

African Farmers In The Digital Age

FOREIGN AFFAIRS

A close-up photograph of a woman in profile, facing right. She is wearing a vibrant, multi-colored headscarf (red, purple, yellow, blue, and black) and a colorful patterned top. She is holding a mobile phone to her ear with her right hand. The background shows a field of green crops under a blue sky with scattered white clouds.

**Overcoming isolation,
speeding up change,
and taking success
to scale**

A Special Issue Curated by Kofi Annan, Sir Gordon Conway and Sam Dryden



AFRICAN FARMERS IN THE DIGITAL AGE

*How Digital Solutions Can Enable
Rural Development*

FOREIGN AFFAIRS



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Editor's Note

Gideon Rose

Editor, Foreign Affairs

Farming is one of mankind's oldest endeavors, and digital technology is one of its newest. The contributors to this fascinating volume bring them together, showing just how much good can come from the collaboration. By thinking in terms not just of crops or yields or prices, but rather of an integrated food system that links all players in the agricultural economy, Kofi Annan, Sam Dryden, and their fellow contributors allow us to see African agricultural issues in a new light. From mobile phones to big data, nutrition to climate change, the collection covers it all, with authors who have something powerful to say and the authority to be heard. They deserve kudos for their efforts in putting it together.

PREFACE: Food and the Transformation of Africa

Getting Smallholders Connected

Kofi Annan is the Chair of the Kofi Annan Foundation and was the Seventh Secretary General for the United Nations

Sam Dryden is a Senior Fellow at Imperial College London and the former Director of Agricultural Development for the Bill & Melinda Gates Foundation

African agriculture has long been a symbol of the continent's poverty. Officials considered the hundreds of millions of African smallholder farmers too backward to thrive; the future would arrive not by investing in them but rather by bypassing them. But all that is changing.

In recent years, African agricultural policies have been haphazard and inconsistent. Some countries have neglected smallholders in favor of commercial farmers. Others have given them attention but focused narrowly on increasing their productivity. African farms' harvests are indeed much smaller than harvests elsewhere, so increasing productivity is important. But agriculture is about more than yields. A vast food system spreads beyond farm and table to touch almost every aspect of life in every society. Making that system in Africa as robust as possible will not merely prevent starvation. It will also fight poverty, disease, and malnutrition; create businesses and jobs; and boost the continent's economies and improve its trade balances.

Food systems cannot be created quickly out of whole cloth. They tend to evolve incrementally over time. But in digital technology, today's African leaders have a powerful tool they can deploy to help clear away the primary obstacle to progress: the profound isolation of the vast majority of smallholder farmers. Until now, it has been very hard to get information to or from smallholders, preventing their efficient integration into the broader economy. But mobile communications can shatter this isolation and enable the creation of a new food system suited to contemporary needs. If farsighted leaders seize this opportunity, they can transform African agriculture from a symbol of poverty and backwardness into a powerful engine of economic and social development.

Five Principles

The new African food system should be built around the idea that agriculture is about more than producing calories; it is about changing society. Its five components should be valuing the smallholder farmer, empowering women, focusing on the quality as well as the quantity of food, creating a thriving rural economy, and protecting the environment.

Neither of us is sentimental about small farms, but we recognize the need to be practical. More than 80 percent of African agricultural production comes from smallholders. Any rational food system for Africa must put its smallholders first. Over the years, many African governments have tried to bypass the existing agricultural sector by investing in large-scale commercial farms, on the theory that they would be more efficient. But allocating large blocks of land to foreign investors, reserving water for industrial-sized operations, and concentrating research and development on a few cash crops doesn't help most farmers. It also hasn't generated enough produce to feed the continent's rapidly growing urban areas, which is why food imports are going through the roof—and why city dwellers are spending more than they should on food.

In fact, Africa's smallholders are more than capable of feeding the continent—so long as they boost their yields by using the latest agronomic practices in combination with appropriately adapted seeds and fertilizer. Most have not adopted these improvements, however, because they don't know about them, or can't get to a place where they can buy them, or can't afford them. The infrastructure to link most

smallholders to markets simply doesn't exist, which means that many farmers have little incentive to increase their productivity in order to generate surpluses to sell. Enabling smallholder farmers to grow more food and sell it in formal markets for a fair price would change life for almost every poor person in Africa.

The keys to fixing this problem are supplying smallholders with appropriate seeds and fertilizer, providing education and training, and ensuring easy access to markets and larger economic networks. Mobile technology can help on all these fronts. Cell phones and digital videos, for example, can revolutionize education and training. Digital Green, an organization that broadcasts videos of farmers conducting training sessions in local languages, is the next generation of farmer extension programs. Because farmers tend to trust their peers more than outside experts, Digital Green's model has led farmers to adopt better methods at very high rates. The organization expanded from India into Ethiopia and is exploring pilot programs in Ghana, Mozambique, and Tanzania.

Women, meanwhile, provide the majority of the labor on African farms, but on average, they are less productive than men—13 to 25 percent less productive, according to a report published last year by the World Bank and the One Campaign. The reasons for this are complicated, ranging from sex discrimination in extension programs to cultural norms that can make it difficult for women to hire and manage labor during the harvest. But fixing it is a necessity. Not only do women form a major part of the agricultural work force; they also spend much more of what they earn than men do on goods such as education, nutrition, and health care, which have large positive multiplier effects. So when women have money and the power to decide how to spend it, everybody benefits.

Here again, digital technology can be incredibly useful. Giving women cell phones allows them to transact business directly, without mediators; open bank accounts only they can access; receive information and training that local men might not support; and get market prices in real time in order to negotiate effectively with potential buyers.

As for food quality, only now is the true impact of malnutrition on poor countries beginning to be understood. It is an underlying cause of almost half of all the deaths of children under five around the world and leaves tens of millions more children cognitively or physically impaired for the rest of their lives. Food everywhere is less nutritious than it should be; in the United States, for example, the food system is

designed to supply people with as many calories as possible, that taste as good as possible, for as little money as possible. As a result, American agriculture focuses on corn as a vehicle for sugar, breeds that corn for high yields rather than nutritional value, and processes it to remove whatever nutrients might still remain. This means that Americans get lots of cheap, tasty breakfast cereal that isn't good for them.

The current African food system shares some of these features. The seeds available in Africa are bred for yield almost to the exclusion of other traits; the breeders who develop these seeds focus mostly on corn and wheat, so crops such as cassava and sorghum remain unimproved; and roller mills remove nutritional value in Africa just as they do in North America. But there are some reasons to be optimistic. For example, the fortification of food that has long been standard in developed countries has begun coming to Africa as well. Rice in Ghana, maize in Zambia, and sweet potato in several countries are now being fortified with vitamin A. And biofortification promises even bigger opportunities, as advances in genetics have made it easier to breed seeds with specific nutritional characteristics, such as high-zinc wheat and high-iron pearl millet.

In a robust food system, farms support a range of businesses. Farmers need financial services, seeds, and fertilizer before they begin planting; after they harvest, they need storage, transport, processing, and marketing. Every step in this process can be an opportunity for entrepreneurial activity, so in theory, a healthy food system could nurture an entire rural sector that creates wealth and provides off-farm employment opportunities to spread it around.

So far, such businesses have been few and far between in Africa, but that may be changing. In Nigeria, for example, for 40 years, the government bought seeds and fertilizer and then had them delivered to farmers. Not only did the system not work—little of the seeds and fertilizer ever reached smallholders—but it also crowded out entrepreneurs who could have served rural communities directly. To address these issues, Nigeria recently dismantled the public procurement system and implemented policies to spur new businesses. By giving farmers a 50 percent subsidy (via vouchers sent to their cell phones), the government has helped generate demand for seeds and fertilizer. In the meantime, to make sure there is enough supply to meet that demand, the Ministry of Agriculture and the Central Bank of Nigeria launched a risk-sharing program to encourage local banks to make agricultural loans. And with the partial guarantee, banks have quadrupled their lending to the agriculture sector.

The number of seed companies operating in Nigeria has gone from just 11 to more than 100, and there are now thousands of local mom-and-pop shops selling these companies' seeds directly to farmers.

The green revolution of the 1950s and 1960s, finally, introduced new and highly productive agricultural technologies and methods and fed a billion people in Asia and Latin America. But it also ended up doing significant damage to the environment of those regions, depleting the soil and reducing biodiversity. We now know that ensuring the long-term sustainability of the African agricultural environment is more critical than ever, given the problems already being caused by climate change.

The good news is that with digital education in basic conservation techniques, such as crop rotation with legumes, so-called green manure, and good water management, smallholder farmers can not only increase yields in the short term but also restore soil health over time. This is crucial, since African soils are the most depleted in the world.

The Promise Of Digital

Digital technology can help advance all these principles simultaneously. It makes connections possible, transfers information instantaneously, and can help build virtual communities even among widely separated and remotely located individuals and communities.

Some appropriate digital applications are already in use, and more are in development. In 2014, for example, Ethiopia's Agricultural Transformation Agency launched an agricultural hot line, and it has already logged almost 6.5 million calls. It also sends text messages and automated calls containing up-to-date agronomic information to 500,000 users. The agency is also developing the Ethiopian Soil Information System, or EthioSIS, a digital soil map analyzing the country's soils down to a resolution of ten kilometers by ten kilometers. Eventually, these two systems will merge, transmitting cutting-edge, highly tailored information to millions of farmers.

Digital technology can also revolutionize farmer organizations. Membership in agricultural cooperatives has always lagged in Africa, because smallholders are too spread out. New, digitally powered organizations, however, can succeed in doing what farmer cooperatives are supposed to do: purchase seeds and fertilizer

in bulk and pass on the savings to their members, serve as trusted sources of information on farming practices, and help farmers aggregate and warehouse produce and negotiate fair prices.

The digital infrastructure for interacting with smallholders is already being put in place, so now is the time to make sure it gets done right. This means making sure that all farmers are included from the start, especially the poorest and most remote. Digital agricultural applications need to be run on neutral digital platforms to which any farmer can connect, rather than proprietary platforms for a select few. It doesn't matter who builds the platforms—whether governments, agribusinesses, or telecommunications companies—so long as they are made accessible to all. To get the most out of these platforms, moreover, farmers need to be assigned unique user identifiers, so that they can receive services tailored to their needs. And information needs to be governed in a way that makes most of it open source. Ethiopia's digital soil map, for example, is public, so anybody can use the data.

As the two of us began our careers, one of the big questions in development was whether the world would be able to feed itself in decades to come. Many predicted a coming global famine, so simply avoiding mass starvation has to be considered a significant success. But it is high time to move beyond simple calorie provision and think about agriculture in the developing world in a more holistic way. Smallholder farmers in Africa can finally be seen not just as part of the problem but also as part of the solution. Using digital technology to reach them, listen to them, support them, and help them organize holds out the potential for another agricultural revolution. Making sure the opportunity is seized will require policy changes, investments, and a great deal of effort on the part of everyone from government officials and entrepreneurs to agronomists and coders. But what is needed most is leaders who can envision a continent transformed.

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FOREWORD:

Digital Thinking to Transform Africa's Food System

Overcoming Isolation, Speeding Up Change, and Taking Success to Scale

Kofi Annan is the Chair of the Kofi Annan Foundation and was the Seventh Secretary General for the United Nations

Sam Dryden is a Senior Fellow at Imperial College London and the former Director of Agricultural Development for the Bill & Melinda Gates Foundation

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In the past decade, the global conversation about Africa has shifted from how hopeless to how hopeful its story is. Many observers see a great future for the continent. We do, too, and if that future is to come to fruition, it will be because the continent's leaders helped create a thriving rural economy based on the effort

and ingenuity of smallholder farmers. If Africa's evolving food system leaves those same farmers behind, however, the continent will not reach its immense potential.

Those are the stakes underlying this collection of essays.

For the past several years, the authors of the essays have been participating in an energetic and ongoing discussion with each other and with other leaders about food systems and the transformation of Africa. In this collection, they capture the spirit of that discussion by asking and trying to answer the question, "How can Africa's family farmers drive the development of a thriving rural economy across Africa?"

Over 80 percent of Africa's farmers are smallholder farmers, living in poverty and farming less than two hectares with low levels of production. Many are women who are less able than their male counterparts to access secure rights to land and the inputs for their farms. Nevertheless, we know from experience that they can be highly innovative.

There is much good news coming out of Africa. The incidence of conflicts is declining, stable macroeconomic policies are encouraging investment, and many countries have high growth rates, including in agriculture. A growing urban population is demanding more food, including more varied and nutritious diets.

Some trends are more mixed in their effects. There is growing investment in large commercial farms, foreign and domestically owned, but in some cases, this investment is causing rural people to lose their land rights. The rapidly growing population of young people provides a potential work force, but they are often not attracted to agriculture.

There are also major threats. The land is degrading rapidly. Over 25 percent of Sub-Saharan Africa's land is seriously degraded. A changing climate is already having highly adverse effects. One estimate suggests there may be a 20 percent increase in malnutrition and hunger by 2020.

Yet there are experiences and tools at hand, both in research stations and in farmers' hands, that can help withstand the adverse trends and capitalize on the many opportunities. Foremost among these are digital technologies, both hardware (mobile telephones, satellites, supercomputers) and software (applications to facilitate decision-making, digital soil maps, and faster breeding cycles for traditional African crops). There are myriad uses of digital technologies in Africa, beginning

eight years ago with the pioneering creation of mobile banking in Kenya. A selection is described and discussed in the articles below.

Ultimately, the combination of the technology itself and human creativity in deploying the technology can revolutionize life for family farmers in three ways.

By overcoming isolation. Many African smallholder farmers live far from cities and towns and are often poorly served by roads. Markets that provide inputs or purchase outputs may be many kilometers away and essentially inaccessible. Digital technology has the potential to effectively shorten the distance between previously isolated smallholders and the other components of the food value chain. For example, it can speed up the supply of inputs through e-vouchers and real-time tracking of inventory. The eWallet system in Nigeria was developed as a means for government to identify and provide input subsidies directly to farmers. Smallholder farmers provide their personal and biometric information and, once registered, can use their eWallets (via a mobile phone or a unique identification code) to make purchases from agro-dealers.

By speeding up change. Traditional extension is a ponderous process relying on poorly paid extension workers to travel from farm to farm or village to village. Digital Green uses technology-enabled dissemination based on projectors and web portals in local languages that greatly speeds up the transfer of information while improving its quality and relevance. Local access to credit can also be made more timely and efficient through digital technology, as can access to micro-insurance. The marketing of farmer products can be made more accessible through SMS messages that provide information on prices offered for crops in different market locations. Farmers no longer have to wait for buyers to come to them; they can actively seek out better deals.

By taking success to scale. Throughout Africa there are numerous successful projects and programs delivering greater yields, more nutritious foods, higher incomes, accessible fairer markets, and benefiting more women. Many are intrinsically sustainable. The challenge many organizations have taken on is determining how to scale them up. The Alliance for a Green Revolution is ensuring key inputs such as improved seed, blended fertilizers, credit and micro-insurance are accessible on an extended basis. The World Food Program's Purchase for Progress Program helps create stable and fair markets on which smallholder farmers can depend. A key component of going to scale is the generation, analysis, and accessibility of mega-data. One example, developed by the

Agricultural Transformation Agency of Ethiopia, is EthioSIS, a digital soil map that provides information for more tailored soil management practices.

The breadth and depth of the ideas in these articles point the way toward a dynamic future for African smallholder farmers and Africa in general. We hope that they spark more conversation and, eventually, powerful action to create a future for Africa that matches Africans' aspirations.

A Note from the Digital Thinking Initiative: Humans have a natural tendency to trust people familiar to them, but, for decades, farmers have received education and training from people with whom they have little in common. Cheap digital video can change this situation by engaging farmers in exciting communities of learning. Rikin explains how Digital Green reaches local farmers with training videos, screened by workers from local communities and showing local people introducing farmers to best practices in local languages. The result is not only better yields but also more empowered farmers.

Building Community at a Global Scale

Using Video to Improve Extension and Create Farmer Networks

Rikin Gandhi is Cofounder and Chief Executive Officer of Digital Green

Reality television programs and social media offer a stage for anyone who aspires to become a star. These platforms offer users a window into the lives of others and inspire them to pursue their own dreams as they watch their peers dance, sing, invent, and cook their way to fame.

Rural smallholder farmers in South Asia and sub-Saharan Africa are motivated by their peers in similar ways. Although they may not have access to the Internet or

even electricity, they learn by observing their neighbors' fields and by asking those who till them about the crops they grow. Governments and companies that work with these rural communities can be critical catalysts in this process.

At Digital Green, we train development agencies and people in the communities with which they work to produce and distribute locally relevant knowledge, mainly in the form of videos. These videos, which feature information about farming techniques and nutrition practices, are then screened by frontline workers among farmer groups, using battery-operated mobile projectors.

This type of digital thinking disrupts the top-down, one-way flow of information characterized by the term *extension*. Traditional agricultural extension methods rely on highly trained experts who go out into the field to interact directly with farmers. However, given that 60 percent of India's population and 80 percent of Ethiopia's population depend on agriculture as their primary source of income, the barriers to extension on a large scale are virtually insurmountable: there are not enough agents, farmers grow too great a variety of crops and speak too many languages, and an inadequate transportation infrastructure can make it difficult for them to reach rural communities.

In the place of extension, Digital Green establishes a platform that brings together public and private agencies and farming communities to exchange knowledge. Videos are produced locally and often feature farmers' own innovations. However, it is important not to romanticize the fact that our partner domain experts are integral to introducing practices based on new research, which even frontline workers may be unfamiliar with, and to moderating the content being produced and shared. The combination of extension agents, farmers, and off-the-shelf technologies like video establishes a network that unlocks the potential of the smallholder farming communities. We have found that facilitated video viewing can spur farmers to adopt new agricultural practices for about one-tenth of the cost of traditional extension systems.

Building Trust Through Localization And Inclusion

When farmers assess the relevance and trustworthiness of a Digital Green video, they consider not just the featured farmer's language but also factors like the clothes she is wearing and the type of dwelling she lives in to determine whether she is someone they can identify with. Indeed, viewers' first questions are often about the name of

the individual featured in the video and the village where she lives. Seeing is often believing for rural farmers—often women with a low level of literacy—and visual cues pertaining to a person or a crop can be crucial in their decision to adopt a practice.

Digital Green’s network of partners and community members have produced more than four thousand videos in twenty-eight different languages. We have found that producing a video in each district is much cheaper and more effective than attempting to translate or dub an existing video for a new locale. Roughly 80 percent of the videos a farmer views in her village are produced in the same district in which she resides; the other 20 percent might be from a nearby locale with comparable language, ecology, and agriculture. Smallholder farmers form a diverse social spectrum. We have sometimes found that those on the upper end are unwilling to learn from those they consider below them, and vice versa, although we have also seen bridges formed between factions as individuals learned from those whom they would otherwise never have considered worthy of their attention.

Traditional agricultural extension reaches out primarily to male heads of household in farming communities because of the belief that the man is the primary farmer. However, the bulk of agricultural labor on small farms is done by women. One reason for Digital Green’s success is that we reach out to women and other marginalized farmers; in fact, women account for 80 percent of our audience. We have found that women tend to be more receptive to videos featuring fellow women, just as men tend to identify with fellow men.

The videos themselves are not the only part of localization. Village-level frontline workers are also a crucial element of the Digital Green approach. Farmers participating in our program report that watching a practice demonstrated on a video while being told about it by a frontline worker boosts their recall. To build even deeper confidence, the frontline workers, who typically live in the same village as the farmers viewing the video, can vouch for the local applicability of the practices taught, ensure that viewers understand them, connect farmers with necessary inputs (such as seeds and fertilizers), and aggregate their produce for sale at market.

“Previously we weren’t even able to grow eight hundred kilos of grain,” remarks Sugna Bai, a smallholder farmer in Madhya Pradesh, India. But after watching a video on pest management techniques for wheat cultivation, she increased her yields substantially. “Now we harvest 3,000 to 3,500 kilos. When we see videos

and do it, then we can believe in it. Belief comes by doing, not just by seeing. So after seeing the video we have to practice it. Then we can believe.”

Adaptation, Partnership, And Scale

So far, Digital Green’s approach has reached more than 800,000 smallholder farmers, with more than 60 percent of them subsequently applying at least one new practice. We estimate that the adoption of these practices has increased crop yield by at least 20 percent and reduced input costs by 15 percent.

Though fundamentals of human behavior, such as the tendency to identify with similar individuals, hold true across geographies, we have found, as we scale from our base in India to parts of sub-Saharan Africa, that the application of digital thinking is context-specific. Some communities in Ethiopia, for example, had never seen a film before attending a Digital Green video screening, and we had to embed visual cues, like stock footage of sunrises and sunsets, to explicitly show the passage of time. Because of the limited reach of media in these areas, our approach affords greater novelty and excitement. Villages in India, by comparison, have more prevalent access to mobile phones, movie theatres, and satellite television, and competition for viewers’ attention greater.

In India, Digital Green works primarily with the Ministry of Rural Development, which runs a program called the National Rural Livelihood Mission that mobilizes women’s self-help groups; we support district teams that both produce videos and enable peer farmers to facilitate screenings for these groups. In contrast, the extension programs run by federal and regional governments in Ethiopia are more coordinated. The country’s public extension system employs domain experts to produce videos and professional extension staff to screen them for development groups, which are primarily led by men. The differences between the two countries lead to trade-offs—for instance, between capturing local nuance and controlling production quality—but we have also found that the various approaches tend to converge. Our partners in India, for example, now ask experts to review the technical soundness of new videos, and their counterparts in Ethiopia increasingly leverage farmer feedback and usage data to better target their programs.

When trying to connect with smallholder farmers in a cost-effective manner, the challenges and the successful approaches are strikingly common in both places. For

example, most smallholder farmers in India are already bombarded with agricultural information, sometimes conflicting in nature, through an assortment of radio, television, newspaper, mobile, and face-to-face extension programs. Therefore we start with a development problem and a partner that is already working on solving it before determining whether a particular technology can amplify its effectiveness. We have also avoided being dogmatic about the use of video; for example, in Ethiopia we are combining mobile and radio services with our video-enabled approach to complement and reinforce messaging. The value of combining multiple channels of communication, though, is not necessarily the additive value of each. The key is to enable farmers to translate information into action, and ultimately income, through localization and integration with existing grassroots-level development efforts.

Digital Green's success is at least as attributable to the grassroots-level organizations that use our approach as it is to the videos themselves. Before making a video on poultry production, for example, we consult with a partner who has already made sure that farmers have ready access to chicks and a market to sell eggs. We also work closely with our partners to balance the process of socializing videos locally with ensuring the technical merit and relevance of the practices that they feature. In addition, we train frontline workers, a group marked by frequent attrition because of the difficult job and low pay, to do more than passively screen a video. They are encouraged to pause, rewind, ask questions, and get feedback in order to engage viewers in a dialog both during video screenings and after, when they visit farmers' fields. Our partners collect a variety of data, from farmer attendance to the application of featured practices; however, this rich data set only has influence when incorporated into existing performance management systems and strategy planning processes.

Empowering The Farmer

The biggest challenge for Digital Green is that smallholder farmers in sub-Saharan Africa and South Asia are increasingly losing confidence in themselves and migrating to cities as farming becomes a vocation of last resort. Mainstream media tend to reinforce this view by portraying farmers in destitute conditions, and, in India, by idolizing software engineers and Bollywood film stars.

Although these aspirations can have positive effects (they have spurred a generation of youth to be educated), agriculture can also be a career of choice; it involves a

unique combination of business acumen, scientific rigor, and technological prowess. Urban and rural communities, much like those in the global north, are increasingly divided, and political constituencies are moving closer to cities. But in the emerging economies of South Asia and sub-Saharan Africa, a staggeringly large population of smallholder farmers still remains. In India, we developed a game on Facebook called Wonder Village and coproduced a reality television series called Green Champion in order to connect urban audiences with the people of rural India and inspire empathy through entertainment, while simultaneously enabling smallholder farmers to see themselves in a new light.

Digital Green also uses data and feedback to inform our videos and target distribution more effectively. Our Connect Online, Connect Offline system, which we affectionately call COCO, allows us to track which farmers attend viewings, which videos they've viewed, which videos have stimulated their interest, and which agricultural practices they have subsequently adopted. This enables a process of rural development grounded in farmers' needs and desires. We do this not only because we think it has intrinsic value but also because farmers are more likely to adopt solutions when those solutions address the problems they consider most pressing.

This approach has the potential to improve the efficacy of knowledge exchange services and food systems more broadly. The combination of social organizations and technology creates a network with potential that expands with the scale and variety of applications that it supports. Agricultural buyers can tap into it to share practices related to the commodities that they are interested in purchasing and to leverage data for food traceability. Researchers can share information more efficiently and inform their studies based on farmer-level data. Curricula in agricultural universities, too, can be complemented with practical videos from actual farmers' fields. Digital thinking shifts the fulcrum of development from distant agencies to smallholder farmers.

Ultimately, technology can only magnify human intent and capability. When a video sparks the curiosity of a farmer in a rural community, it can help her take new steps toward improving her life and the lives of those around her.

AUTHOR'S PERSONAL STORY

For as long as I can remember, I wanted to be an astronaut. Their combination of brains and brawn was inspiring to me. I studied computer science and aerospace engineering, and the next step on the path was joining the Air Force. Before I could do that, however, I had to get eye surgery, and while I was recovering, I decided to help some friends who were starting a biodiesel company in India. The company did not last, but the time I spent immersed in rural communities in India changed my life. I met people who had nothing but themselves and their land, but, like astronauts, they were heroes in their own right. I read biographies of people who had been to space, and I learned that many of them come back to Earth with a new perspective on life. They tended to ask the big questions: Why is there war? Why is there poverty? My time in rural India led me to similar questions, and that is where Digital Green came from. I am not an astronaut, but I still love flying; I took my first helicopter ride just a few months ago.

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Sam Dryden