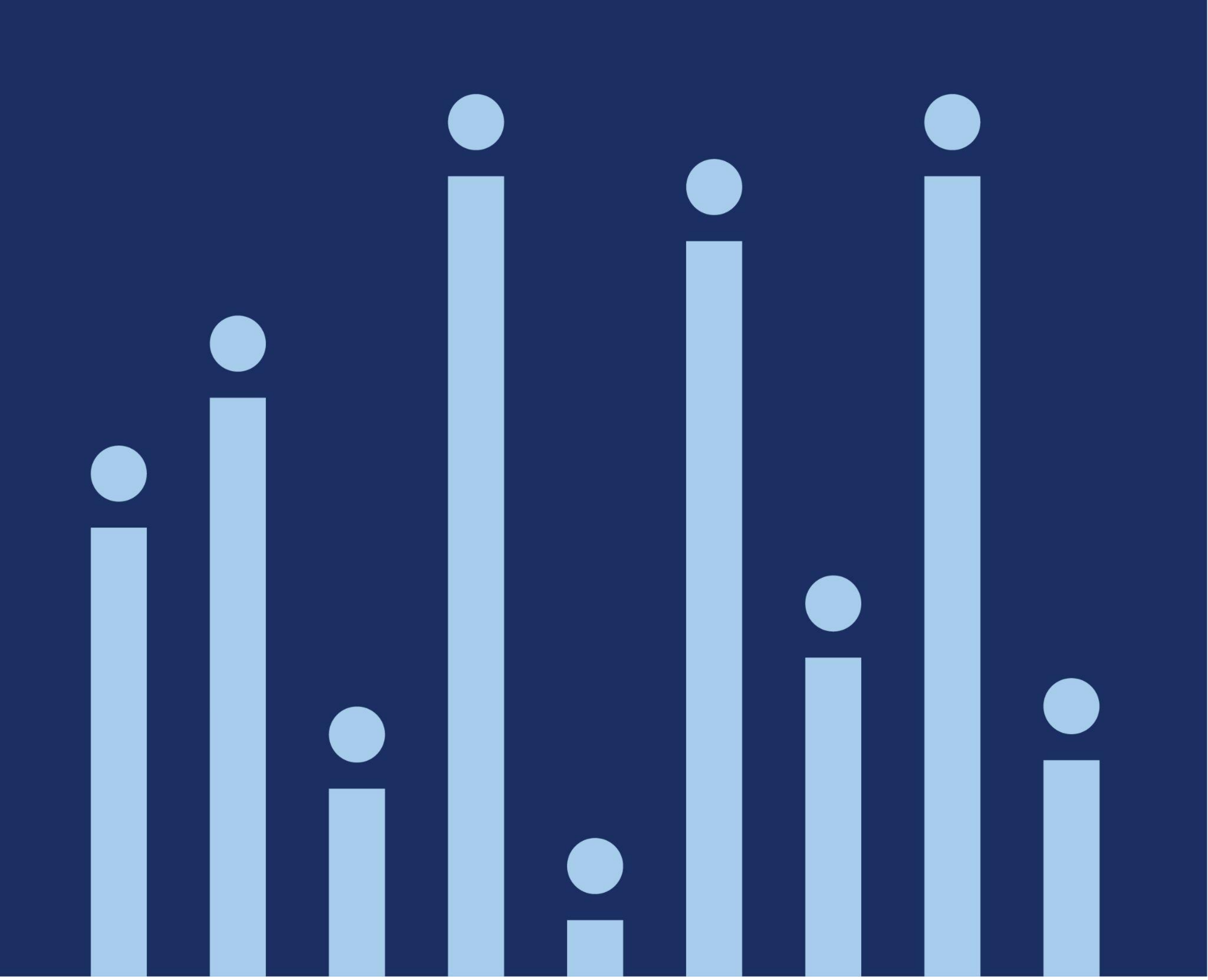

# Summary of Evidence Review of Digital Green's Video-Mediated Farmer Extension Approach

Technical Report presented to Digital Green

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# 1. Executive Summary

Video-based or video-mediated approach to agricultural extension (VMA) is a community-led approach for digital content production and in-person farmer training involving the creation of agricultural videos enacted by local farmers. It differs from traditional extension by allowing for consistency in content delivery, being a low-cost service, and encouraging role model effects via community members' participation in the extension videos. VMA has also been combined with other ICT (Information and Communications Technology) interventions, such as SMS (Short Message Service) and IVR (Interactive Voice Response), to overcome the challenge of farmers forgetting or misremembering information delivered via video. IVR and SMS services have been used to send reminders at relevant periods of the agricultural season and share follow-up information (*Casaburi et al., 2014; Larochelle et al., 2019; Cole and Fernando, 2021*).

Digital Green (DG) is a global development organization focusing on technology-enabled solutions to empower smallholder farmers who pioneered the video-based participatory approach to agricultural extension. In this document, IDinsight summarizes the findings from a prior evidence review of DG's work on VMA *(IDinsight, 2020)* and includes more recently published research studies conducted.

The following are our main observations and conclusions from the review of different studies.

- **Cost effectiveness of VMA -** *Toyama et al.* (2009) identified VMA as ten times more cost-effective than traditional extension. While the study had some limitations, more recent research has also echoed similar results, finding that VMA has lower marginal costs than the conventional approach (*Baul et al., 2023),* which reduces further once VMA is scaled up. For instance, in Ethiopia, *Abate et al. (2023)* found that additional adoption costs drop from $16–$30 to $3-$6 once scaled up, and *Bernard et al. (2019)* see similar drops from $30, $16, and $18 per additional adoption to $6, $3, and $4.
- **Increased knowledge levels and adoption of new technologies -** Across Ethiopia *(Abate et al., 2023)* and Uganda *(Campenhout et al., 2021)*, researchers found that farmers exposed to VMA performed better on knowledge tests regarding seed planting, urea dressing, seed spacing, etc., for a variety of crops, and this effect was more pronounced for new technologies. Similarly, the researchers found a higher rate of adoption of the technologies by treatment farmers compared to control farmers. *Abate et al. (2023)* saw that adoption effects sustained beyond the first year of the study. However, *Baul et al. (2023)* did not find an increase in the adoption of the System of Rice Intensification[1] (SRI) in India, possibly due to the framing of the questionnaire.
- **Increased knowledge for women but mixed effect on women's adoption of new technologies -** *Abate et al. (2023)* looked at gender disaggregated impacts of the intervention by adding a treatment group where they showed the video to both the male household head and his spouse. They found that VMA increased knowledge amongst women but didn't have an incremental effect on adoption compared to the male-only treatment group. *Lecoutere et al. (2019)* found showing VMA videos to women led to improved outcomes with an increase in women's knowledge index, an improvement in the women's adoption index, and an increase in yield on women-managed plots.

[1] System of Rice Intensification (SRI) is an agro-ecological approach aimed at enhancing the yield of irrigated rice while reducing resource use through modification of plant, soil, water, and nutrient management practices (Cornell University, College of Agriculture and Life Sciences).

- **Mixed effects on yield and production -** *Campenhout et al. (2021)* found a 10.5% increase in maize yields, and *Baul et al. (2023)* estimated a 5% and 9% increase in rice output and profits, respectively. However, *Abate et al. (2023)* didn't find evidence of an increase in yields, potentially due to issues with self-reported measures of output and the limited effect of the recommended technology on production.

Over the last few years, Digital Green has worked closely with the Indian and Ethiopian governments to institutionalize VMA. They collaborated with India's National Rural Livelihood Mission (NRLM), reaching over one million smallholder farmers in multiple states, and subsequently extended to 8 additional states. With the Ministry of Rural Development (NRLM), Department of Agriculture, and Health Department's co-investment of $23.2 million, Digital Green supported the government in procuring equipment, extensive training, and integrating VMA into government operations. Similarly, VMA became part of the Ethiopian government's Second Growth and Transformation Plan (GTP2) and the Second Agricultural Growth Program AGP2 with a $12 million investment from the government towards staff salaries, training, and equipment acquisition. Digital Green trained local extension agents and Subject Matter Specialists, leading to substantial institutionalization.

**The available evidence suggests that the VMA approach is cost-effective and can positively influence agricultural extension.** For organizations interested in further scale-up and institutionalization of VMA, we recommend considering:

- the importance of customized VMA messaging for farmers' awareness and improvement in women's agricultural decision-making. Any scale-up should consider customized messaging based on different themes, geographical area and local context.
- improved adoption of intervention when women see the videos alone when planning for a VMA scale-up. Organizations should carefully consider the gender effects of VMA operational design (showing videos to men, women, or both - individually or separately) when planning the scale-up.
- the mixed impact of IVR and SMS in VMA, which depends on context and region. Any scale-up plan should carefully evaluate the cost and benefits of IVR and SMS in VMA before including them.
- high cost effectiveness at a larger scale. The scale-up should factor the fixed costs associated with VMA into planning the intervention scale for high cost-effectiveness, including identifying the minimum number of villages/districts required to breakeven and expanding to more regions to maximize the return on investment.
- varying levels of take-up based on content. Scale-up efforts should emphasize the adoption of new, efficient agricultural practices in VMA extension services, as research suggests farmers are more inclined to adopt novel approaches over well-established ones.

# 2. Background

The video-based participatory approach to agricultural extension is a method that utilizes videos as a tool for engaging farmers and communities in the agricultural extension process. It involves creating and sharing videos that showcase best practices, agricultural techniques, and local success stories, involving active participation and feedback from the target audience. This approach is designed to overcome challenges associated with traditional extension, such as high costs, limited geographic coverage, lack of effective/qualified extension agents, and low customization. VMA's cost-effectiveness solves the limited scalability of the traditional extension and brings in greater customizability to local conditions and consistency in messaging and quality. Participatory videos are tailored to the specific needs and context of the local community, making the information more relevant and applicable to farmers' circumstances.

In recent years, Digital Green has emerged as a key player in video-mediated extension services to enhance traditional extension via custom videos featuring localized agricultural best practices. At the core of Digital Green's strategy lies the creation of videos featuring local farmers conversing in their native language while demonstrating the recommended technology on their farms. Digital Green works with public extension agents to improve their capacity to create and screen localized agricultural videos while incorporating farmer feedback and usage data to create effective, context-appropriate content. Videos on various agricultural subjects are shown in villages using battery-operated pico projectors suitable for off-grid dissemination. Digital Green collaborates with community agents in India who train women's self-help groups. In Ethiopia, they partner with government Development Agents (DAs) who work with development groups[2]. Extension agents play the videos multiple times during the session, with pauses to address inquiries and offer extra information. Agents also incorporate insights from model farmers present at the meetings who belong to the community. Concerning the audience, Digital Green places a special focus on smallholder farmers and hard-to-reach female farmers.

Since its inception in 2008 in India, Digital Green has expanded its services and geographic reach across South Asia and Africa. In India, they primarily engage with the Ministry of Agriculture, the National Rural Livelihood Mission and its state-level counterparts, NGOs and private businesses. They also partnered with the Andhra Pradesh government to scale VMA in 2019. In Ethiopia, Digital Green works with the Ministry of Agriculture (MoA), the Regional Bureaus of Agriculture, and the Agricultural Transformation Agency. As of 2023, Digital Green has reached 4.7 million farmers, screened over 1.5 million videos, enabled 60% of their target farmers to adopt at least one new practice, and increased farmers' income by 24% (Digital Green, n.d.).

## 3. Study Designs

This section outlines the scope and methods of each major evaluation covered in this evidence review.

**1. Information and communication technologies to provide agricultural advice to smallholder farmers: Experimental evidence from Uganda (Campenhout et al. 2021)**

- Randomised Controlled Trial[3] (RCT) featuring a 2-stage cluster sampling strategy
- The study randomized ~3700 farmers into three treatment groups (Video, Video+IVR, Video+IVR+SMS) and one control group (placebo video). Authors further disaggregated by the recipient (male-only, female-only, joint) to create 9 T + 1 C groups per village. The study estimated the average treatment effect by comparing the average outcomes of the treatment group with those of the control group.
- The paper compared the average outcomes of the video + IVR group with the only-video group to obtain the additional effect of the IVR treatment. For the

[2] Groups of farm households designed to provide community members with access to extension services and a forum to discuss local development issues (Abate et al., 2023)
[3] An RCT is a research design that randomly assigns participants to experimental or control groups to assess causality. Random assignment reduces bias as it balances participant characteristics across the groups, allowing any differences in outcome for the two groups to be attributed to the intervention itself (Hariton & Locascio, 2018)

additional effect of the SMS campaign, the study compared the average outcomes of the video + IVR + SMS group with the video + IVR group.

- Regarding the limitations, there was a risk of spillover between groups due to their intra-village proximity, which the study does not address. The research faced about 8.6% attrition between baseline and midline, though based on calculations, researchers suggest that attrition is unlikely to drive the study results. Further, low IVR takeup reduced statistical power for detecting an effect.

**2. Accelerating technical change through ICT: Evidence from a video-mediated extension experiment in Ethiopia (Abate et al. 2023)**

- A clustered RCT[4] featuring a 4-stage sampling process, with a sample size of ~2400 farmers
- The study randomly allocated villages to the control group (traditional extension), treatment group 1 (VMA targeted at only male HoH) and treatment group 2 (VMA targeted at both HoH & spouse).
- The authors use an intent-to-treat (ITT) approach[5] to estimate the impact of the intervention, comparing the control group and treatment groups.
- The authors established gender-based results of the intervention by comparing differences in outcomes between the two treatment groups.
- One of the key limitations of the study mentioned by the authors is that it uses self-reported measures for output.

**3. Improving Smallholder Agriculture via Video-Based Group Extension (Baul et al. 2023)**

- A clustered RCT across 420 villages and ~2520 farmers.
- Among the 280 treatment villages given VMA, researchers randomly assigned 70 each to one of the four treatment arms (base video, self-efficacy, labor costs, and self-efficacy+labor).
- The authors use two methodologies to estimate program impact - the frequentist and Bayesian approaches.
- The authors used the Bayesian approach to best accommodate peculiarities in the data.
- Regarding the study's limitation, the baseline data was compromised as the team could not complete the baseline for most households. The authors observed some risk of error in the self-recall measurements of adoption/yields. The authors also mentioned limitations in the questionnaire design as many farmers who reported having grown rice using the traditional approach adapted aspects of SRI practices.

**4. Effect of nutrition-sensitive agriculture interventions with participatory videos and women's group meetings on maternal and child nutritional outcomes in rural Odisha, India (UPAVAN trial) (Kadiyala et al. 2021)**

- The study was an observer-blind cluster RCT with four arms in the Keonjhar district. The three treatment groups, in addition to the control group, were 1) Nutrition-sensitive agriculture (NSA) videos (AGRI group), 2) NSA and nutrition-specific videos (AGRI-NUT group) and 3) NSA videos and nutrition-specific participatory learning and action (PLA) cycle meetings and videos (AGRI-NUT+PLA group). The authors did not power the trial to detect differences between intervention groups.

[4] A clustered RCT involves randomizing groups or clusters of participants, instead of individuals, and is valuable for assessing interventions with group-level effects (Puffer et al., 2005).

[5] The ITT approach measures the impact of the intervention on all individuals who were supposed to be treated with the intervention, regardless of actual take-up. Since achieving full treatment compliance in real-world situations is unlikely, ITT estimates serve as reliable indicators of the intervention's effects beyond the study environment (Abate et al., 2023).

- The authors stratified treatment and control allocation by block, distance to the nearest town (<10 km or ≥10 km) and low (<30%), medium (30–70%), and high (>70%) proportion of Scheduled Tribes or Scheduled Caste households. 4736 mother-child dyads across 148 villages were eligible for the RCT from 4 blocks (Ghatgaon, Harichandanpur, Patna, and Keonjhar Sadar).
- The primary analysis of outcomes was by ITT by comparing outcomes in each intervention group and the control group at the endline. Each outcome was analyzed using separate generalized estimating equations (GEEs) to account for clustering and adjusted for baseline measures of the outcomes and the stratification variables.[6] The authors were concerned about the risk of spillovers as the control and intervention groups were geographically close.

**5. Women's empowerment, agricultural extension, and digitalization: Disentangling information and role model effects in rural Uganda (Lecoutere et al. 2019)**

- The study assessed the effectiveness of involving women in conveying and receiving information on various outcomes for women individually and jointly with their male co-heads of households compared to the male-only control group. It covered 3,331 maize-farming households in five districts in eastern Uganda: Bugiri, Mayuge, Iganga, Namayingo, and Namutumba.
- There were nine treatment arms in a 3×3 factorial design with the factors corresponding to the gender of the information conveyor and the information receiver. Each factor contained three levels: man alone, woman alone, or man and woman together (as a couple). The study screened one of these three versions (based on the gender group of the actors) of the video to the participating individual(s) (based on the gender group of the viewers) according to the treatment arm that it randomly assigned the household to.
- The study used a two-stage cluster sampling approach[7] to obtain a representative population sample. In the first stage, it randomly selected parishes in proportion to the number of villages within each parish. Within the selected parishes, the study included all villages. In the second stage, researchers listed all households within each village and randomly selected households, assuming that outcomes within villages are correlated. The research team administered all possible treatment combinations related to the two factors in each village. Hence, the study selected a maximum of nine households in a village. Each of the nine treatment arms achieved a sample size ranging from 342 to 385.
- In terms of the limitations, the authors were concerned about the increase in labor-based agricultural intensification practices when only female heads were exposed to the videos. Based on their assumption, labor-based practices may have been more accessible to women. Thus, the authors suggested studying the labor and drudgery implications and the possible strategies for improving women's access to less labor-based intensification practices.

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[6] For the primary outcome of child minimum dietary diversity, a log-binomial GEE estimated relative risk (RR) for each intervention compared to control, and for maternal BMI, a GEE with Gaussian link estimated a mean difference in BMI between each intervention group and the control. (Kadiyala et al, 2021). The relative risk (RR) is the ratio of risk of an event in one group (e.g. treatment group) versus the risk of the event in the other group (e.g. control group) (Ranganathan et al., 2015).

[7] In a two-stage cluster sampling approach, the primary sampling unit i.e. clusters (parishes, schools,etc) are sampled first and within those sampled clusters, the secondary or the final sampling unit (villages, individuals, etc) are sampled. Two-stage cluster sampling is more cost-efficient than simple random sampling and can provide *'more precision per dollar spent'* (Lohr, 2010).

# 4. Impact on outcomes and cost-effectiveness of VMA

In this section, we discuss the learnings of VMA for agriculture, including farmer-level outcomes, cost-effectiveness, and gender-level results.

## Cost effectiveness of VMA

*Baul et al. (2023)* calculated the marginal cost of Digital Green's intervention for 1000 farmers. For Bihar, they estimated that traditional extension services cost ~Rs 190,500 (2000-3000 USD). Excluding the cost of video production (Rs 200,000), they estimated VMA costs 18% of the traditional extension, i.e. Rs 35,800 (500-600 USD).

In an earlier study in India, *Toyama et al. (2009)* found that implementing VMA costs $3.70 per adoption compared to $38.18 for the traditional extension, indicating a tenfold increase in cost-effectiveness. It is important to note that the study was executed in a limited number of villages, and calculating the total cost involved making several challenging assumptions.

*Abate et al. (2023)* calculated marginal cost-effectiveness. They found that within the experimental scenario, each additional adoption cost between 16–30 USD, though this fell to 3-6 USD if scaled up to 350 *kebeles* (villages) across 30 *woredas* (districts) in Ethiopia.

In Ethiopia, *Bernard et al. (2019)* estimated the cost of row planting, lower seeding rate, and urea top dressing to be $30, $16, and $18 per additional adoption, which was reduced to $6, $3, and $4, respectively when scaled up.

In Uganda, *Campenhout et al. (2021)* estimated that the video-mediated approach led to an additional income of USD 6.4 per acre due to higher yields compared to the traditional approach. The marginal cost of the intervention was 37,000 USD, of which the variable cost (showing the video, enumerator transportation) was USD 5.54 per farmer, and the fixed cost (video production, tablet computers, enumerator training) was USD 3.7 per farmer. While the variable cost was lower than the additional income, including the fixed cost would require the intervention to be scaled up to 10,000 households to break even. The authors anticipated an internal rate of return of 23% if the intervention was scaled up to 360,000 households.

*Kadiyala et al. (2021)* compared the effect of three nutrition-sensitive agricultural (NSA) interventions on maternal and child nutrition outcomes. The interventions were 1) NSA videos (AGRI group), 2) NSA and nutrition-specific videos (AGRI-NUT group) and 3) NSA videos and nutrition-specific participatory learning and action (PLA) cycle meetings and videos (AGRI-NUT+PLA group). The experimental costs of the intervention ranged from $16 to $21 per person (for all ages) and $146 to $199 per pregnant woman or mother of a child under two years. These are higher than the agriculture VMA costs recorded in Table 1 below but low compared with other nutrition or health interventions with an agriculture component. This suggests that VMA can be adapted to improve sectoral outcomes.

*Table 1: Cost Effectiveness by Study*

| Study (Year) | Country | Total Cost per Adoption | Marginal Cost per Adoption |
|---|---|---|---|
| Baul et al. (2023) | India | | $0.5 -$0.6 [8] |
| Toyama et al. (2009) | India | *Experimental*<br>$3.70 | |
| Abate et al. (2023) | Ethiopia | | *Experimental*<br>$16- $30<br><br>*Scale Up*<br>$3-$6 |
| Bernard et al. (2019) | Ethiopia | | *Experimental*<br>Row planting: $30<br>Lower seeding rate: $16<br>Urea top dressing: $18<br><br>*Scale Up*<br>Row planting: $6<br>Lower seeding rate: $3<br>Urea top dressing: $4 |
| Campenhout et al. (2021) | Uganda | | *Experimental*<br>$ 9.24<br><br>*Scale Up*<br>$6.4 |
| Kadiyala et al. (2021) | India | | *Experimental*<br>$16 to $21 |

## Increase in knowledge levels

The video-based approach positively impacted farmers' knowledge of agricultural methods, assessed via tests on information shared in the extension videos.

*Abate et al. (2023)* found that Ethiopian farmers exposed to VMA performed better (approximately 1-2 percentage points higher) on knowledge tests on row planting, precise seeding rates, and urea dressing for teff, wheat, and maize compared to control farmers in year 1. The knowledge effects dissipated in year 2 of the study as the control group 'caught up' with the treatment group.

In Uganda, *Campenhout et al. (2021)* found that treated farmers' knowledge of novel methodologies regarding seed planting and combined input use increased by 13.2 percentage points and 4.5 percentage points, respectively. In contrast, there was no difference between the groups regarding well-known methodologies related to weeding. Sub-treatment arms such as IVR and SMS had no additional impacts on knowledge, possibly because low IVR takeup reduced statistical power for detecting an effect.

[8] *This value excludes the fixed cost of video production (Rs 200,000)*

***Table 2: Knowledge Outcomes by Study***

| Study (Year) | Country | Knowledge Outcomes |
|---|---|---|
| Abate et al. (2023) | Ethiopia | Improvement of **1-2 p.p.** in treatment group for teff, wheat, and maize methodologies in Year 1 with **no difference** in Year 2. |
| Campenhout et al. (2021) | Uganda | Improvement of **4.5 - 13.2 p.p.** in treated farmers' knowledge of novel methodologies but no improvement in well-known weeding methodologies. |

## Increase in adoption of new technologies

VMA largely improved the take-up of suggested agricultural timelines and recommended methodologies, especially novel methodologies, and led to sustained adoption in some instances.

*Campenhout et al. (2021)* reported an increase in the adoption of recommended seed spacing (6.2%), removal of Striga (5.7%), use of urea (5% points) and use of organic fertilizers (7.3% points), although the intervention had no impact on timely planting or weeding (potentially because these are practices which are already well-known among farmers) or use of improved seeds.

*Abate et al. (2023)* estimated an increase in adoption of the recommended technology compared to the control group by 6 p.p. in the first year and 7 p.p. in the second year following the intervention, indicating sustained adoption.

In India, *Baul et al. (2023)* found no impact of the intervention on adopting the System of Rice Intensification (SRI). However, they noted that the framing of their question on adoption may have excluded farmers who partially adopted SRI.

***Table 3: Adoption Outcomes by Study***

| Study (Year) | Country | Adoption Outcomes |
|---|---|---|
| Campenhout et al. (2021) | Uganda | Increase in adoption of **5-7.3 p.p.** across technologies except in timely weeding or use of improved seeds. |
| Abate et al. (2023) | Ethiopia | Increase in adoption by **6 p.p. in Year 1** and **7 p.p. in Year 2**. |
| Baul et al. (2023) | India | **No impact** on adoption, possible result of exclusion due to questionnaire design. |

## Increased knowledge and mixed effect on adoption for women

VMA increased knowledge outcomes and access to extension services for women; however, the effect on adoption is mixed.

*Abate et al. (2023)* looked at gender disaggregated impacts of the intervention on technology adoption by adding a treatment group where they showed the video to both the male household head and his spouse. They found that VMA increased knowledge (3% in year 1, no change in year 2) and access to extension services (17% and 8% in years 1 and 2, respectively) for spouses. They found no improvement in the adoption levels compared to the male-only treatment group, potentially due to the male household head's control over cropping decisions.

*Lecoutere et al. (2019)* studied the role of gender in VMA in Uganda (*Campenhout et al. (2021)* were a branch of this study). They examined the effect of gender of the household member viewing the video (male head only, female head only or the male and female head together) as well as the gender of the actors in the VMA (male only, female only, both male and female) on outcomes. The study found that exposure to VMA content improved women's outcomes with an increase of 0.11 in women's knowledge index, an improvement in the women's adoption index of 0.12 and an increase in yield on women-managed plots by 50.4 kg/acre when women were shown videos. However, joint knowledge outcomes of the male and female heads together and jointly managed plots either remained the same or worsened, indicating the improvement in women's outcomes might have been at the cost of outcomes of the male heads of the household. The study also found that when women were exposed to VMA alone (without the male household head), the joint-knowledge index worsened by 0.02, indicating a lack of knowledge sharing between females and males when males did not see the videos.

The gender of VMA actors had no significant effect on the knowledge or adoption index. However, when VMA with female actors was shown to women alone without male co-heads, the authors observed a statistically significant improvement in the adoption of the intervention.

## Increased access to extension services

VMA increased the likelihood of farmers having access to extension services, including direct contact with development agents.

*Abate et al. (2023)* found that the treatment group had a 40% increase in the likelihood of having direct contact with a development agent compared to the control group. Further, treatment farmers attended 40% more meetings than control farmers. The authors also found that DAs assigned to areas receiving VMA made an additional effort to visit farms and provide follow-up advice (an 18% increase in the probability of a field visit by a DA on treatment farmers' plots) potentially because VMA increased their sense of effectiveness. However, the results did not persist in the second year of the study.

## Mixed effects on yield and production

While VMA did not impact yields in certain experimental settings, it led to an increase in yield in others.

*Campenhout et al. (2021)* found a 10.5% increase in maize yields for the households exposed to treatment compared to the control households. There was no increase in total production. IVR and SMS treatment arms had no additional impact on yields.

In Ethiopia*, Abate et al. (2023)* found no clear evidence indicating an increase in yields. While the intervention positively impacted teff yields (65 percentage point increase at the 10% significance level) in the first year following the evaluation, the impact disappeared in the second year, and the researchers did not find any impact on wheat and maize yields. The authors attributed this to challenges related to the accuracy of self-reported measures of output as well as the potentially limited effect of the recommended technology on production.

*Baul et al. (2023)* employed the Bayesian Hierarchical Model and found impacts of the treatment on output and profits to the effect of a 5% and 9% increase, respectively, compared to the control. The intervention also included two sub-treatment arms – additional messaging for labor requirements for SRI and self-efficacy messaging for farmers. For the labor arm, the authors found smaller increases in output and profit compared to the main arm. In contrast, they found no change in yields and a decline in profits (potentially due to the negative correlation between self-efficacy and planning) for the self-efficacy arm. The best effects were seen when both arms were delivered[9].

***Table 4: Yield and Production Outcomes by Study***

| Study (Year) | Country | Production Outcomes | Yield Outcomes |
|---|---|---|---|
| Campenhout et al. (2021) | Uganda | **No increase**. | **10.5%** increase in maize yields |
| Abate et al. (2023) | Ethiopia | | Increase in teff in year 1 (**65 percentage point**), no impact in year 2. No impact on wheat and maize in either year |
| Baul et al. (2023) | India | Output increases by **5%** and profits by **9%** | |

## 5. Recommendations

Based on our literature review above, we recommend organizations working in the space of participatory video-based agricultural extension to consider the following programmatic and implementation aspects while scaling up VMA.

1. **Customized VMA Messaging:** Studies indicate the importance of customisation to VMA content based on target population needs and awareness. For instance, messaging on additional labor requirements can be associated with increased output and profit compared to the traditional VMA content *(Baul et al., 2023)*. Additionally, including nutrition-sensitive content as well as additional nutrition-specific videos has shown improvement in child and maternal nutrition outcomes (*Kadiyala et al., 2021)* at a higher cost. Any scale-up should consider customized messaging based on different themes, geographical area and local context.
2. **Role-model effects of the gender of actors in VMA**: Overall effect on joint agricultural outcomes are mixed on male and female-owned plots together, however, they can play a role if the target population is predominantly female or program goals include women empowerment. Statistically significant improvement is observed in agricultural decision-making and adoption of intervention when women are shown videos alone, without male co-heads *(Lecoutere et al., 2019)*. Hence, organizations should carefully consider the gender effects of VMA operational design (showing videos to men, women, or both - individually or separately) when planning the scale-up.
3. **Impact of using different ICT technologies:** The incremental impact of IVR and SMS, in addition to VMA, has been mixed and dependent on context and region

[9] *Baul et al. (2023)* also employed an additional methodology, the frequentist approach, and found economically large but statistically insignificant effects on the output and profits earned by treatment farmers.

(Campenhout et al., 2021). Digital Green could further evaluate the cost and benefit of these services in the applicable region before scaling up. Any scale-up plan should carefully evaluate the cost and benefits of IVR and SMS in VMA before including them.

4. **Planning the scale of the intervention to maximize cost-benefit:** Past studies have shown VMA's cost-effectiveness in scale-up scenarios. Given the largest costs under VMA are typically the fixed cost of video production and purchase of equipment, scale-up efforts should keep in mind the minimum number of villages/districts required for the VMA efforts to breakeven, and further increase scale to as many locations as possible in order to increase the return per dollar spent.
5. **Content of VMA extension services:** The content of VMA extension services should emphasize the adoption of new and efficient agricultural practices. Previous studies have shown that farmers are more inclined to adopt novel approaches compared to widely known ones *(Campenhout et al., 2021; Abate et al., 2023)*. Given these findings, scale-up efforts should prioritize methods which are effective yet relatively new or underutilized in specific regions to encourage wider adoption.

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