|
| Automated Solar Powered Machines | Solar-powered machines to deliver biopesticides and fertilizers | Tanzania |
| Bebeque Limited | Mobile, modular biopower | Nigeria |
| Comet-ME | Solar-powered piston pumps | Israel/Palestinian Territories |
| Cool Lion | Solar-powered refrigeration for mangoes, tomatoes, and other crops | Côte d'Ivoire |
| Esoko | Digital matchmaking platform for increasing farming sales | Ghana |
| Farmbetter | Mobile app offering advanced farming advice | United Kingdom |
| FarmCommander | Mobile app for managing intelligent farm irrigation | South Africa |
| GreenPod Labs | Active packaging to slow down ripening and prevent microbial growth | India |
| Hello Erf | Digital platform for agricultural machinery, with business support services | Ethiopia |
| IRRI–AfricaRice | Bioengineering to create flood-tolerant rice | Philippines/Côte d'Ivoire |
| Karpolax | Extending the shelf life of mangoes through specially designed sachets | Uganda |
| Koolmill Systems | High-tech rice milling, including 3D-printed mini-mill | United Kingdom |
| Kuronga | Machine learning-powered digital marketplace for groundnuts, potatoes, and tomatoes | South Africa |
| Lemaculture | Biomolecular analysis, including RNA sequencing, followed by big data analysis to offer farm-specific strategies | Botswana |
| Magofarm LTD | Converting food waste into organic fertilizer | Rwanda |

| Team Name *(cont.)* | Description of Innovation | Home Country |
|---|---|---|
| MicroMek Flying Things | Drone solution with aerial imagery for crop monitoring | Malawi |
| Molepse Bioresources | Affordable biopesticides made from locally available products | Kenya |
| NjordFrey | Closed-loop aquaponics to increase vegetable yields | Rwanda |
| NovFeed | Usage of organic wastes to grow bacteria cultures | Tanzania |
| Producers Direct | Data sharing, data analysis, and farmer trainings via mobile phones | Kenya |
| Safi Organics | Decentralizing fertilizer production through low-cost portable systems | Kenya |
| SVRG–EcoLife | Solar-powered farming enterprise center offering cold- and dry-storage and farmer trainings | United Kingdom/Uganda |
| Toothpick Project | Cultivated fungal strains for weed management | United States |
| Village Infrastructure Angels | Solar-powered, multicrop milling system | United Kingdom |
| Vuna Technologies | Drones and analytics to monitor crops | Kenya |

# ENDNOTES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18. Additional, needs-based grant funding was also made available to finalist teams to support their field testing activities.

19. TruePic is a mobile-based tool for verifying the authenticity of images and video and is meant to complement or replace on-site inspection and due diligence.

20. Finalists had the optional opportunity to submit comment letters to respond to the analysis and conclusions of the WFP staff, and, for the several teams who did so, these letters were included in the final package of materials submitted to the prize judges.

21. Appendix 2 provides brief descriptions of all finalist teams.

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# ABOUT THE AUTHORS

**Emily Musil Church, PhD,** is dedicated to harnessing technology and innovation to address global challenges for social good. Church currently serves as a senior director at the Center for Strategic Philanthropy at the Milken Institute, where she leads the Center's Environment and Social portfolio. She specializes in human equity, high-impact philanthropy, entrepreneurship, and innovation competitions. Church spent over a decade in academia where, as a college professor at Trinity College and Lafayette College, she specialized in African history and human rights. She then joined the XPRIZE Foundation, leading the human equity domain and operating large-scale global competitions to develop new technology solutions to help solve social problems. She has a PhD and MA from the University of California, Los Angeles, is a Fulbright-Hays Scholar, and graduated with honors from Drew University, where she now serves on the Board of Trustees.

**John Schellhase** is a director at the Center for Strategic Philanthropy at the Milken Institute. His work focuses on social impact philanthropy, including designing and operating innovation competitions to increase prosperity and quality of life around the world. Prior to his current role, Schellhase worked on capital market development in developing countries as part of the Milken Institute's Center for Financial Markets. He holds a Master of Science in global affairs from New York University, where he focused his coursework on issues in international economic development with a regional focus on sub-Saharan Africa. Before his graduate studies, he served as a US Peace Corps volunteer in the Philippines. Based in Madrid, Spain, Schellhase is part of the Institute's growing team in Europe.

**Madeleine Cashin** is an associate director with the Milken Institute Center for Strategic Philanthropy, where she designs and operates the Institute's innovation competitions. Prior to this role, Cashin worked closely with the African tech and startup ecosystem at insiderPR, where she drove investment and media engagement toward impact-driven companies. Born in Nairobi and based in DC, Cashin holds a BA in sociology with a concentration in social justice analysis from Georgetown University and a master's degree in international relations from King's College, London. Before her graduate studies, Cashin served as a Youth in Development Peace Corps Volunteer in Morocco.

**Michael Dunford** became regional director of the United Nations World Food Programme's Eastern Africa Bureau based in Nairobi in June 2020. Dunford is a lawyer who has worked for the United Nations for over 20 years, commencing at the WFP in 2001. As regional director, Dunford oversees WFP operations, providing strategic guidance, supervision, and support across the region in 10 countries—namely Burundi, Djibouti, Eritrea, Ethiopia, Kenya, Rwanda, Somalia, Sudan, South Sudan, and Uganda. Overseeing 5,600 staff and a total annual budget of USD 5.6 billion, his leadership steers WFP's interventions in providing vital food and nutrition assistance to food-insecure populations.

**William Holden** is an innovative financing advisor at WFP's IGNITE East African Innovation Hub. He has 13 years of experience in energy, agribusiness, and sustainable development across Africa and Europe. His work at IGNITE is focused on supporting a portfolio of innovators in creating impact and achieving scale.


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