The Bridgespan Group

Leveraging Technology to Improve Smallholder Agriculture at Scale:
Video-Based Knowledge Sharing

OVERVIEW: Digital Green is a nonprofit that partners with governments and communities to produce, disseminate, and monitor the impact of short, locally relevant videos that increase the uptake of improved agriculture practices among predominantly female smallholder farmers. The organization operates primarily in India and Ethiopia, while pursuing additional projects in 13 other countries in Africa, Asia, and Latin America.

ESTABLISHED: 2008 (spun out of Microsoft Research)

QUICK FACTS

PRIMARY PHILANTHROPISTS/ FUNDERS:
The Bill & Melinda Gates Foundation (Gates Foundation) (India and Ethiopia); USAID (global)

GRANT AMOUNT:
INR 169 crores[1] (USD 25 million) from the Gates Foundation; **INR 136 crores** (USD 20 million) from USAID

PRIMARY FOCUS:
Rural Livelihoods— Agriculture

ARCHETYPE: Scale proven solutions
Digital Green developed a comprehensive evidence base for its video-based knowledge sharing model, which it leveraged to scale the initiative's reach and impact.

KEY PARTNERS:
- National Rural Livelihoods Mission and State Rural Livelihoods Missions (India)
- Ministry of Agriculture & Livestock Development (Ethiopia)

WHY BOLD?

Digital Green uses innovative technology and works through government systems to drive higher and more cost-effective adoption of best practices in agriculture among predominantly female smallholder farmers. A comprehensive evidence base of quantitative and qualitative studies serves as a testament to the success of Digital Green's model. To date, the organization has scaled its reach to 1.9 million smallholder farmers globally through its video-based knowledge sharing model and is expanding its focus to include the dissemination of health and nutrition best practices to rural populations.

KEY LEARNINGS

Invest philanthropic capital in piloting innovations and scaling what works

Use technology to help frontline workers deliver and scale programs more effectively

Tailor messaging to maximize engagement and motivate behavior change

Identify and partner with government entities that have wide reach and share similar goals in order to scale

Continuously refine, adapt, and build on a model to accelerate its impact

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1   Conversion rates (INR to USD) reflect rates available during the April 2018 to June 2018 time period.

THE OPPORTUNITY FOR IMPACT

India's economy is highly dependent on agriculture. Roughly 43 percent of the country's labor force (some 224 million individuals) relies on farming for employment.[2] Eighty percent of Indian farmers are smallholders who own fewer than two hectares of land[3] and are highly susceptible to food and nutrition insecurity. Drought, flooding, and other factors can drastically limit the yields, welfare, and consumption of these families. Indeed, more than half of India's 191 million undernourished citizens come from smallholder farming households.[4]

In 2011, India's Ministry of Rural Development established the National Rural Livelihoods Mission (NRLM) to stimulate self-employment among the rural poor, particularly women. Partly funded by the World Bank, it is one of the world's largest poverty reduction programs, with an annual budget of approximately INR 2,500 crores (USD 364 million).[5]

At the state level, the NRLM establishes State Rural Livelihoods Missions (SRLMs), responsible for forming women's self-help groups (SHGs) that catalyze economic activity within their communities. For example, SHGs can access government credit and savings programs to establish small businesses. SRLMs further engage SHGs by establishing agriculture extension systems comprised of agriculture experts and predominantly female frontline extension workers. Agriculture experts conduct scientific research on farming-related best practices, while frontline workers teach SHG members how to adopt them. SRLM extension systems can also disseminate information on health, nutrition, and family planning.

However, it is challenging to scale government efforts that support smallholder-farming communities. Because such communities are typically located in remote areas with limited internet connectivity, agriculture extension systems traditionally rely on in-person information sharing between frontline workers and farmers, with limited use of visual aids. Beyond being resource intensive and time consuming, this highly personal approach is prone to inconsistencies in information dissemination among farmers.

A BOLD INVESTMENT FOR SMALLHOLDER FARMERS

To help smallholder farmers, Digital Green, a nonprofit dedicated to improving the livelihoods of the rural poor, developed a video-based knowledge sharing initiative to strengthen agriculture extension systems. The organization partners with SRLMs,

2 "Employment in agriculture (% of total employment) modeled ILO estimate)," The World Bank, International Labour Organization, ILOSTAT database, data retrieved November 2017; "Labor force, total" The World Bank, International Labour Organization, ILOSTAT database and World Bank population estimates, data retrieved November 2017.

3 George Rapsomanikis, *The economic lives of smallholder farmers: An analysis based on household data from nine countries*, (Rome: Food and Agriculture Organization of the United Nations, 2015): 1.

4 *2017 The State of Food Security and Nutrition in the World: Building Resilience for Peace and Food Security*, Food and Agriculture Organization of the United Nations (Rome, 2017: 89).

5 Roopal Suhag, "Demand for Grants 2017-18 Analysis," PRS Legislative Research (Institute for Policy Research Studies: February 27, 2017) 7.

equipping them with the skills to produce and disseminate short videos that explain agricultural best practices to smallholder farmers. Digital Green's growing library of more than 5,800 videos, each featuring local farmers, covers such topics as the importance of growing kitchen gardens, measuring wheat grain quality, and collectively selling produce.

SRLM agriculture experts review and vet video content before frontline workers show the videos to SHGs during weekly information sharing sessions. At these sessions, frontline workers—all of whom come from the villages they serve—respond to farmers' questions and track adoption of best practices. Since 2012, Digital Green has expanded the focus of its video-based knowledge sharing initiative beyond agriculture to health and nutrition, targeting the same smallholder farming populations.

Trained video-resource people film content to be included in an instructional video featuring local farmers. (Photo: Digital Green)

HOW THE INITIATIVE CAME TO LIFE

In 2006, Digital Green began as a research project within the Technology for Emerging Markets Group of Microsoft Research, a division of Microsoft dedicated to using technology to support people living in underserved rural and urban communities throughout the world. Between 2006 and 2008, researchers including Digital Green's CEO Rikin Gandhi conceived and piloted the video-based knowledge sharing model.

In 2007, the team tested the approach through a controlled trial study of smallholder farmers in Karnataka. The study showed promising results. Digital Green's model appeared to be 10 times more cost effective than a conventional agriculture extension system, and to result in seven times more uptake of farming best practices.[6] Encouraged by those

6 Rikin Gandhi, Rajesh Veeraraghavan, Kentaro Toyama, and Vanaja Ramprasad, "Digital Green: Participatory Video and Mediated Instruction for Agricultural Extension,"*Information Technologies and International Development 5*, no. 1 (Spring 2009): 1.

results, Mr. Gandhi established Digital Green in India in 2008 as a nonprofit, with the goal of lifting farmers out of poverty. With pilot funding from the Bill & Melinda Gates Foundation (Gates Foundation), Digital Green began rolling out its video-based initiative through nonprofit implementation partners in four states: Jharkhand, Karnataka, Madhya Pradesh, and Odisha. While Digital Green was successful at the village level, it faced difficulties in scaling its reach, not least because of the limited geographic footprint of many of its nonprofit partners.

Its effort to expand and scale impact improved significantly in 2012, when the NRLM invited Digital Green to become its formal partner and embed its video-based knowledge sharing model in state-level agriculture extension systems. This milestone paved the way for a strong partnership with state governments and shaped the initiative's rapid growth over the past six years.

HOW THE INITIATIVE WORKS

To deliver its video-based knowledge sharing model, Digital Green partners with SRLMs in five states: Andhra Pradesh, Bihar, Jharkhand, Madhya Pradesh, and Odisha. Its ultimate goal is to help government partners in each state build sufficient capacity to take over the initiative's operations. To achieve this, Digital Green provides technical training and support across three levels of government:

- **District level:** At a district level, Digital Green and SRLM partners identify four to six video-resource people who receive five days of professional training. Those selected learn to produce instructional videos featuring local farmers speaking in their local languages.

- **Village level:** At a village level, Digital Green and SRLM partners train frontline extension workers to screen videos using portable projectors, facilitate discussions with SHGs, and capture program data, such as attendance at information sessions and best practice adoption rates. Frontline workers receive two to three days of training on their role, along with periodic follow-up trainings as needed.

- **State level:** At a state level, Digital Green helps SRLMs procure video production and dissemination equipment, which SRLMs are responsible for funding. The organization also works with SRLM leadership to develop and refine protocols related to its video-based initiative and to oversee the handover of its model.

During weekly information dissemination sessions, frontline extension workers collect feedback on the clarity and relevance of the videos they screen. The workers collate the feedback on a monthly basis and share it with district- and state-level extension system employees, who then modify video content as needed.

To capture and analyze data, Digital Green developed COCO, a data management system that works both online and offline. It links to a digital analytics dashboard that provides near real-time information on attendance, adoption rates, field operations, performance targets, and other metrics. With this information in hand, SRLM leadership can troubleshoot delivery of its video-based knowledge sharing initiative in areas where attendance or adoption rates are low.

HOW THE INITIATIVE HAS SCALED IMPACT

Since its establishment in 2008, Digital Green has scaled operations in India to reach more than 1.5 million predominantly female smallholder farmers across five states. In 2013, Digital Green established a permanent presence in Ethiopia, where it partners with the government's Ministry of Agriculture & Livestock Development (MoALD), after having piloted its model in collaboration with implementing nonprofits.[7] Digital Green works closely with MoALD's regional bureaus to embed its video-based model into the agriculture extension systems of four administrative regions that account for approximately 75 percent of Ethiopia's agricultural output: Amhara; Oromia; Southern Nations, Nationalities, and Peoples' Region; and Tigray. Today, Digital Green reaches more than 364,000 smallholder farmers in Ethiopia.

The nonprofit also pursues initiatives in agriculture extension funded by the United States Agency for International Development (USAID) and the United Kingdom's Department for International Development (UK DFID) in 13 other countries across Africa, Asia, and Latin America.[8] These additional projects involve assessing global agriculture extension systems and sharing locally customized solutions to improve their effectiveness. In some of these countries, Digital Green engages with nonprofit and government partners to implement Digital Green's video-based approach. Altogether, Digital Green has reached 1.9 million smallholder farmers globally.

Two factors have been fundamental to Digital Green's growth in India and Ethiopia: (1) its pivot from working with nonprofits in its early years to forming government partnerships, and (2) committed funding from the Gates Foundation.

In both India and Ethiopia, state- and regional-level agriculture extension systems cover vast populations of smallholder farming communities. These systems employ thousands of workers who have established strong relationships with members of their communities. "We partner with existing government programs, like Government of India's National Rural Livelihoods Mission (NRLM), who have scaled our approach as well as sustained it as they have seen it improve the efficiency of their day-to-day, grassroots-level work," says Mr. Gandhi. The fact that both India's NRLM and Ethiopia's MoALD saw the utility of using video technology to empower their frontline workers presented Digital Green with an almost boundless opportunity for growth. By shifting its delivery strategy from partnering with implementing nonprofits to embedding its video-based approach in government extension systems, Digital Green has accessed a critical mass of smallholder farmers in both countries.

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> ## Rikin Gandhi
> CEO, Digital Green

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7 Implementing nonprofits include Oxfam America, International Development Enterprises, and Sasakawa Africa Association.

8 Additional countries include: Afghanistan, Bangladesh, Burkina Faso, Ghana, Honduras, Kenya, Malawi, Myanmar, Nepal, Nigeria, Senegal, and Uganda.

The second factor for driving growth—funding from the Gates Foundation—continues to allow Digital Green to test and scale its model and experiment with digital innovations that could amplify its impact. Since 2009, the Gates Foundation has provided Digital Green with approximately INR 169 crores (USD 25 million) to scale its operations in India and Ethiopia, continue building its evidence base through three additional controlled trial studies, and experiment with a variety of digital innovations that could advance the model's impact. Digital Green has also received approximately INR 136 crores (USD 20 million) from USAID to pursue additional projects across Africa, Asia, and Latin America, some of which incorporate the use of Digital Green's video-based model to disseminate information to smallholder farmers.

Beyond scaling its reach and impact, Digital Green has also experimented with expanding its areas of focus. In partnership with nonprofits such as SPRING, PATH, and VARRAT,[9] along with funding from USAID and UK DFID, Digital Green began piloting the delivery of health and nutrition videos in India and Ethiopia through state extension systems in 2012. These videos highlight best practices such as handwashing, breastfeeding, and food supplementation. An external impact study of this pilot revealed that health and nutrition interventions were "well-received by rural communities and viewed as complementary to existing frontline health services."[10] While Digital Green mainly focuses on agriculture, it has received funding from USAID for a five-year project to support health and nutrition outcomes in India.

A frontline extension worker in Bihar, India, disseminates a video to a women's self-help group.
(Photo: Digital Green)

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9   SPRING stands for Strengthening Partnerships, Results, and Innovations in Nutrition Globally; PATH stands for Program for Appropriate Technology in Health; and VARRAT stands for Voluntary Association for Rural Reconstruction & Appropriate Technology.

10 Suneetha Kadiyala, Emily H. Morgan, Shruthi Cyriac, Amy Margolies, and Terry Roopnaraine, "Adapting Agriculture Platforms for Nutrition: A Case Study of a Participatory, Video-Based Agricultural Extension Platform in India," *PLOS ONE*, October 13, 2016, 19.
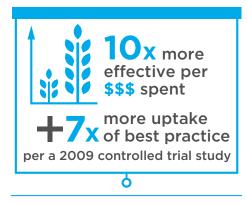
PROGRESS AND RESULTS

Over the years, Digital Green has continuously added to its video-based model's evidence base. To date, three controlled trial studies confirm the efficacy of its video-based approach in driving higher adoption rates of farming best practices compared to traditional agriculture extension systems. Two of the studies focused on measuring the adoption of improved rice cultivation practices in Karnataka and Bihar through Digital Green's model, compared to traditional extension systems.

Digital Green's model
vs. traditional extension systems in India

10x more effective per **$$$** spent

+7x more uptake of best practice

per a 2009 controlled trial study

The study in Karnataka, published in 2009, demonstrated that Digital Green's model was 10 times more effective, per dollar spent, than traditional extension systems in driving best practice adoption. Additionally, the model helped smallholder farmers adopt best practices at seven times the rate of traditional systems. The study conducted in Bihar, and published in 2015, demonstrated a 50 percent increase in adoption of best practices compared to traditional extension systems.[11]

The third study, conducted in Oromia and Amhara in Ethiopia, and published in 2017, demonstrated an increased incidence of wheat cultivation and collectivized marketing best practices by 12–13 percent, compared to 2 percent in control groups.[12] In addition, the Gates Foundation and UK DFID are funding an ongoing randomized controlled trial in India to confirm the impact of Digital Green's health and nutrition work in such areas as reducing the rate of stunting.

As noted above, Digital Green has scaled its reach significantly. To reach 1.5 million Indian smallholder farmers, 90 percent of whom are female, Digital Green has helped SRLMs produce 4,800 videos, resulting in more than 2.6 million best practice adoptions. To reach 364,000 smallholder farmers in Ethiopia, Digital Green has helped regional MoALD bureaus produce 950 videos, resulting in more than 85,000 best practice adoptions. Globally, 1.9 million farmers and 20,000 frontline extension workers have benefitted from Digital Green's work.

Progress notwithstanding, Digital Green faces some operational challenges. For one, as it rapidly scales, the nonprofit has found that some frontline workers fail to enter information into the COCO system in a timely manner. At times, some extension workers enter inaccurate information. To address these problems, Digital Green established a comprehensive, data-quality assurance protocol, where frontline workers and external

11 Kathryn Vasilaky, Kentaro Toyama y Tushi Baul, Mohak Mangal, and Urmi Bhattacharya, "Learning Digitally: Evaluating the Impact of Farmer Training via Mediated Videos," Columbia University Earth Institute, August 15, 2015, 6, https://editorialexpress.com/cgi-bin/conference/download.cgi?db_name=NEUDC2015&paper_id=519.

12 Gashaw T. Abate and Tanguy Bernard, "Farmers' quality assessment of their crops and its impact on commercialization behavior: A field experiment in Ethiopia," Ifpri Discussion Paper, 2017.

auditors recheck data entries on a periodic basis. Another challenge: some SRLMs in India lack the financial capacity to procure video production and screening technology. Those SRLMs require long lead times to purchase equipment and continue embedding Digital Green's video-based knowledge sharing model in their extension systems.

LOOKING TO THE FUTURE

Digital Green's strategy for the next five years reveals a shift in the way it thinks about measuring its impact. To date, Digital Green's data monitoring system has focused solely on the reach and rate at which farmers adopt best practices. The organization has only measured additional impact metrics, such as crop yield and farmer income, during controlled trial studies. Moving forward, Digital Green aims to have a clear view on how the adoption of best practices directly affects those impact metrics. Frontline extension workers, by conducting periodic surveys, will soon be responsible for tracking crop yield and income.

With this information, Digital Green plans to identify videos that have led to the highest increases in crop yield and farmer income, and screen them more often. By doing so, Digital Green aims to achieve a sustainable and measurable 25 percent increase in the incomes of 1.1 million smallholder farmers globally by 2022. It also plans to identify two to three additional focus countries (beyond India and Ethiopia) to scale its video-based model through government partnerships. In addition, Digital Green will continue to develop a host of other innovative technologies that aim to strengthen farm-to-market linkages. A few of these innovations include:

Digital Green's goal (2022)

25% income increase for 1.1 million smallholder farmers globally

2022

2-3 more countries Identify 2-3 additional countries of focus in which to scale its video-based model

Loop. This farm-to-market transport initiative encourages smallholder farmers to use technology to collectively transport and sell their produce. Collectivizing through Loop significantly reduces transportation costs, saves farmers from having to travel to the market, and consolidates their selling power. Digital Green enables digital payments between farmers and aggregators through a Loop mobile app in partnership with Paytm, a digital payments company based in Noida, Uttar Pradesh. The nonprofit has deployed Loop in India in 2015 and Bangladesh in 2017, which has facilitated the sale of 75,000 tons or INR 89 crores (USD 13 million) worth of produce. Digital Green is now in the process of spinning out Loop into a separate, commercial social enterprise.

Interactive Voice Response (IVR). Through an interactive hotline, farmers can access automated best practice information and speak directly to extension workers. IVR also sends automated text reminders that reiterate the video content that a farmer has watched. Digital Green is deploying IVR in India, Ethiopia, and Uganda.

Satellite yield estimation. Digital Green uses satellite imagery to estimate the crop yields of a given plot of land. The organization is running a feasibility study with Stanford University to examine the accuracy of this technology compared to traditional in-person assessments.

By developing a host of innovative technology solutions, Digital Green ultimately hopes to create a comprehensive platform for farmer-centered services and interventions aimed at increasing incomes among the rural poor.

KEY LEARNINGS

Invest philanthropic capital in piloting innovations and scaling what works. Before Digital Green spun out of Microsoft Research, the research team that conceptualized the video-based model focused on rigorously testing the viability of its approach. The organization deployed a comprehensive, 13-month controlled trial in the state of Karnataka to measure the adoption of improved rice cultivation practices through Digital Green's model and compare it to traditional extension systems. Motivated by the positive results of the study, the Gates Foundation began funding the nonprofit a year after it spun out of Microsoft Research. Once Digital Green formed partnerships with the governments of India and Ethiopia, the Gates Foundation again provided substantial funding to scale Digital Green's model across five states in India and four regions in Ethiopia, by embedding it within government agriculture extension systems.

Use technology to help frontline workers deliver and scale programs more effectively. Recognizing the potential for information and communications technology to strengthen traditional agriculture extension systems and to scale its impact beyond the existing in-person tutorial model, Digital Green developed a video-based model to empower frontline extension workers to more effectively engage with farmers. The model enabled the traditional agriculture extension system to disseminate information with greater reach and accuracy. The nonprofit's additional investment in COCO, its data management system, has also improved the initiative's effectiveness. Equipped with farmer-level data, SRLM leaders can troubleshoot program delivery issues in areas where attendance or adoption rates are low.

Tailor messaging to maximize engagement and motivate behavior change. Digital Green's videos are "of the farmer, for the farmer, and by the farmer." They feature local community members narrating (in their own regional languages) their personal experience in adopting agriculture best practices. These champions, who themselves are smallholder farmers from nearby villages, lay out the steps for adopting best practices and walk through the direct benefits that result. By equipping local teams with video production skills, Digital Green tailors video content to each community. For smallholder farmers, seeing a best practice work for a neighbor assures them of its worth. Follow-up discussions, mediated by frontline extension workers, reinforce the adoption of best practices shown on screen.

Identify and partner with government entities that have wide reach and share similar goals in order to scale. While Digital Green's initial nonprofit partners implemented the organization's model with fidelity, achieving scale through these partners was a challenge. Teaming with India's Ministry of Rural Development (the NRLM and SRLMs) and Ethiopia's MoALD dramatically improved Digital Green's capacity to scale, as these governments' agriculture extension systems already reached significant populations of smallholder farmers. Both governments also committed to funding the procurement of video production and dissemination equipment, along with the cost of training networks of frontline extension workers. By embedding its program model within government agriculture extension systems, Digital Green has reached 1.5 million smallholder farmers in India and 364,000 in Ethiopia.

Continuously refine, adapt, and build on a model to accelerate its impact. Digital Green constantly reevaluates and modifies its video content to promote higher adoption rates. It has established a comprehensive protocol for collecting farmers' feedback during weekly information-dissemination sessions. This feedback helps to improve video content. Beyond striving for higher adoption rates of agriculture best practices, Digital Green has committed to developing and piloting innovations—including Loop, IVR, and satellite-based technology for assessing soil health—aimed at increasing the annual incomes of smallholder farmers.