Evidence Review of Digital Green's Video-Mediated Farmer Extension Approach

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ACRONYMS

DA - Development Agents (gov. extension officers in Ethiopia)

DG - Digital Green

GoE - Government of Ethiopia

MIYCN - Maternal Infant and Young Child Nutrition

MoA - Ministry of Agriculture

RCT - Randomized Controlled Trial

VMA - Video mediated approach

SHGs - Self Help Groups

RCTs - Randomized Controlled Trials

SRI - Systematic Rice Intensification

COCO - Connect Online, Connect Offline

IVR - Interactive Voice Recording

F&V - Fruits and Vegetables

MOANR - Ministry of Agriculture and Natural Resources

EXECUTIVE SUMMARY

Digital Green is a global development organization that seeks to "empower smallholder farmers to lift themselves out of poverty by harnessing the collective power of technology and grassroots-level partnerships.” Starting in 2008 in India, Digital Green has been partnering with governments, private agencies, and rural communities to promote good practices in agriculture, nutrition and health, producing and sharing locally produced videos that feature farmers as messengers. In the years that followed, Digital Green expanded its offerings and geographical footprint, and now offers a variety of technology-enabled farmer services across South Asia and Africa.

Digital Green is an organization driven by research, learning, and self-improvement. Accordingly, it has conducted myriad studies on various components of its model. These range from large, independent randomized controlled trials (RCTs) to small, internal pilot studies. IDinsight reviewed 48 research reports, which are compiled in a separate knowledge bank. This document is an attempt to collate these studies (as of January 2021) into a central repository and assess the strengths and weaknesses of each. We draw out key learnings from the body of work, as well as identify research gaps for future exploration. IDinsight also examined raw data from Connect Online Connect Offline (CoCo, Digital Green’s monitoring and information system that is used by its government partners).

Working closely with public extension agencies, Digital Green builds their capacity to produce and screen localized videos of agricultural practices and use farmer feedback and usage data to inform relevant content. Over the years, Digital Green has been able to fine tune the community video approach as a scalable and replicable model, effectively applying principles of adult learning, peer education and positive deviance that aims to change the knowledge, behavior, and practices of smallholder farmers to become more productive and resilient. In India, this means working with the Ministry of Agriculture and National Rural Livelihood Missions, as well as NGOs and private businesses. In Ethiopia, Digital Green works with the Ministry of Agriculture (MoA) and Regional Bureaus of Agriculture. Typically, videos on different topics are screened in villages every fortnight using a mobile (pico) projector in group settings with farmers growing different crops and raising livestock. The approach is adapted by context; for instance, Digital Green works with part-time community agents who train women self-help groups (SHGs) in India, whereas they work with well-trained government Development Agents (DAs) and farmers’ development groups comprising head-of-households in Ethiopia. Finally, Digital Green works to sustain its approach by building partner capacity and integrating video production and dissemination into government systems and processes.

Farmer level impact

According to CoCo data, Digital Green has reached 1.48 million farmers (94% women) across 53,582 villages in India, using 1,655 unique videos. Of farmers participating in the video screenings, CoCo recorded 4.98 million total, 898,295 unique adoptions, and a 60% adoption rate (defined as unique adopters/ total reach). In Ethiopia, it has reached 438,488 farmers (26% women) with 1236 videos. CoCo recorded 537,247 total, 249,259 unique adoptions, and 57% adoption rate.

Our key takeaways on the **video-based approach in agriculture** include:

- **Results from four rigorous RCTs:** (1) **IFPRI's RCT** (Abate et al. 2018) (Abate et al. 2019) in Ethiopia studied the video approach in the context of three crops (teff, wheat, maize) and practices already being promoted by MoA (e.g., row planting, precise seeding rate and urea dressing), and also varied the gender of the recipient; This RCT was part of a larger research collaboration between IFPRI and Digital Green in Ethiopia, of which many outputs are discussed in this report. (2) **The J-PAL study** (Baul et al. 2020) in India looks only at one crop (rice) with a focus on System of Rice Intensification, and also studies different types of messages delivered to farmers; (3) **The London School of Hygiene and Tropical Medicine (LSHTM)** led a 4-arm cluster RCT, in Odisha, India to test participatory videos to promote nutritionally sensitive agriculture (NSA) and use of participatory learning and action meetings; and (4) **IFPRI study in Uganda** (Campenhout et al. 2018, Lecoutere et al. 2020, Campenhout et al. 2020) was shorter-term, and studies an approach piloted in Uganda that uses an alternative approach of distributing tablets with preloaded videos. Unlike the others, this study took place outside of the context of an existing extension system. These studies provide a strong base of evidence on the program's effects, particularly on farmer knowledge and adoption.[1]
- **Access to extension services increases:** Abate et al. (2019) show increases in access to extension services of 6-16 percentage points (relative increase of 16-37%), depending on the year and crop. In a related study also conducted by IFPRI, Abate et al. (2018, 2019b) show that local extension agents assigned to areas receiving the video approach made greater effort to visit farms, inspect technology use, and provide follow-up advice to farmers. Treatment farmers reported a 7 percentage point higher probability of receiving a DA visit to their farm (38% vs 45%, an 18% relative increase in Year 2 of the study.)

[1] Note that all the quantitative results listed in this section are based on "Intention to Treat" (ITT) analysis.

- **Knowledge generally increases:** Abate et al. (2019) show increases in some knowledge scores for the household head in the first year of the study. Depending on the crop, specification, and household member, treatment households score around 1-2 percentage points higher on a knowledge test (~5% relative increase), and only some estimates are statistically significant. They do not show knowledge increases for any household member in Year 2. Campenhout et al. (2020) report an increase in an index of knowledge of maize practices. Since the video approach primarily focuses on practices already being promoted by public extension systems, in these contexts knowledge increase may not be necessary to drive adoption.
- **Adoption increases:** Baul et al. (2020) report an increase of 4.6 percentage points (from 10.6% to 15.2%, 40% relative increase) of adoption of the system of rice intensification in India, but also see signs of partial adoption of the practice; They find that being assigned the Digital Green treatment increases the likelihood of adopting an additional SRI practice by around 23%. Abate et al. (2019) report mostly significant increases of 4-8 percentage points (5-36% relative increase) for adoption of practices related to wheat, maize, and teff in Ethiopia sustained over two years of evaluation; Campenhout et al. (2020) report a .16 SD increase in an index of promoted maize practices in Ethiopia.[2]
- **Effects on yield and production are mixed**: Baul et al. (2020) find a 28% relative increase in rice yield comparing control (1123 kg/acre) and treatment (1436 kg/acre), with similar results in the second year of the program. However, they find no significant increase in total production. Abate et al. (2019) find yield increases in Year 1 for teff (13%) and maize (12%), but not for wheat They do not find significant effects on total production for any of the three crops. In the second year of the program, effects on yield are positive but noisy and therefore not statistically significant.[3] They do find a significant 23% increase in production of teff. Campenhout et al. (2018) find a 10% increase in self-reported maize yields. However, they do not find an increase in total production as acres planted decreases.
- **Positive effects on some nutrition indicators:** Preliminary results of the LSHTM RCT in Odisha, India indicate 19-27% and 21-30% improvements in children's and maternal minimum dietary diversity respectively relative to control. No change was seen in maternal BMI and child wasting outcomes.

[2] It's important to note that these adoption effects refer to specific single practices, while the CoCo definition of a unique adopter is a farmer who adopts any promoted practice. That may explain why the absolute rate of adoption in CoCo seems higher than the numbers quoted in the RCTs. All specific practices may not be applicable to each individual farmer.

[3] Abate et al. (2019) cite previous studies (not involving video) that also fail to find that the practices promoted by the Ethiopian government improve yields in smallholder settings.

- **No Spillover Effects:** Abate et al. (2019b) studies the effects of farmers who do not view Digital Green videos. They generally find no effects on this spillover group for access to extension, knowledge, adoption, or yield.
- **Promising Cost Effectiveness**: Abate et al. (2019) calculates the marginal cost-effectiveness of Digital Green's video-based approach on adoption (compared to standard extension services), and find costs (assuming scale-up) of \$3-\$6 per farmer adopting a practice. Gandhi (2014) states that Digital Green is 10 times more cost-effective than traditional extension in India, though we raise some questions about the reliability of this estimate.
- **Mainstreaming Gender:** Digital Green's engagement with women differs by location. For example, in Bihar, India 99.6% of its viewers are women, compared to 26% in Ethiopia. As per CoCo data for India and Ethiopia, adoption rates by male and female attendees were comparable, though farmers attending female facilitated screenings reported higher adoption rates (e.g., 57% adoption rate for female facilitated screenings vs 49% for men facilitated screenings). Additionally, some of the RCTs explored innovations by Digital Green to better engage women, such as casting women as actors in the videos and encouraging women from participating households to directly view the videos. These studies find mixed results. Abate et al. (2019a,b) finds that showing videos to the spouse of the household head increases access to extension for women, and also increases their knowledge of agricultural practices for some crops in the first year of their study. However, in the second year of the study the treatment group no longer shows higher knowledge than the control group. They do not find any effect of spouse engagement on adoption or yield. Lecoutre et al. (2019) study the effects of providing the video to the spouse or the couple (as opposed to just the male head of household). They find showing videos to the female spouse increases her knowledge, decision-making power, adoption of practices, and production (on plots she manages). They also vary the gender of the messenger (actor) in the video and find mixed effects. For instance, when women are solely shown a video where a woman is the messenger this increases womens' decision-making and improves timing of planting and fertilizer application. However, it also results in lower yields.
- **Continual improvement in content:** In an effort to improve cost-effectiveness of the video-based approach, Digital Green piloted the Most Important Practices (MIP) approach in both India and Ethiopia. MIP involves condensing video extension to leaner packages of two to five non-negotiable recommendations per crop that still deliver on farmer outcomes. A series of studies involving third-party crop cuts in India and Ethiopia helped determine which practices were most highly correlated with high yields. In India, assessments indicate adoption of all of the recommended MIPs is correlated with higher yields (starting at from 24% for paddy in Bihar to

>300% for pigeon pea[4] in Jharkhand) and higher incomes (80-145% higher)). In Ethiopia, MIPs were correlated with a 24.4% yield increase in teff and 35% increase for wheat as per external crop-cut surveys.

System level impact[5]

Digital Green works closely with government and non-government extension providers to deliver its services, with the goal that eventually local institutions can independently provide all components of video-based extension, from producing videos to dissemination to data collection. It is through these activities that Digital Green hopes to achieve long-lasting "systems change".

- In India, the government co-invested $23.2 million to sustain and scale the video approach. Digital Green worked with partners to procure 9,223 pico projectors and 96 camera sets, with partner commitments to procure an additional 9,250 projectors. They trained 14,655 extension agents (~70% women) and streamlined systems for officer training through the deployment of virtual training courseware (Virtual Training Institute), which trained 1,550 frontline workers. They also established a trainer-of-the-trainer system (Master Resource Persons) to more efficiently build agent capacity and enhance supervision and monitoring, resulting in 277 master trainers (36% women). Finally, data from CoCo is being used to set performance based incentives for extension agents.
- IDinsight conducted a qualitative study to understand drivers of institutionalization in Andhra Pradesh, India and identify what approach Digital Green can take in future government partnerships. They found that several key tasks related to video-based extension have been incorporated into the state and district government's routine work. With strong buy-in and co-investment in implementation, the government has taken on activities like content selection, dissemination and monitoring data collection. There are still some crucial areas where DG continues to support the government in the model like video production training, equipment management and data analytics.
- In Ethiopia, the video-based approach was formally included in the government of Ethiopia's Second Growth and Transformation Plan (GTP2) and Second Agricultural Growth Program (AGP2). This allowed the Ministry of Agriculture and Regional Bureaus of Agriculture to invest $3.4 million in the approach, with this money going towards staff salaries, training and equipment purchase. Digital Green trained 6681 local extension agents (13% were women) and 623 Subject Matter Specialists (SMS) (10% women). They partnered with 5 Agricultural Technical and Vocational

[4] Pigeon pea farmers in Jharkhand experience very low yields of about 700 kg/hectare at a baseline

[5] In this section (unless otherwise noted) institutionalization and implementation data has been provided directly by Digital Green.

Education Training Centers (ATVETs) to incorporate the digitally-enabled extension approach into training curricula for new and in-service DAs. Two ATVETs trained 1,536 DAs in video dissemination and 601 SMS in video production.

- An independent qualitative study by IFPRI explored the extent of institutionalization in Ethiopia. Notable documented achievements included: integration of video extension in government staff performance criteria, and videos incorporated in annual extension plans in almost all woredas. Challenges included insufficient field staff trained in production and dissemination, hardware issues with projection equipment, and significant variation in quantity of screening across woredas.
- Digital Green's CoCo system has been adopted by many of their partner governments, and has been assessed for accuracy by third parties. An IFPRI report (Makhija et al. 2019) studied the relationship between adoption data collected by the government of Ethiopia and Digital Green on farmer adoption. The study found a positive and significant correlation between government and IFPRI-generated data on video attendance (correlation of .11) and farmer adoption (correlation of .17), indicating the fidelity of the operations' monitoring systems. A similar study by CMS in India visited farmer fields and compared observed adoption to that in DIgital Green's CoCo database. They found the CoCo system to be improving over time, with 23% of adoptions verified in 2015, 53% verified in 2016, and 65% verified in 2017.

Innovations

Besides the video-based approach, Digital Green has tested and scaled other technology-based innovations for farmers. Three notable approaches are mobile-based extension (specifically IVR messages being used to reinforce the video-based approach), customized IVR and text advisories based on soil and weather information and LOOP, which is an app-based system that links farmers to markets. Key learnings include:

- An exploratory study conducted by Awaaz.De and Digital Green in Andhra Pradesh found strong engagement with an IVR extension system. They found pick-up rates of 64-90%, where a majority of the farmers who picked up (37-92%) actually listened to the messages. They also showed indicative improvement in adoption practices.
- However, the Uganda RCT (Campenhout et al. 2018) found limited incremental effects of IVR and SMS messages above the effects caused by the video-based approach. The limited effects of IVR were possibly because few farmers appear to have called the IVR hotline.
- IDinsight conducted an RCT in Andhra Pradesh, to evaluate the effect of customized IVRs in addition to showing videos. The study found that farmers who received Video+IVR were more likely to know about all promoted practices, with effects ranging from 5.2 to 9.1 percentage points

(8%-52% relative increase). Farmers were 8.6 percentage points more likely to adopt at least one practice (a relative increase of 21%). There was no significant effect found for production and yields.
- A study by the MINI research team finds that LOOP increases farmer income and revenue, but does not improve nutritional outcomes. The difference in per unit transport costs contributes to an estimated 18-25% reduction in total marketing costs and 5-20% increase in profits for LOOP farmers relative to non-LOOP farmers. A report by 60 Decibels discusses LOOP participants' perceived improvements in fruit and vegetable production and income.

Future Research

Based on this evidence review, we have identified three areas for future investigation by Digital Green:

- The sustained effects of video-enabled agriculture extension -- relevant questions include whether farmers influenced by VMA continue to adopt practices over multiple seasons, and whether production and yield gains persist over time.
- The effects of promoting women in the process of technology adoption -- relevant questions include what factors most mediate the impacts of gender sensitive VMA for women, what actions targeting couples promote adoption of improved practices.
- The effects of integrated channels (including mobile technologies) on farmer outcomes -- relevant questions include what are the opportunities and impacts of real-time and farm-tailored SMS and IVR messaging.

INTRODUCTION

Digital Green (DG) is a global development organization that focuses on technology-enabled solutions to empowering smallholder farmers. Digital Green has operated in 16 countries primarily in Asia and Africa, with major ongoing activities in India and Ethiopia. In order to scale its solutions, Digital Green typically partners with local extension partners, including governments, NGOs, and agribusinesses.

DG's flagship program is the video-mediated approach (VMA), a participatory, community-based, and digitally-enabled methodology for agriculture extension. VMA involves 5 distinctive features:

1. Participatory content production, wherein videos are shot, cast, and edited locally, and scripts are written in local languages
2. Off-grid dissemination equipment, such as mobile battery-operated PICO projectors
3. A group-based and agent-mediated instruction model that promotes interactive and engaging disseminations
4. A video database of practices, each deployed by extension agents according to season, relevance, and community needs
5. A transparent management information system (CoCo) for monitoring video disseminations and farmer adoptions

While myriad research studies have been conducted on DG's activities and outcomes, the results have been scattered in various forms and repositories, encumbering the organization's process of review, learning, and reporting. In order to strengthen the link between evidence and decision-making by DG and the wider sector, we undertook to systematically collate and evaluate the contribution of these research studies.

The Evidence Review process involved two steps: in the first phase, we developed a knowledge bank of DG's internal and external research, and systematically assessed their scope, significance, and methodological qualities and findings. In this technical report, we then drew out a clear narrative of the organization's recorded impact from the research to date, emphasizing results from rigorous studies.

The Evidence Review is organized as follows: **Section A** discusses learnings on the video-based approach for agriculture extension, including in farmer-level outcomes, cost-effectiveness, and gender-level results. **Section B** describes the process of scale-up and institutionalization of VMA in India and Ethiopia. **Section C** goes beyond VMA to describe other applications and digital innovations by DG, such as leaner extension packages, mobile-based farm advisories, app-driven market aggregation systems, and the use of videos for health and nutrition. We conclude with a discussion of the strengths, opportunities, and areas for future research in Digital Green's evidence base.

A. VIDEO EXTENSION FOR AGRICULTURE

STUDIES

Multiple high-caliber studies have been conducted on Digital Green's core program of video-enabled agriculture extension, which collectively describe positive influences on farmer outcomes. Our review draws significantly from these studies, so we begin by outlining the scope and methods of each major evaluation. Additional details on some of these resources are compiled in the **Appendix.**

1. Participatory Video and Mediated Instruction for Agricultural Extension (Gandhi et al. 2007)

A proof-of-concept study co-conducted by DG founder Rikin Gandhi exploring **farmer adoption**[6] and **cost-effectiveness** under video-mediated versus traditional extension[7] in Karnataka, India. It features a non-randomized controlled design with a sizable sample (16 clusters, 1,000 households); while the design does not rigorously establish causality, results (particular re. cost-effectiveness) provide early and promising indications of DG's influence.

2. Improving Smallholder Agriculture via Video-Based Group Extension (Baul et al. 2020)

A clustered randomized controlled trial[8] (RCT) implemented by J-PAL on the impact of video-based extension of systematic rice intensification[9] (SRI) in Bihar, India. The intervention ran from June 2014 to the end of the study, and endline collections occured in Spring 2015 and 2016. Outcomes measured include **adoption** and **yield**. The study further examines the effects of two program variants: incorporation of modules on SRI-associated labor costs and farmer self-efficacy (see Appendix A for details).

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[6] Promoted practices involved 7 categories of poly-crop agricultural methods, such as seed treatment, kitchen gardening, silage, and organic fertilizers.

[7] In the majority of reviewed studies, traditional extension refers to non-digital Training and Visit (T&V) methods, incl. in-person lectures and field demonstrations with small or large groups of farmers.

[8] RCTs use random assignment to reduce systematic selection biases and strengthen our ability to draw causal conclusions about the outcomes of an intervention.

[9] SRI is a cultivation methodology for boosting rice yields with three components: minimal water usage (moist rather than saturated fields), planting of young seedlings (less than 15 days old), and single and wide spacing of plants (to encourage root and canopy growth).

3. The Impact of Video-mediated Agriculture Extension in Ethiopia
(Abate et al. 2018) (Abate et al. 2019)

A clustered RCT implemented by IFPRI on the impact of video-based extension for wheat, teff, and maize cultivation in Ethiopia. Two follow-up surveys were conducted while the program was running, in 2017/18 and 2018/19. Farmer outcomes include **access to extension**, **knowledge**, **adoption**, and **yields**; the study also examines **gender-level effects** by varying the recipient of videos, as well as the **extent of spillove**r within communities. This is a rigorous, experimental evaluation that allows for causal inference relative to most treatment arms; however, we note that 'spillover households' were added later in the study, so the control group may not serve as a perfect counterfactual in the spillover analysis.

4. The Marginal Cost of Technology Adoption
(Bernard et al. 2019)

A cost-effectiveness analysis (CEA) conducted by IFPRI on video-mediated extension in Ethiopia. Specifically, the study measures the **marginal cost of adoption** for multiple practice types and crops, considered in both experimental (231 kebeles) and scale-up (450 kebeles) scenarios. The CEA draws from experimental data collected in the IFPRI RCT.

5. Accelerating Technological Change Through Video-mediated Agricultural Extension
(Zerfu et al. 2019)

A qualitative process evaluation conducted by IFPRI on video-mediated extension in Ethiopia. The study draws from interviews and focus group discussions with over 200 farmers, extension agents, functionaries and program staff members. The authors report on the primary drivers, achievements, and obstacles in the institutionalization of videos with governmental partners.

6. Information and Communication Technologies to Provide Agricultural Advice to Smallholder Farmers: Experimental Evidence from Uganda (Campenhout et al. 2020)
   Women's empowerment, agricultural extension, and digitalization: Disentangling information and role model effects in rural Uganda (Lecoutre et al. 2020)

An externally-conducted clustered RCT that assesses the influence of 3 ICT-enabled extension services (video, IVR, and SMS) on farmer outcomes (**knowledge**, **adoption**, **yields**), with an emphasis on **gender-level effects**, in the context of maize cultivation in Uganda. The evaluation allows for causal inference;

however, as the assignment of interventions occurred *within* villages, there is some risk of spillover between groups, which the study does not address. We also note this RCT was delivered under a programmatic context that is different from DG's core model in Ethiopia and India; in Uganda, videos were disseminated via tablets and there was no underlying extension program.

IMPACT ON OUTCOMES[10]

Knowledge and adoption

In a variety of contexts, DG's video-mediated approach (VMA) generally demonstrates gains in farmer knowledge and adoption of improved practices relative to traditional methods of agriculture extension. We summarize outcomes from the listed RCTs in **Table 1**. (Note that the results listed in this table are not comprehensive.)

In India, Baul et al. (2020) reports the combined DG intervention led to an increase in farmer uptake of SRI by 4.6 percentage points (10.6% to 15.2%, 38% change) in Year 1. The effect was largest for farmers who received extra modules on managing labor costs (7 percentage points, 10.7% to 17.3%, 62% change), but the effects of this arm were not statistically different than the other arms.. In Year 2, results are smaller: the authors report a marginally significant 4 percentage point increase in adoption from combined DG (10% to 14%). Although earlier versions of the India ECT listed changes in knowledge, the authors believe that data issues with these metrics made those findings unreliable.

The authors note some limitations in the survey instruments that may have led farmers to under-report their partial adoption of SRI practices. First, the sequence of questions may have inadvertently excluded a number of partial adopters. The survey initially asked farmers whether or not they adopted the SRI methods, and only if they answered "yes" would the survey go on to ask which of the constitutive practices were adopted. Using this probe, the authors were able to determine farmers' extent of adoption for people who answered "yes", and found most were only partial adopters (70% adopted at most 3 out of 4 practices). However, this method may have *excluded* a population of partial adopters who either (a) did not feel they sufficiently adopted the SRI methods, or (b) were unaware of the term SRI, even if they adopted some of its elements, and consequently reported "no" to the lead-in question. Secondly, the survey did not distinguish between SRI methods and SRI seeds, which means some SRI method adopters who did not purchase branded seeds may have mistakenly self-reported as non-adopters.

[10] All reported outcomes in this section are statistically significant at conventional levels (p<0.01, p<0.05, p< 0.1) unless otherwise specified.

Taken together, it is not clear how many of the non-adopters (85% of the treatment arm) were actually partial adopters. This ambiguity also affects our understanding of the study's productivity outcomes (described further below).

Table 1: Knowledge and Adoption Outcomes by Study

Study	Country	Knowledge	Adoption
Baul et al. 2020	India		Year 1 4.6 pp increase in self-reported SRI from C (10.6%) to T (15.2%). Year 2 4 pp increase in self-reported SRI from C (10%) to T (14%)
Abate et al. 2018 Abate et al. 2019 (Full results in Appendix)	Ethiopia	<u>Year 1</u> 1.8 pp increase in knowledge of teff practices from C (37.5%) to T (39.3%) No significant increases for maize or wheat. <u>Year 2</u> No significant increase in knowledge for maize, wheat, or teff	<u>Year 1</u> 5.8 pp increase in teff *row planting* from C (16%) to T (21.8%) 3.5 pp increase in wheat *row planting* from C (17.4%) to T (20.9%) 3.6 pp increase in maize *row planting* from C (65%) to T(68.6%) <u>Year 2</u> 5.5 pp increase in teff *row planting* from C (12.5%) to T (18%). No significant change for wheat *row planting* 9.4 pp increase in teff *row planting* from C (70.5%) to T(79.9%)
Campenhout et al. 2020	Uganda	13 pp increase in knowledge of *optimal seed spacing* from C (16%) to T (29%)	0.16 SD increase on adoption index of any maize practice 0.12 SD increase on adoption index of fertilizer use

	4.5 pp increase in knowledge of *combined input use* from C (90%) to T (94.5%) No sig. increase for weeding or pesticides	

In Ethiopia, Abate et al. (2018) found modest improvements (37.5% to 39.3%, ~5% change) in knowledge of *teff* practices in the first year of its evaluation. They also found an increase in *wheat* knowledge when the video was shown to the household head and spouse. However, by the second year, there were no significant effects on knowledge for any crop, which the authors believe occured because comparison communities 'caught up' in knowledge.

In terms of adoption, the study finds in Year 1 significant increases for nearly all crops and technologies, save for two technologies (*lower seeding rate* and *urea application* by maize farmers). In Year 2, the authors report a 5.7 pp (~10% relative) increase in at least one *teff* practice from C (56%) to T (61.7%); a 5.9 pp (~11% change)increase in at least one *wheat* practice from C (52%) to T (57.9%); and 8.3 pp (~11% change)increase in at least one maize practice from C (75%) to T (83.3%). The study does not find any evidence of spillover effects in knowledge or adoption, suggesting that the effects of VMA are only felt by those directly exposed to the intervention. We note, however, spillover households were not selected by the same procedure as in treatment arms, and so may not be a perfect counterfactual to the study's comparison group. A full table of adoption outcomes are presented in the Appendix.

In Uganda, Campenhout el al. (2020) found that gains in farmer knowledge varied by practice type. For example, the authors recorded a 13.2 percentage point increase in knowledge (16% to 29.2%, 82.5% change) of the novel practice *optimal seed spacing.* However, gains were less substantial for older practices where baseline levels of knowledge were already high. For instance, the study found a 4.5 percentage point increase (~90% to 94.5%,5% change) in *combined input use*, and no significant changes for two practices relating to weeding and pesticide use. The differences suggest the influence of VMA on farmer knowledge is especially poignant for novel practices.

Regarding adoption, Campenhout et al. found a positive and significant increase in both the uptake of practices (0.16 SDs on composite index), and the uptake of fertilizer use (0.12 SDs on composite index). Lastly, the study finds changes in the program recipient (e.g. household head versus spouse) affects some knowledge and adoption outcomes, which we discuss further in the gender section**.**

Productivity

VMA also shows positive influence on farmer productivity, though the evidence is less consistent across studies and crop types. All of the studies rely on self-reported harvest outcomes, which are inherently prone to some degree of measurement error. We summarize findings from the listed RCTs in **Table 2.**

Table 2: Productivity Outcomes by Study

Study	Country	Production	Yield
Baul et al. 2020	India	<u>Year 1</u> No sig. changes <u>Year 2</u> No sig. changes	<u>Year 1</u> 28% increase in paddy yields (1123 to 1436 kg/acre) <u>Year 2</u> 30% increase in paddy yields (1176 to 1534 kg/acre)
Abate et al. 2018 Abate et al. 2019	Ethiopia	<u>Year 1</u> No sig. changes for any crops <u>Year 2</u> 22.8% increase in teff production (5.18 to 6.36 quintals); no sig. changes for wheat, maize	<u>Year 1</u> 15% increase in teff yields (7.9 to 9.1 quintals/hectare); no sig. changes for wheat, maize <u>Year 2</u> No sig. changes for any crops
Campenhout et al. 2020	Uganda		10.5% increase in maize yields (430 to 475 kg/acre)

In Bihar, Baul et al. (2020) find a 28% increase in paddy yields (1123 kg/acre v 1436 kg/acre) between control and treatment groups in Year 1, but no significant increase in total production for the pooled DG group. In the second year, they find a similar increase in yields (1176 kg/acre vs 1534 kg/acre, a 30% relative increase), and there are again no significant changes in production. Altogether, these relatively strong yield effects are hard to align with the modest results on adoption. If we assume all adopters (partial and full) were accurately counted by the study, then we are uncertain as to how modest adoption rates (15% in the treatment group) drives such high gains in paddy yields. However, if partial adoption was considerably underreported, then the high yield outcomes are more understandable. We are unable to fully assess the reliability of the reported yields without knowing the extent of partial adoption in the sample.

Baul et al (2020) also find increase in paddy profits in the first year (1010 Rs vs 3822 Rs, a 278% increase). However, they also find a decline in off-farm income of Rs 4579, resulting in no significant total income effect for the DG treatment group.

Abate et al. (2018, 2019) measure plot-level yields in their Ethiopia study by combining farmers' self-reported harvests with geo-spatial area measurements. In Year 1 (Abate et al. 2018), they detected a 15% increase in teff yields (7.9 to 9.1 quintals/hectare), but no significant gains for any other crops. In Year 2 (Abate et al. 2019), they report gains in teff production (5.3 to 6.5 quintals), but no significant changes in production or yields for the other two crops. The authors consider these noisy estimates to be consistent with prior efforts to measure yield effects from these packages of practices in Ethiopia.

In Uganda, Campenhout et al. calculate a 10.5% increase in maize yields (430 to 475 kg/acre) between traditional and VMA communities. Data were collected using farmer estimates of both land size and harvest quantity. However, total production did not appear to increase, as average acreage *decreased* by 11% (not significant) in the treatment group, adding to the estimated positive change in yields. The authors comment that the videos encouraged farmers to combine inputs and practices on a smaller scale to increase cost-effectiveness, which could explain the decreased plot sizes.

Sustained improvements

While the studies indicate positive effects on near-term outcomes, we only weakly understand VMA's influence on farmers' retention of behaviors and sustained welfare.

In Ethiopia, farmers were studied over two seasons in which they received the VMA approach both years. To study the dynamics of adoption over time, the researchers categorized farmers according to their adoption patterns: 'non,' 'early,' 'lagged,' and 'sustained adopters.'[11] Sustained adopters are farmers who maintain adoption of a practice for both years of the study. Among wheat farmers, we see a gain of 7 percentage points (35% to 42%, 20% increase) in sustained adoption of any technology in VMA communities. More modest gains are seen for teff (~22% increase from 23% to 28%), and no significant changes among maize farmers. All findings are collated in **Table 3** below (presented as percentages).

In Bihar, the effects in the second year of implementation were very similar to that in the first.

Table 3: Sustained adoptions between 2017-2019 (Abate et al. 2019)

Group	Crop	Non-adopter	Early adopter	Lagged adopter	Sustained adopter
Treatment	Teff	0.261	0.550	0.189	0.286
Control		0.324	0.498	0.178	0.237
Difference		-0.063**	0.052*	0.011	0.049**
Treatment	Wheat	0.192	0.569	0.240	0.420
Control		0.253	0.497	0.251	0.351
Difference		-0.061***	0.072***	-0.011	0.069**

Significance levels: * < 10% ** < 5% *** < 1% | No significant changes for Maize

In Bihar,

PROGRAM COST-EFFECTIVENESS

DG's VMA is designed to be a low-cost add-on to traditional extension systems, which can lead to attractive cost-effectiveness numbers. Cost-effectiveness has been explored in two metrics: (1) the *total* cost per adoption considers all costs to integrated VMA extension (videos + extension); (2) the *marginal* cost per adoption considers the cost of VMA as an add-on to underlying extension. Results are collated in **Table 4**, and learnings described below.

Table 4: Program Cost-effectiveness

[11] *Non-adopters:* farmers who did not adopt in both years of the study; *Early adopters:* farmers who adopted in the first year, regardless of later adoptions; *Lagged Adopters:* farmers who only adopted in the second year; *Sustained adopters:* farmers who adopted for both years of the study. Adopters were defined as farmers experimenting with at least one practice on any portion of acreage.

Study	Country	Total Cost (USD) per adoption	Marginal cost (USD) per adoption
Gandhi et al. 2014	India	Experimental $3.70	-
Bernard et al. 2019	Ethiopia	-	Experimental: $30.00 (row planting) $16.00 (lower seeding rate) $18.00 (urea top dressing) Scale-up: $6.00 (row planting) $3.00 (lower seeding rate) $4.00 (urea top dressing)
		-	

In Ethiopia, Bernard et al. (2019) also calculate the marginal cost of adoption of VMA. Cost-effectiveness figures were calculated per practice type (aggregating multiple crops), under both experimental and scale-up scenarios[12]. In the former, the authors approximated the cost of *row planting* to be $30.00 per additional adoption; *lower seeding rate* $16.00 per additional adoption; and *urea top dressing* $18.00 per additional adoption. Under the scale-up scenario, marginal costs were much lower: one additional adoption of *row planting* costs $6.00; *lower seeding rates* $3.00; and *urea top dressing* $4.00. Thus, since most training, personnel, and technological costs are fixed at the sub-regional woreda level, scaling-up VMA to include more kebeles (villages) within woredas significantly increases cost-effectiveness.

[12] The experimental scenario considers the intervention coverage of the Abate et al. RCT, or 240 kebeles in 30 woredas over one rainy season in 2017. The scale-up scenario extrapolates findings to *all* kebeles (450) in 30 woredas. The authors use the reported changes in adoption per technology from the RCT: 0.043 pp (row planting), 0.078 pp (lower seeding rate), and 0.069 pp (urea top dressing).

Gandhi et al. (2014) attempt to calculate the *total* cost per adoption of each treatment arm, rather than calculate the relative cost-effectiveness of adding video-based extension to an existing system (as in the previously-described studies). This is a difficult exercise, since it requires estimating the specific amount of time that NGO agents spent on extension between the two arms.

In the study context (Karnataka, India), the authors estimate the same NGO extension agents spent 80% of their time in control (T&V) villages and 20% of their time in treatment (DG) villages. This was made possible because the extension agents employed local, part-time video mediators in DG program areas to support disseminations. Since agent salaries comprised the bulk of T&V extension costs, the authors approximated a 25% reduction ($850 to $630) in annual extension costs per DG village, even when accounting for the extra duties and fixed costs of setting-up the video infrastructure.

In terms of adoption, the authors reported that 85% of DG farmers adopted at least one practice over 13 months, relative to 11% in the T&V group. Taken together, the study determined VMA implementation to cost $3.70 per adoption, compared to T&V costs of $38.18 per adoption. The authors frame this as a 10x increase in cost-effectiveness.

Although this early study of Digital Green's effectiveness had promising results, we believe that the numerical estimates of this study should be taken with caution. As it was a non-experimental design with a small number of villages, the treatment effect on adoption may not be precisely estimated. Additionally, calculating the total cost required a number of difficult assumptions. Regardless, this study provided a directional indication that the Digital Green approach had the promise to become extremely cost-effective.

INTERNAL DATA ON OUTCOMES (COCO)

An important and enduring feature of Digital Green has been a public-facing monitoring system called Collect Online, Collect Offline (CoCo). CoCo is a central data repository that goes beyond independent evaluations to capture basic farmer outcomes across all program sites and periods. Typically, basic farmer data (e.g. attendance at disseminations, agent-verified adoptions) is collected by frontline extension workers, verified by field supervisors, and then uploaded to the CoCo system by district-level staff.

We provide below a snapshot of CoCo metrics for key geographies from 2011 to present. Notably, female farmer viewership has been substantially higher in India (90%) than in Ethiopia (28%). In India as well, the recorded adoptions per viewer in India (3.03) is three times higher than in Ethiopia (1.02).

Table 5: CoCo reported farmer outcomes for India, Ethiopia, and sub-regions

	Global	India	Bihar	AP	Jhark	Ethiopia	Amhara	SNNP	Oromia	Tigray
Farmer viewers	1943940	1475870	697355	241585	92901	442791	116607	76377	166381	83453
Male v female viewers	Male: 24.4%, Female: 75.6%	Male: 10%, Female: 90%	Male: 0.4%, Female: 99.6%	Male: 18.6%, Female: 81.4%	Male: 0.7%, Female: 99.3%	Male: 72.2%, Female: 27.8%	Male: 68.4%, Female: 31.6%	Male: 71.1%, Female: 28.9%	Male: 83.6, Female: 16.4	Male: 55.8%, Female: 44.2%
Number of adopters	1159781	896727	367106	281003	26351	249275	51479	48647	102909	46240
Male v female adopters	Male: 33.9%, Female: 66.1%	Male: 28.6%, Female: 71.4%	Male: 0.3%, Female: 99.7%	Male: 38.6%, Female: 61.4%	Male: 0.1%, Female: 99.9%	Male: 77.5%, Female: 22.5%	Male: 73.9%, Female: 26.1%	Male: 77.5%, Female: 22.5%	Male: 86.0%, Female: 14.0%	Male: 65.9%, Female: 34.1%
Average adoptions per viewer	2.56	3.03	3.26	2.52	2.28	1.02	0.83	0.95	1.11	1.14

Source: Digital Green CoCo

While the CoCo system is designed with data fidelity checks, the inputs are collected by a wide variety of frontline workers and may be prone to errors. In Ethiopia, a supplementary analysis by IFPRI (Makhija et al. 2019) considered the concordance between their team's independently-collected survey data and data generated by the GoE and housed in CoCo. The study found a positive and significant correlation between government and IFPRI-generated data on video attendance (correlation of .11) and farmer adoption (correlation of .17), indicating that CoCo data contained a lot of correct information but also a good amount of errors. A similar study by CMS in India visited farmer fields and compared observed adoption to that in DIgital Green's CoCo database. They found the CoCo system to be improving over time, with 23% of adoptions verified in 2015, 53% verified in 2016, and 65% verified in 2017. These two studies suggest that CoCo data is collected and managed with a reasonable degree of accuracy, yet there is clearly room for continued support to governmental partners to enact robust data quality procedures.

LEARNINGS ABOUT GENDER

Digital Green has explored ways VMA can be used to improve womens' access to formal extension services and womens' decision-making in agriculture. Thus, multiple studies have integrated gender-level effects to understand how information is best diffused within households to enable inclusive learning and adoption of technologies.

In Ethiopia, agriculture extension is largely male-dominated. A learning report by Digital Green (2017) found through focus group discussions (FGDs) that men are the primary deciders of agriculture activities, and married womens' access to new information is largely dependent on their spouses. In particular, the uptake of the more labor intensive technologies like 'row planting' are the most male-dominated. Generally, the authors observe how illiteracy and cultural norms negatively affected womens' ability to actively participate in extension sessions. In order to resolve these imbalances, respondents indicated a preference for mixed-gender discussions led by female extension officers. Women also expressed an interest in female casting, in the context of VMA.

Two of the previously-discussed RCTs also tested specific program modifications to increase engagement and improved outcomes for women.

Abate et al. experimentally test the relative effects of delivering VMA to men only vs couples in Ethiopia. The study involves three intervention arms: in the 'control group', conventional extension was delivered to typically male household heads; in the 'regular DG group', VMA was delivered to male household heads; in the 'DG + spouse' group, VMA was delivered to male household heads *and* their female spouses. Outcomes were measured for household heads and spouses in all three groups.

In the first year of the study (Abate et al. 2018), the authors find 'DG + Spouse' increases spouses' content knowledge of teff cultivation (by 1.4 percentage points, 4.3% increase) and wheat cultivation (by 1.6 percentage points, 4.8% increase) relative to control group spouses. These knowledge gains for spouses are not seen in the 'regular DG' group. Spouses' adoption levels, however, are similar for the 'regular DG' group compared to the 'DG+Spouse' group. No other significant effects were found for other practices or crop types.

In the second year (Abate et al. 2019), however, the study finds no positive and significant effects in the 'DG + Spouse' group on spouses' content knowledge for any crop. Interestingly, the authors do find a significant effect on spouses' self-reported adoption in the 'regular DG' arm. This leads to a 6.4 percentage point increase in spouses' adoption of *row planting* for any crop (44% to 50.4%, 14.5% increase), and a 6.8 percentage point increase in spouses' adoption of *urea dressing* for any crop (44% to 50.8%, 15.4% increase). No significant effects were found on spouses' adoption of *seeding rate* for any crop. While the estimated effects on spouses of the 'DG + Spouse' are not significantly different than zero, they also aren't generally different from the effect of the 'regular DG' arm, making the effects of the 'DG + Spouse' arm somewhat inconclusive.

Altogether, results from Year 1 and Year 2 indicate that spouse-targeted extension can lead to some gains in womens' agriculture outcomes, but that male-targeted extension may also diffuse to female spouses.

In Uganda, Lecoutre et al. (2019) also study the differential effects of showing videos to male heads, female co-heads, and farmer couples, respectively. As a part of their analysis, the authors consider the productivity impacts on male-managed, female-managed, and jointly-managed plots.
The authors find showing videos to female co-heads (alone or jointly) positively and significantly increases their content knowledge, decision-making power, practice adoption, and productivity. For example, relative to control spouses, women's adoption increases by 1 to 5 percentage points (depending on the practice), and womens' productivity nearly doubles (from 58 kg/acre to 108.4 kg/acre) on plots managed by them. However, there were no significant changes in production, productivity, or area under cultivation on jointly-owned plots when women were involved in receiving information.

The authors also report on the effects of varying the gender of the messenger (actor) in the videos. Specifically, the study compares outcomes for households where information was provided by a woman actor alone, by a male actor alone, and by a farmer-couple. The results are mixed. Involving a female actor (alone or jointly) significantly increased women's decision-making index by .15 SD. It did not lead to significant changes in adoption.

Overall, while VMA seems to bolster some agricultural outcomes for women, the results are not consistent over time, practices, and crops. Specifically, more research can be conducted on promoting women in the process of technology adoption and plot management.

B. INSTITUTIONALIZATION

DG seeks to ensure the scale-up and sustainability of the VMA approach by working with national and local governments to integrate VMA into its extension platform. Efforts to drive and support official adoption of VMA are well-documented in process studies from India and Ethiopia. These studies indicate factors which can enable or detract from successful take-up by programs and farmers at-scale. Note: statistics on program operations in this section were supplied to us directly by Digital Green.

India

In India, beginning in 2012, Digital Green collaborated with the National Rural Livelihood Mission (NRLM) (implemented by the Ministry of Rural Development), to institutionalize VMA with state-level partners, initially in Bihar and Andhra Pradesh. The project has successfully reached over 1 million smallholder farmers (95% of them women) in more than 12,000 villages across the two states. The DG and NRLM partnership has since expanded to include eight other states in India.

In a 2018 institutionalization memo (Digital Green 2018), DG defined the factors which enabled them to achieve this degree of scale across the Indian subcontinent. First is an emphasis on *partnerships, alignment of priorities, and co-investment*. A successful partnership is indicated through equal commitments to objectives, plus the provision of resources to achieve them. Altogether, state partners in India have contributed over $23.2 million towards video equipment, personnel, and training. This includes the procurement of 9,223 Pico projectors and 96 camera sets, with commitments for an additional 8,000 projectors in Bihar by March 2021.

Secondly, DG considers the importance of *effective governance structures* for regular project and performance review; in Bihar and Andhra Pradesh, DG formulated block, district, and state-level project management committees to regularly assess policies and processes.

Third, DG emphasizes *capacity for digital extension*, which includes the design of highly-effective curricula, robust training of agents to deliver videos, and efficient systems to supervise those agents (Digital Green 2018). Under NRLM, DG worked with technical experts to produce over 5,000 videos (in 25 languages), with an emphasis on easily adoptable, locally-prioritized, and high ROI practices (see the discussion on Most Important Practices [MIP] below). DG has also trained over 14,655 extension officers (70% women), in part through the deployment of **virtual training courseware** (Virtual Training Institute or VTI) which trained 1,550 officers, and by establishing a **trainer-of-the-trainer system** to more efficiently build agent capacity. In Bihar, as a tactic to alleviate the burden of direct staff supervision, DG identified the most skilled officers to become **Master Resource Persons** (MRPs). MRPs are responsible for regular supervision of peer extension agents, monitoring video disseminations, and verifyng 10% of recorded farmer adoptions. As of 2020, there are 277 MRPs, 35% of whom are women.

Lastly, *tech enabled data systems* use analytics to continually track performance and inform programmatic decisions. DG has spearheaded this effort with the development of **CoCo**, a public-facing information system adapted for low-resource environments (Digital Green 2018). CoCo has been adopted by state-partners in Bihar, Andhra Pradesh, and Jharkhand to capture data on video disseminations, adoptions, and farmer feedback; notably, counterparts have begun to use CoCo metrics as a basis for assessments and remuneration of extension officers (Digital Green 2018).

In the context of these achievements, DG has also reflected on certain obstacles which can recurrently detract from institutionalization (Harwin et al. 2014). Based on its scale-up experiences in Bihar, DG has pointed to the following categories which can pose risks to effective extension:

- Extension officers lacking required mediation abilities
- Officers demotivated by inadequate or delayed payments
- Vulnerability of PICOs to breakage and delayed repairs
- Issues with relevancy of videos
- Village bodies such as FPGs lacking sufficient organizing power
- Delays in procurement of seeds or other inputs for farmers

These remain important areas for consideration in the DG's continued scale-up in India.

As per a qualitative study (IDinsight, 2020) conducted to assess institutionalization in Andhra Pradesh, India, the other drivers of institutionalization were internal champions within the state government, interest and motivation of key staff responsible for ground implementation, and time over which government stakeholders were convinced about the efficacy of video-based dissemination. In addition to some of the risks highlighted above, the other main barrier to institutionalization was the lack of specialized video production unit within agriculture departments posing an ongoing challenge to complete ownership of video-based extension by the government.

Ethiopia

In Ethiopia, beginning in 2014, Digital Green partnered with the Ministry of Agriculture and Natural Resources (MOANR) to integrate VMA and other digital solutions to boost the reach and efficacy of conventional extension approaches. In 2015/16, VMA was formally incorporated in the government's Second Growth and Transformation Plan (GTP2) and Second Agricultural Growth Program (AGP2). Since then, VMA has expanded to over 76 woredas across four states (Amhara, Oromia, Tigray, and SNNPR), with $3.4 million invested by the Government of Ethiopia for the approach (Digital Green 2017).

This high level of institutionalization in Ethiopia has evolved through a combination of policy formation, domestic resource mobilization, and strengthened local capacity for implementation. As reported by Digital Green (Digital Green 2017), major milestones in this work have included:

- Building locally-owned governance structures: DG and MOANR stakeholders jointly established a federal-level governing body, the Project Management Committee (PMC), in order to strategically manage the process of VMA integration. Beneath this are regional PMCs which directly supervise content development and DA performance management. In 2018, DG officially handed over many responsibilities to regional extension offices (and their composite management structures) to supervise VMA delivery at the woreda, zonal, and regional levels.

- DA training and improved management: DG's VMA curriculum has been integrated in five formal training institutes for DAs (ATVETs), leading to the training of over 1500 DAs in VMA and 600 video producers. Additionally, DG has trained more than 6,000 local extension agents (13% women) and 623 Subject Matter Specialists (10% women), in part through the use of VTI. State partners are also utilizing CoCo as a means for DA performance monitoring, reporting, and management; video dissemination quality protocols have also been integrated in the job descriptions of all DAs trained in the approach.
- Scaling up VMA in Ethiopia - DG has continually identified new woredas and kebeles for VMA integration, procured more PICO projectors and other video equipment, and achieved budget commitments from local partners to continue the scale up beyond initial intervention areas.

In 2019, Zerfu et. al released an in-depth qualitative report on DG's process of institutionalization in Ethiopia (see details in the Appendix). The authors conceptualize the results of institutionalization in two parts: readiness capacity -- relating to human and infrastructural activities --; and primary outcomes -- the programmatic results of these activities. We summarize findings for each below:

- Readiness capacity - (a) Digital Extension Management Committees (DEMCs) were largely in place across the 4 regions, which indicates good governance systems for VMA; (b) unevenness (across regions) in the training of video production teams (VPTs), the role of VPTs in video production, and the acquisition of PICO projects; (c) adoption verification data on CoCo is not widely available, particularly in Amhara and Tigray; and (d) operational budget allocations required for VMA were not in place for most woredas.
- Program outcomes - (a) VMA was incorporated in annual extension plans in almost all studied woredas; (b) severe unevenness (across regions) in the number of videos produced, edited, and distributed; (c) only low to mid usage of data collection and management with CoCo.

Distilling these results, Zerfu et. al. consider the overall drivers and detractors involved in institutionalization. Collectively, these can serve as guideposts for Digital Green in future scale-up.

- Drivers - (a) strong institutional leadership that guides integration of VMA with macro plans and structures; (b) well-informed champions who efficiently filter down VMA protocols to other extension teams and staff; (c) successful hiring of high-performing VPT members, and high quality of initial and follow-up training of VPT members; (d) regular data collection, evaluation, and feedback to DEMCs, zonal, and regional support

- Detractors - (a) inaccurate verification of farmer adoptions by DAs, in part due to misunderstanding on how to monitor uptake of activities, (b) unevenness and inconsistency in the efficacy of DEMCs, incl. absence of review and reflection opportunities and poor management of budgetary resources, (c) at the local level, limited availability of PICO projectors, short battery life, minimal memory stick capacity, and inadequate venues which reduce the frequency of screenings

C. INNOVATIONS

MOST IMPORTANT PRACTICES

In an effort to improve cost-effectiveness of the video-based approach, Digital Green piloted the Most Impactful Practices (MIP) approach in both India and Ethiopia. MIP condenses video extension to leaner packages of 2-3 *non-negotiable* recommendations per crop that still deliver on farmer outcomes.

In India, Digital Green (Digital Green 2018) piloted MIP in the states of Bihar and Jharkhand in 2018. To test the MIP approach, an independent assessors[13], used crop cuts to compare the outcomes of farmers who adopted all MIPs (for a given crop), to farmers who viewed MIP videos but did not apply any practices (non-adopters). Across the board, adopters produced higher yields relative to non-adopters, ranging from a 24% increase in paddy yields (Bihar) to over 300% in pigeon pea yields (Jharkhand). Since the comparison farmers are ones who chose not to adopt, they may not be similar to the adopting farmers. Therefore, the results of this study are best understood as a correlation between adoption and yields, rather than a causal measure of the impact of MIPs.

In Ethiopia, the evaluation group DAB DRT (2019) ran another agronomic assessment of MIPs for wheat and teff, specifically to see what combinations of practices were correlated with high farmer productivity. This study collected data from 296 households, where researchers took crop cuts to estimate yield and also surveyed the farmers to understand their farming practices. The authors grouped the practices into seven ‘bundles’, and categorized each farmer based on their adoption of certain bundles. DAB DRT estimate that among seven teff practices shown by DG, a bundle comprising just four practices -- *land preparation*, *variety and seed selection*, *row planting*, and *urea application* -- optimized teff growers’

[13] Paddy crop cuts were performed by the Pran Development Service Trust (Bihar); wheat and potato crop cuts by Impact Partners for Social Development (Delhi); pigeon pea crop cuts by Digital Green with support of JSLPS/MKS workers.

productivity[14]. In the case of wheat, a bundle comprising five out of six practices produced the highest yields per hectare, where *chemical management* did not appear to be cost-effective.

This study establishes a positive correlation between condensed practices and farmer productivity, suggesting the potential for MIPs to cost-effectively improve outcomes, especially in the case of teff cultivation. This study does not confidently establish causality of the effect of these practices on yields, since the correlation may have been driven by other unobserved differences between farmers.

INTEGRATED CHANNELS

In recent years, Digital Green has experimented with integrating traditional and non-traditional channels to boost farmer reach. In particular, DG has experimented with combining VMA with mobile phone based technologies such as SMS and IVR.

In Uganda, Campenhout et al. (2020) combined VMA with two add-on information technologies. In the first scenario, farmers were provided a number to an interactive voice recording (IVR) system, which they could voluntarily call into for ad-hoc assistance. In the second, alongside IVR, farmers received periodic SMS-based nudges about key maize practices they should apply (mirroring content in the VMA).

The authors found no significant differences in farmer knowledge as a result of either the IVR or SMS add-ons, which they attribute to the fact that these media did not provide any new information beyond the videos (10). In terms of adoption, too, the study detects no significant changes due to IVR or SMS for any of the 10 promoted practices. However, the authors do find IVR contributes a 4.1 percentage point increase (29 to 33.1%) in farmers' use of hybrid seeds, relative to comparison farmers. In regards to productivity, the study registers a 10.5 percent increase in yields from VMA, but no significant changes with the IVR or SMS add-ons.

Campenhout et al., despite the mixed results, do not dismiss the potential value of mobile technologies. Due to low uptake of IVR by treated farmers (8.9%), the study may have been underpowered to detect slight gains from these services. The authors encourage future experimental research with a larger sample of IVR users.

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[14] Three practices -- hand weeding, chemical weed management, and shoot fly control -- were found to be the least cost-effective.

In 2018, Digital Green worked with Awaaz.de to understand farmer reception to mobile-based voice messages in Andhra Pradesh, India (Awaaz.de 2018). Messages took three forms: story-based reinforcement messages, supplementary information messages, and targeted weather advisories. The mobile messages were delivered as an add-on to DG's base VMA program. Results on engagement were encouraging. On average, paddy farmers (N=811) showed a 70% pick-up rate for both reinforcement and supplementary messages; after pick-up, farmers listened to 66% of the length of the reinforcement messages, and 61% of the supplementary messages. Weather advisories sent to groundnut farmers (N=1528) returned an 80% pick-up and 80% listen rate. Qualitative data indicated the messages were interesting to farmers, and encouraged attendance at video screenings and interaction with local extension agents. The study also compares self-reported adoption of key practices (using secondary data from government sources) between farmers who received the IVR add-on and those who only received the base video program. The authors find an overall 32% increase in adoption of key practices by groundnut farmers who received Video+IVR, and between a 21 to 74% increase in adoption of practices by paddy farmers who received Video+IVR (variable to the practice). However, without details on the selection or sampling strategies for the two farmer groups we cannot verify the precision of this impact. Overall, the study points to positive farmer engagement with IVR and weather messages, and makes a good case for further experimentation.

IDinsight conducted a mixed-methods evaluation (including an RCT) of an early version of Digital Green's data-sharing platform called FarmStack. The pilot use case of this platform involved providing advisory to cashew farmers in Andhra Pradesh. In addition to the VMA, the farmers received IVR to reinforce the practices shown in the videos, along with customized of soil and weather data. The advisory included a range of natural farming practices aimed at crop care and productivity enhancement. Overall the results on knowledge and adoption rates were positive for the first season of crop.

Farmers who received Video+IVR were more likely to know about all promoted practices, with effects ranging from 5.2 to 9.1 percentage points (8%-52% relative increase). Video+IVR farmers were more likely to adopt all promoted practices, with effects ranging from 4.7 to 7.6 percentage points. They were 8.6 percentage points more likely to adopt at least one practice (a relative increase of 21%). There was a slightly higher production levels and yields in the Video+IVR group, but the indicators were noisily measured and there was no statistically significant difference from the Video Only group. The Video and Video+IVR groups were also compared with a 'non-intervention' group of farmers which were not randomly selected. Cashew farmers in the project area reported much higher levels of knowledge and adoption of promoted practices than cashew farmers outside the project area ("non-intervention farmers").

This study also included IVR reminders sent to field functionaries about the video dissemination schedule and content, and also captured farmers and field functionaries' perception and experience of receiving the IVR calls. As per self reported data, in the Video+IVR group, 59.0% of farmers reported receiving an IVR call. The pick up rate of at least one IVR call as per the administrative data was ~82%. Functionaries and farmers reported supplementary IVR and weather IVR to be highly relevant and easily understandable but somewhat difficult to access in part due to network and other technical issues.

MARKET AGGREGATION

LOOP is a shared transport-to-market service and mobile application originally developed by Digital Green and now managed as an independent enterprise. LOOP matches farmers, local carriers, and wholesale markets, to reduce logistics expenses and enhance information flows to fetch optimal rates on commodities.

As a use case, Cooper et al. (2018) studied the viability of LOOP to improve access to and consumption of fruits and vegetables (F&V) locally in Bihar, India. Numeric data (captured in LOOP's system) show the service reduced marketing costs, and diversified and multiplied the sale of produce at aggregation points. The difference in per unit transport costs contributes to an estimated 18-25% reduction in total marketing costs and a 5-20% increase in profits for LOOP farmers relative to non-LOOP farmers.

However, most of these gains were occurring around more distant hub markets (and not around local markets). Systematic barriers in the value chain -- such as enduring relationships between producers and non-local commission agents, a dominance of distance traders at regional markets, and lower absorptive capacity plus higher retail prices at provincial markets -- continue to make it economically disadvantageous to shift the supply of F&V to local markets. The study concludes that while LOOP functionally improved the availability of produce in some markets, it did not successfully benefit local, nutritionally vulnerable communities.

A report by 60 Decibels also discusses LOOP participants' perceived improvements in F&V production and income. Of 259 users interviewed, 11% claimed improvement in their production of F&V, 19% claimed improvement in their income from F&V, and 28% described an improvement in their quality of life as a result of LOOP.

HEALTH AND NUTRITION

Digital Green has also explored the application of VMA to promote Maternal, Infant, Youth, and Child Nutrition (MIYCN) programs.

In 2013, DG partnered with health officials to run videos on health education in 30 villages in Odisha, India. After one year of the intervention, Kadiyala et al. (2014) reported positive knowledge transfer using a post-exposure assessment. Among 42 women, 67% were familiar with one of the key concepts promoted (*1,000 day window*), and 30% could fully explain its significance relative to child development. Without a baseline (a counterfactual), we cannot ascertain the change in outcomes or attribute them to the intervention. Still, the positive results indicate the feasibility of VMA as a tool for MIYCN learning.

Kumar et al. (2015) explored the qualitative results of Projecting Health, a video-enabled maternal and child health program in Uttar Pradesh. Between 2012-2014, Digital Green worked with local NGO partners to disseminate over 4500 group screenings across 84 villages. Using data from interviews and focus groups, the authors find VMA carries several advantages over conventional health extension. These include:

- Greater engagement by women with new MIYCN content, due to the credibility of videos and the repeatability of disseminations.
- Greater ease, confidence, and motivation by community health workers (ASHAs) in performing their duties with the video aids. ASHAs also reported a feeling of elevated social status due to the novelty of the videos in their communities.
- More local influence over health extension through volunteer-led Community Advisory Boards (CABs). CABs continually ideate, produce, and improve videos in response to community feedback.

Lastly, Kadiyala et al. (2018) describes the design of an experimental impact evaluation of VMA for agriculture and nutrition extension in Odisha, India. Deploying a clustered RCT, the authors studied the relative impacts of three interventions and a control group:

- Group video disseminations and home visits on agriculture practices (AGRI),
- Group video disseminations and home visits on agriculture and nutrition-specific practices (AGRI-NUT)
- Group video disseminations and home visits combined with participatory learning workshops (AGRI-NUT-PLA).
- Control group receives no interventions beyond conventional government-run extension

In the design, 148 clusters (of 1-2 villages) were randomly allocated to the four treatment arms (37 clusters per arm); within each cluster, an average of 32 mother-child dyads were randomly sampled for the evaluation. The interventions ran for 32 months, with one round of baseline (2016/2017) and endline (2019/2020) surveying.

While the final report is still under review, the authors have shared initial results in a video summary (Kadiyala et al. 2020). Relative to the comparison group, they found:

- Positive, significant gains in child minimum dietary diversity in the AGRI-NUT (19%) and ARI-NUT-PLA (27%) arms
- Positive, significant gains in maternal minimum dietary diversity in the AGRI (21%) and ARI-NUT-PLA (30%) arms
- No detected differences in Maternal BMI or Child Wasting
- Significant increases in net value of agricultural production in the AGRI arm

Taken together, these studies indicate impactful avenues for VMA in the health and nutrition domains. The two process studies (Kadiyala et al. 2014 and Kumar et al. 2015) describe the potential outcomes and mechanisms for video-enabled MIYCN behavior change and the recent impact evaluation in Odisha (Kadiyala et al. 2018) provides robust evidence on its effectiveness for enhancing nutrition outcomes.

D. AREAS FOR FUTURE RESEARCH

Our examination of Digital Green's evidence base points to three areas for further investigation: long-term effects of VMA, gendered impact in VMA model and integrated channels.

First, while multiple impact evaluations demonstrate positive gains from VMA on near-term farmer outcomes -- particularly on adoption and productivity indicators within two years of the intervention -- we have less evidence on the long-term effects of video-enabled agriculture extension. Pertinent questions may include:

- Do farmers continue over seasons to adopt practices spurred by VMA? How do adoption rates change over time?
- Does VMA need to continue to sustain adoption?
- Do productivity and yield gains persist over time?
- How often does video content need to be updated to sustain results?

Secondly while VMA models targeted at increasing awareness and adoption amongst women seem to bolster some agricultural outcomes for them, the results are not consistent over time, practices, and crops. More research can be conducted on promoting women in the process of technology adoption and plot management. Some questions may include:

- -What factors most mediate the impacts of gender sensitive VMA for women?
- -What actions targeting couples constrain or promote adoption of improved practices?
- -How do videos of female role models impact men and their perceptions of women in decision-making?
- -What is the gendered impact of mobile-delivered messaging (reach/adoption, perhaps others)

Thirdly, given Digital Green's evolving approach to integrated channels and its mixed results to date, we encourage future research on the use of mobile technologies like SMS and IVR to bolster VMA extension. Example questions may include:

- What are the marginal impacts of SMS and IVR on top of VMA for various crop types, practices, and geographies?
- What are the opportunities for and impacts of real-time and farm-tailored SMS and IVR messaging? Areas for exploration could include: weather, soil health, crop disease, market information, etc.
- What are the opportunities for SMS and IVR to bolster government extension agent performance?
- What are the opportunities for mobile-phone based data collection to improve regularity, quantity, and accuracy of internal monitoring?
- How effective is mobile-based training for extension agents when compared to face-to-face training?

CONCLUSION

Digital Green has accumulated a substantial bank of evidence on the efficacy of VMA and other technologies for improving farmer welfare. Its combination of experimental evaluations, in-depth qualitative work, and internal learning reports form a useful evidence base for Digital Green's decision-making. We found the most empirically rigorous research -- useful for answering causal questions related to program features, choices, and scale-up decisions -- to be found in RCTs led by independent assessors like J-PAL, IFPRI, and LSHTM. Meanwhile, the organization's process studies and lean trials critically inform regular program monitoring, operational questions, and underlying mechanisms relating to technology adoption and institutionalization.

In terms of results, we see consistent achievements in the use of VMA to enhance near-term extension outcomes. VMA significantly increases farmer knowledge and adoption of new technologies in India and Ethiopia (Baul et al. 2020, Abate et al. 2019,, and can positively influence womens' agricultural decision-making in the household (Abate et al. 2019). A number of studies suggest higher adoption also translates to improved farm productivity (Baul et al. 2020, Abate et al. 2019, Campenhout et al. 2020), though the evidence is less robust for this outcome area.

A second area of success has been Digital Green's institutionalization of VMA with state partners to amplify the reach of agriculture extension. In both India and Ethiopia, the organization has developed the governance structures, agent training curricula, and performance tracking systems necessary to steer VMA integration. Risk areas for Digital Green to continually evaluate include: reliability of dissemination equipment, fidelity of data collection and monitoring, and budgetary and operational commitments by local partners.

We also highlight three areas worth future exploration by Digital Green.

APPENDIX

This appendix contains IDinsight's review and assessment of three key studies cited in this report. A comprehensive categorization of studies can be found in the accompanying work\book. This appendix contains further explanation of the following studies:

1. Participatory Video and Mediated Instruction for Agricultural Extension

(Gandhi et al. 2007)

2. Improving Smallholder Agriculture via Video-Based Group Extension

(Baul et al. 2020)

3. Impact of video-mediated agricultural extension in Ethiopia

(Abate et al. 2018) (Abate et al. 2019)

1. Participatory Video and Mediated Instruction for Agricultural Extension (Gandhi et al. 2007)

Research Questions

This proof-of-concept study by Digital Green in Karnataka, India investigates (a) the effects of VMA on farmer adoption and (b) the total costs per adoption of the VMA system.

Methodology

The authors devised a controlled study involving 16 villages under the extension area of the NGO Green Foundation. Villages were purposely assigned to two groups: (a) eight comparison villages received periodic, conventional extension by NGO agents (T&V); (b) eight program villages received conventional extension plus video screenings by local mediators (VMA).

The same set of seven agricultural practices were disseminated in all villages for 13 months. In order to minimize confounding factors, treatment and comparison villages were balanced on population size, availability of irrigation, and years of previous Green Foundation interventions.

In treatment villages, over 1,500 video screenings took place (approximately three per village per week), involving more than 2,000 farmers (approximately 125 per village). After each screening (or instruction in control villages), participating farmers were asked if they were interested in taking up the featured practice(s). Mediators and extension staff then verified adoptions through follow-up visits to farmers' households and plots. The final convenience sample (built from a sample of farmers with verified adoption data) included 530 comparison households and 540 program households.

Results

The authors report that 85% of program farmers adopted at least one practice over 13 months, relative to 11% in the comparison group. They also estimate VMA implementation costs $3.70 per adoption, while T&V costs $38.18 per adoption (normalized for a village of 200 households). The authors frame this as a 10x increase in cost-effectiveness, and cite the reduced time spent by extension agents in program villages as the primary driver of lower costs.

Assessment

We believe this study's numerical estimates should be taken with caution. First, since the design is non-experimental and includes a small number of villages, the treatment effect on adoption may not be precisely calculated. Secondly, since farmers were not randomly sampled from the village and may not have had the same sampling strategy in treatment and control, sampling bias may be affecting the results. As such, we consider the adoption and cost-effectiveness outcomes more indicative than causal.

2. Improving Smallholder Agriculture via Video-Based Group Extension (Baul et al. 2020)

Research Questions

This experimental study by J-PAL in Bihar, India explores the relative impacts of VMA variants on paddy farmer knowledge, adoption, productivity, and cost-effectiveness. VMA content focused on the agronomic technology System of Rice Intensification (SRI), which involves four component practices: seed treatment, nursery bed preparation, transplantation and use of conoweeder.

Methodology

The authors devised a clustered randomized controlled trial (RCT) with four treatment arms and a control with the following targeted sample sizes:

- 70 villages received the VMA for SRI base program (DG)
- 70 villages received VMA + supplementary labor cost messaging[15] (DG + Labor)
- 70 villages received VMA + supplementary self-efficacy messaging[16] (DG + Self)
- 70 villages received VMA + labor cost + self-efficacy messaging (DG + Labor + Self)
- 140 comparison villages received only the underlying conventional government extension

Villages were randomly sampled from a government extension area in Bihar, and randomly assigned to the five intervention arms. Within each village, six female farmer participants (organized in self-help groups) were randomly sampled for the study. The intervention ran for two years (2014-2016), with baseline (2014), midline (2015), and two endline (2016) collections. After accounting for attrition and inconsistencies in productivity[17], the final analysis included 1395 individuals.

Results

Adoption	Yield
Year 1 4.6 pp increase from C (10.6%) to T (15.2%).	Year 1 28% increase in paddy yields (1123 to 1436 kg/acre)
Year 2 4 pp increase from C (10%) to T (14%)	Year 2 30% increase in paddy yields (1176 to 1534 kg/acre)

For most outcomes, there are no significant differences between the effects of the Labor or Self augmentations and the normal DG treatment arm.

Assessment

Overall, Baul et al. present a rigorous study that uses a sufficiently large sample size representative of DG's target population in Bihar.

We note potential gaps in the quality of adoption and productivity data. Due to unclear language and sequencing on the questionnaire, the authors believe partial adoption may be underreported, though we do not have a sense of its extent.

[15] Depicts the cost of hiring labor and labor availability
[16] Messages promoting beliefs in one's own abilities to produce certain outcomes
[17] The authors drop farmers who reported inconsistent yields between the two endlines in 2016.

Treatment effects for yield are high in both years, but there is no increase in production. If the recorded treatment effect on adoption is accurate (4-5 percentage), then we are uncertain as to how this modest figure could drive those gains in productivity. If partial adoption was considerably underreported, then the productivity results are more understandable. Adding to the complexity, while the authors found very high adoption in the Year 1 DG + Labor arm (60% increase), we do not see any significant difference in productivity for that arm in Year 2.

The authors also find an increase in paddy profits of Rs 2812 in Year 1 (profits are not reported in Year 2.) However, they also find that off-farm labor in the kharif season statistically significantly decreases in Year 1 following the gain in production and yields from DG training. Farmers work 10 fewer days off-farm and earn 4,500 INR less. This calls into question whether there was actually a positive welfare increase from exposure to DG.

3. The impact of video-mediated agricultural extension in Ethiopia (Abate et al. 2018 and 2019)

Research Questions

This experimental study by IFPRI explores the impacts of VMA on farmer knowledge, adoption, and productivity across four regions of Ethiopia. Additionally, the study investigates the extent of information spillover, and the influence of VMA on male versus female coheads. VMA content focused on three agronomic practices (row planting, optimal seeding rates, and fertilizer use) for three cereal crops (teff, wheat, and maize).

Methodology

The authors report a clustered randomized controlled trial (RCT) with four treatment arms and a control.

- In 115 villages, VMA targeted the male head (Regular DG)
- In 116 villages, VMA targeted the male head and female cohead A (DG + Spouse)
- In Regular DG villages, some non-VMA households were studied (Regular DG Spillover)
- In DG+Spouse villages, some non-VMA households were studied (DG+Spouse Spillover)
- In 116 comparison villages, households received only the underlying conventional government extension

Villages (kebeles) were randomly assigned to the two primary intervention arms (Regular DG and DG + Spouse), stratified by woreda. Extension services (VMA and conventional) were delivered to village-level development groups. The study randomly sampled 7 households from VMA development groups in each village to comprise Regular DG and DG + Spouse arms. In each village, 4 households were also sampled from non-VMA development groups to comprise the two spillover arms.

The intervention ran for two years (2017-2019), with post-intervention data collected in 2018 and 2019. Adoption was self-reported; productivity was measured by combining self-reported production with GIS-calculated plot areas.

Results

The study reports positive and significant changes in **adoption** for all three crops and technologies (see table below).

There were significant increases in knowledge of teff (1.8 pp) and wheat (1.96 pp) practices in Year 1, but not for any crops in Year 2. The authors also reported significant increases in teff yields in Year 1 (15%) and in teff production in Year 2 (22.8%), but no changes in production/productivity for wheat or maize in either year. No significant changes in the spillover arms were detected.

Assessment

Abate et al. present a rigorous study with strong evidence on the positive effects of VMA for farmer adoption. Yield data was noisier and less consistent, conclusions on productivity are unclear. We also cautiously interpret the null results on information spillovers. Spillover households were added mid-study in Year 2, so the control group may not have been a perfect counterfactual. Sample sizes may also have been too limited to detect any significant changes in spillover.

Table of Results on Adoption, Abate et al. (2018 and 2019)[18]

Year 1 - effect of any DG intervention on household head (by crop and practice)

	Teff	Wheat	Maize
Row Planting	0.058***	0.035*	0.036*
(control mean)	(0.16)	(0.174)	(0.65)
Lower Seeding Rate	0.070***	0.079***	0.034
(control mean)	(0.311)	(0.222)	(0.436)
Urea Top Dressing	0.082***	0.084***	0.032
(control mean)	(0.371)	(0.333)	(0.506)

[18] Significance levels: * p < 10% ** p < 5% *** p < 1%

Year 2 - effect of any DG intervention on household head (by crop and practice)

	Teff	Wheat	Maize
Row Planting	0.055***	0	0.094***
(control mean)	(0.125)	(0.238)	(0.705)
Lower Seeding Rate	0.083***	0.046	0.104***
(control mean)	(0.313)	(0.290)	(0.499)
Urea Top Dressing	0.023	0.062**	0.050*
(control mean)	(0.438)	(0.364)	(0.540)

Year 2 - effect of any DG intervention on all practices (by crop)

	Teff	Wheat	Maize
Effect	0.059*	0.059**	0.083***
(control mean)	(0.555)	(0.515)	(0.746)

REFERENCES

Abate, G., Bernard, T., Makhija, S., Spielman, D., 2018. Accelerating Technical Change through Video-Mediated Agriculture Extension: Evidence From Ethiopia. IFPRI discussion paper no. 01851. Washington, DC: IFPRI.

Abate, G., Bernard, T., Makhija, S., Spielman, D., 2019. The impact of video-mediated agricultural extension in Ethiopia: Assessment of sustained adoptions.

Baul, T., Karlan, D., Toyama, K., Vasilaky, K., 2020. Improving Smallholder Agriculture via Video-Based Group Extension

Bernard, T., Makhija, S., Spielman, D., Abate, G., 2019. The Marginal Cost of Technology Adoption. IFPRI project note. Washington, DC: IFPRI.

Digital Green, 2017. Learning Brief Improving women engagement across ICT enabled extension channels

Digital Green, 2018. Institutionalizing the Digital Extension Approach in National Rural Livelihoods Mission (NRLM), Submission under Grant No. OPP1038968

Digital Green, 2017. Strategy to Institutionalize Digital Green's Digital -Enabled Extension Approach in Ethiopia's Ministry of Agriculture and Natural Resources

Digital Green, 2017-18. Promoting MIPs and their impact on the yield

Digital Green: Evidence and learning (recording)
https://www.youtube.com/watch?v=OsTaOeKLCqo&feature=youtu.be

DAB Development Research and Training PLC , 2019, Impactful Practices of Tef and Wheat Packages Promoted among Smallholder farmers In Four Regions (Amhara, Oromia, SNNP, and Tigray) of Ethiopia

Gandhi, R., Veeraraghavan, R., Toyama, K., Ramprasad, V., 2009. Digital Green: Participatory Video and Mediated Instruction for Agricultural Extension. Information Technologies and International Development. 5(1), pp.1-15

Harwin, K., Ficarelli P., Gandhi, R., 2014. Supporting Social Organizations Through Technology Integrated Interventions. White Paper.

Kadiyala, S., et al. 2014. Using a Community-Led Video Approach to Promote Maternal, Infant, and Young Child Nutrition in Odisha, India: Results from a Pilot and Feasibility Study

Lecoutere, E., Spielman, D., and Van Campenhout, B., 2019. Women's empowerment, agricultural extension, and digitalization: Disentangling information and role model effects in rural Uganda. IFPRI Discussion Paper 1889. Washington, DC: IFPRI

Seth, M. Singh, R., and Stein D., 2020. Digital Green Andhra Pradesh Institutionalization Study: IDinsight

Singh, R., Stein D., and Slotznick, W., 2020. Digital Green FarmStack Evaluation: IDinsight

Van Campenhout, B., Spielman, D., Lecoutere, E., 2018. Information and communication technologies (ICTs) to provide agricultural advice to smallholder farmers: Experimental evidence from Uganda. IFPRI Discussion Paper 1778. Washington, DC: IFPRI.

Zerfu, E., Aregu, L., Abera, D., 2019. Technical Change Through Video-mediated Agricultural Extension: Qualitative Evidence from Ethiopia.