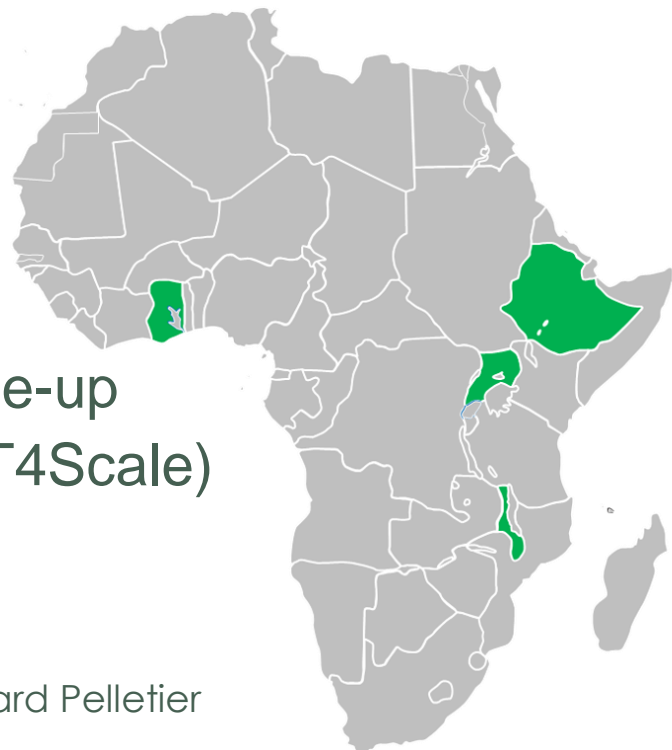


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# Harnessing ICTs to Scale-up Agricultural Innovations (ICT4Scale)

## Case Study Report

Berhane Gebru, George Vili, and Bernard Pelletier



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## Table of Contents

List of Acronyms and Abbreviations .....	5
Background.....	7
Case Study Purpose and Study Questions.....	9
Study Design.....	9
Case Selection .....	10
Unit of Analysis.....	11
Data Sources .....	12
Document Review .....	12
Key Informant Interviews.....	12
Data Analysis .....	14
Summary of Findings .....	15
Roles of ICTs in scaling up agricultural solutions.....	15
Improving Adoption of Agricultural Solutions .....	15
Avoid Dilution of Content .....	20
Enhanced Inclusion of Women.....	20
ICT Tools Used by the Cases.....	21
Case 1: Enhancing Resilience to Water-Related Impacts of Climate Change, Uganda .....	27
Project Overview .....	27
Project Overview.....	27
CHAI Theory of Change.....	28
Information Dissemination Platforms.....	29
ICT-mediated agricultural solutions .....	30
Partnerships and Institutional Arrangement .....	32
Role of ICTs in Scaling-up Agricultural Solutions.....	33
Improved access and timeliness of information .....	33
Enabling and Limiting Factors.....	34
Enabling Factors.....	34
Limiting Factors.....	35

---

Best Practices and Lessons Learned .....	36
Case 2: Scaling up Radio and ICTs for Enhanced Extension Delivery, Malawi .....	38
Project Overview .....	38
SRIEED theory of change .....	39
Information Dissemination Platforms.....	40
ICT-mediated agricultural solutions .....	41
Partnerships and Institutional Arrangement .....	41
Role of ICTs in Scaling-up Agricultural Solutions .....	42
Improved access and timeliness of information .....	42
Enabling and Limiting Factors .....	44
Best Practices and Lessons Learned .....	44
Case 3: Digital Integration to Amplify Agricultural Extension, Ethiopia .....	46
Project Overview .....	46
Project Theory of Change .....	47
Information Dissemination Platforms.....	48
ICT-mediated agricultural solutions .....	49
Partnerships and Institutional Arrangement .....	49
Role of ICTs in Scaling-up Agricultural Solutions .....	49
Improved access to information .....	49
Improved adoption of improved agronomic practices.....	50
Enabling and Limiting Factors .....	50
Best Practices and Lessons Learned .....	51
Case 4: ESOKO Digital Farmer Services, Ghana.....	52
Overview .....	52
ESOKO Business Model .....	52
Agricultural Solutions and Information Dissemination Platforms.....	53
ESOKO Partnerships .....	53
Role of ICTs in Scaling-up Agricultural Solutions .....	53
Enabling and Limiting Factors .....	54

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Best Practices and Lessons Learned .....	55
Annex I: Key Informant Interview Guide .....	58

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## List of Acronyms and Abbreviations

ADLI	Agriculture Development Led Industrialization (Ethiopia)
ADVANCE	Ghana Agricultural Development and Value Chain Enhancement
BBM	Broad Bed and furrow Maker
CBO	Community-Based Organization
CCAFS	Climate Change, Agriculture and Food Security
CHAI	Climate Change Adaptation and ICTs
DA	Development Agent
DAES	Department of Agricultural Research Services (Malawi)
DARS	Department of Agricultural Extension Services (Malawi)
DG	Digital Green
DIAAE	Digital Integration to Amplify Agricultural Extension
EIIDE	Ethiopian Industrial Inputs Development Enterprise
ESOKO	ESOKO Digital Farmer Services
FAO	Food and Agriculture Organization
FHI 360	Family Health International
FM	Frequency Modulation
FRI	Farm Radio International
FRT	Farm Radio Trust
FUM	Farmers Union of Malawi
GDP	Gross Domestic Product
GOU	Government of Uganda
GSMA	Global System for Mobile Communications
ICT	Information and Communication Technology
ICT4Ag	Information and Communication Technology for Agriculture
ICT4D	Information and Communication Technology for Development
ICT4Scale	Information and Communication Technology for Scaling-up Agricultural Solutions
IDRC	International Development Research Centre
IICD	International Institute of Communication and Development
IVR	Interactive Voice Response
LMIC	Low and middle-income countries
LUANAR	Lilongwe University of Agriculture and Natural Resources
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries (Uganda)
MoAFS	Ministry of Agriculture and Food Security
MoANR	Ministry of Agriculture and Natural Resources (Ethiopia)

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MOU	Memorandum of Understanding
NASFAM	National Association of Smallholder Framers in Malawi
NDC	Nationally Determined Contributions
NGO	Non-Governmental Organization
Nvivo	Qualitative data analysis software application
PICS	Purdue Improved Crop Storage
SARI	Savanna Agriculture Research Institute
SDG	Sustainable Development Goals
SMS	Short Message Services
SRIEED	Scaling up Radio and ICTs for Enhanced Extension Delivery
SSTP	Scaling Seeds and Technologies Partnership
TCO	Total Cost of Ownership
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNMA	Uganda National Meteorological Authority
USSD	Unstructured Supplementary Service Data
VoIP	Voice over Internet Protocol
WhatsApp	Messaging and Voice over IP (VoIP) service

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## Background

There is widespread recognition that information and communication technologies (ICT) are pillars of the world's digital economy and have tremendous potential to facilitate the achievement of the Sustainable Development Goals (SDGs) and improve people's lives. The use of ICTs can hasten the action of SDGs by accelerating the rollout of services in multiple sectors including health, finance, education, and agriculture; reducing the cost of deploying health, education, financial and other services; increasing public engagement and awareness of new opportunities through rapid information exchange; and providing low-cost platforms for workforce training through online media (Ericsson, 2015). Research conducted by Ericsson and the Earth Institute on the role of ICTs for achieving the SDGs concludes that “every goal—from ending poverty and halting climate change to fighting injustice and inequality—can be positively impacted by ICT.” (Ibid.)

To bring desirable impacts, ICTs should be deployed in conjunction with institutional arrangements that facilitate and support the use of the ICT-based tools and in collaboration with actors who champion the use of technology for maximizing impact. Hanna (2015) notes five interdependent elements that are required for successful ICT-enabled development:

1. enabling policies and institutions that “are critical in promoting the supply and use of ICT services in all sectors;”
2. skilled workforce;
3. a dynamic ICT ecosystem capable of adapting technology to local needs and manage technology platforms;
4. affordable communication infrastructure; and
5. Application of ICTs and corresponding advancement of organizational developments needed to transform key economic sectors

There is consensus among practitioners and researchers that the use of ICTs to help achieve agricultural development goals requires the formulation of supportive policies and regulations, investments to improve communications infrastructure, adoption of user-centered design approach, the creation of enabling environments for innovation, and the institutional setup to support and scale up new technologies and approaches. However, while such lessons serve as important considerations in designing future interventions on the use of ICTs for reaching agricultural goals, the “lessons are not conclusive—much remains to be learned” (World Bank, 2017).

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The literature shows that there has been more emphasis on the developmental elements of ICT than on the contextual factors that hinder or expedite the success of ICT interventions especially in developing countries (Aker & Mbiti, 2010). Robinson et al (2006 and 2014) argued that ICT4D authors have their own unique, critical success factors for their projects and there is no consensus on the success factors generalizable to other initiatives outside of the specific initiative. Hence, the generation of evidence on how different combinations of ICT solutions, institutional arrangements, and actors affect the implementation of agricultural solutions will contribute useful information to governments and organizations seeking to address agricultural development challenges

In pursuit of this objective, the “Harnessing ICT to Scale-up Agricultural Solutions” (ICT4Scale) project aimed to examine the roles and contributions of ICT in scaling agriculture solutions for food, nutrition and income security, with a focus on sub-Saharan Africa. The study focused on the role and contributions of ICT as an enabler to building awareness of agricultural improvements; the skills, knowledge and contacts to apply them; linkages between key players; and reducing information and communication transaction costs. The project aimed to answer the following research questions:

1. What combinations of ICT, actors and institutional arrangements are most effective and efficient in scaling agricultural solutions?
2. What strategies for the use of ICT are successful in facilitating the scaling of agricultural solutions, e.g. interaction with audiences, type and quality assurance of information and content?
3. What are the gender equality considerations of ICT-enabled scaling of agricultural solutions?
4. How and by whom are ICT technologies and applications being designed, applied and tested as part of business models that lead to successful scaling of solutions and practices?
5. What barriers may limit the reach and/or effectiveness of ICTs in scaling initiatives?

To answer these questions, the project used mixed research methods including literature review, meta-research, intervention research and case studies. This report provides the outcomes of a case study that involved projects in Uganda, Ghana, Malawi and Ethiopia.



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## Case Study Purpose and Study Questions

The purpose of this case study was to examine the roles of ICTs in scaling up agricultural solutions and the institutional arrangements needed for the effective use of ICTs to support the scale up, and to synthesize lessons learned that may be applicable to developing countries.

To address the overall purpose, the case study explored the following research questions that provide contextual insights to the study purpose.

1. What agricultural solutions were scaled and what combinations of ICTs were used?
2. Who were the key players and what institutional arrangements were employed for supporting the development, deployment and supporting the use of ICTs?
3. How did the use of different ICT tools, key players and institutional arrangements support the scale up of the agricultural solutions?
4. What were the enabling factors and how did the factors enhance the effectiveness of ICTs for scaling agricultural solutions?
5. What barriers limited the effectiveness of ICTs for scaling agricultural solutions?
6. What are the best practices can be drawn from what worked and what did not on how to meaningfully use ICTs for scaling up agricultural solutions and that can be replicated in other similar settings?

## Study Design

In his influential book on the design and methods of case study research, Yin defines a case study as an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon (the “case”) and context are not clearly defined. Yin identifies two major types of case study designs: single-case design and multiple-case design. The single-case study design is appropriate if the single case represents a *critical* test of a well-formulated theory; or the case represents an *extreme* or unique case “deviating from theoretical norms” and the objective is the documentation and analysis of such a rare case; or the case represents a situation previously inaccessible to researchers (“*revelatory*”); or the case is studied for exploratory purposes as the first phase of a multiple case study research. The multiple-case study design is applied when the objective of the study is to show that different cases are likely to produce similar results (“*literal replication*”) and/or to show that different cases are likely to produce contrasting results (“*theoretical replication*”). The use of multiple cases strengthens

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the results by replicating the patterns thereby increasing the robustness of the findings (Yin 2014).

For this study, the multiple case study design was applied to investigate and produce detailed descriptions of using multiple ICT tools, institutional arrangements and actors in scaling up agricultural solutions. The literal replication logic guided the selection of four cases from Sub-Saharan Africa that are currently operational or were recently closed out and use different ICT tools with elaborate institutional arrangements for scaling up agricultural solutions. The study explored how the use of ICTs supports the scale up and adoption of agricultural solutions, the opportunities and barriers that enable or hinder the effectiveness of ICT use, and the best practices drawn from what worked and what did not on how to meaningfully use ICTs for scaling up agricultural solutions. The results of this case study provide insights into factors that might influence the successful introduction of ICTs to support the expansion of agricultural solutions in developing countries.

## Case Selection

In multiple-case study designs, the literature suggest that the selection of cases needs to be guided by appropriateness and adequacy of the cases (Kuzel, 1999). The appropriateness component is related to selecting cases that demonstrate a fit to the purpose of the research and the phenomenon of inquiry, while adequacy is concerned with how many cases are enough (Patton, 2002). To satisfy the appropriateness of the cases, Patton (2002) provides fifteen possible strategies for case selection for a case study research. This study applied the combined use of the criterion selection strategy where cases are picked because they meet a set of predetermined criteria; and information rich cases that intensely manifest the phenomenon of interest (“intensity” cases).

The selection process involved identifying current and recently completed projects that used ICT tools for scaling agricultural solutions. Key journals that feature the use of ICTs for agriculture were searched for relevant journal articles. Unpublished grey literature was identified by the research team and from contacts with expertise in ICT4Ag and manual searches of websites using Google Scholar and other search engines. The websites of the following organizations involved in the development and deployment of ICT solutions for agriculture were searched: The International Development Research Centre (IDRC), International Institute of Communication and Development (IICD), ICT4D Collective, World Bank, UNDP, FAO and UNESCO.

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The initial search identified a total of 190 projects. After removing duplicates, title, abstract, and full text screening was performed and through this process, a total of 71 projects were identified. As a final step, the following selection strategy was employed to select four projects for the case study.

1. Interventions that are current or recently completed (one year or less since completion) that used ICT tools for scaling agricultural solutions.
2. Interventions that adopt the use of ICTs for scaling up agricultural solutions and have expanded their solution at least to the district level will be selected.
3. Information-rich programs that intensely manifest the use of combined ICT tools and an institutional framework for scaling up agricultural solutions will be selected.
4. If the second step of the case selection strategy results in more than four potential cases, cases with maximum variation in their operating environment will be selected. For example, the geographical variation of the interventions can be made to include rural and urban settings.
5. If there are still more than four candidates, four cases will be selected based on convenience such as requiring minimum resources to conduct the study.

Based on the above criteria, the following four cases were selected.

1. Enhancing Resilience to Water-Related Impacts of Climate Change (also known as “Climate Change Adaptation and ICTs” or CHAI), Uganda;
2. Scaling up Radio and ICTs for Enhanced Extension Delivery, Malawi;
3. Digital Integration to Amplify Agricultural Extension, Ethiopia; and
4. ESOKO Digital Farmer Services, Ghana.

## **Unit of Analysis**

The main unit of analysis were the selected four projects with sub-units of analysis embedded in each case. The sub-units of analysis included the combinations of ICTs used, the agricultural solutions scaled up, the enabling environments that existed, and the drivers that facilitated the scale up of the solution. The sub-units of analysis were used for cross-case analysis for identifying best practices and barriers on the use of ICTs for scaling up agricultural solutions.

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## Data Sources

Two sources of evidence provided the basis for this case study: document review and key informant interviews.

### ***Document Review***

An initial document review was conducted to understand the projects' objectives, agricultural solutions promoted, types of ICT tools used, institutional arrangements for the implementation of the project, and scale and reach of the initiative. The key documents reviewed include:

- Program documents including project proposals;
- Progress reports;
- Final reports (when applicable);
- Monitoring and Evaluation frameworks;
- Monitoring and Evaluation reports;
- Publications and promotional materials related to the projects; and
- Memorandum of Understanding establishing partnerships with key stakeholders.

### ***Key Informant Interviews***

Primary data was collected onsite from the project leadership and partner institutions of the cases through semi-structured, key informant interviews. Purposive and convenience sampling was used to identify key informants based on the list of potential respondents identified by the research team and the project management of the selected cases. Only respondents with knowledge of the cases and who were active participants in the implementation of the projects were interviewed.

Key informant interviews were conducted with 16 participants representing the following lead implementing organizations of the four cases.

<b>Case</b>	<b>Lead organization</b>
Scaling up Radio and ICTs for Enhanced Extension Delivery, Malawi	Farm Radio Trust
Enhancing Resilience to Water-Related Impacts of Climate Change, Uganda	FHI 360 and Uganda HealthNet

Digital Integration to Amplify Agricultural Extension, Ethiopia	Digital Green and Farm Radio International, Ethiopia
ESOKO Digital Farmer Services, Ghana	ESOKO

Key informant interviews were also conducted with 15 participants from implementing partners with the most direct knowledge of the project.

<b>Project</b>	<b>Implementing partner</b>
Scaling up Radio and ICTs for Enhanced Extension Delivery, Malawi	<ul style="list-style-type: none"> <li>• Lilongwe University of Agriculture and Natural Resources</li> <li>• Department of Agricultural Extension Services (DAES)</li> <li>• Department of Agricultural Research Services (DARS)</li> </ul>
Enhancing Resilience to Water-Related Impacts of Climate Change (CHAI), Uganda	<ul style="list-style-type: none"> <li>• Uganda National Meteorological Authority</li> <li>• Ministry of Agriculture, Animal Industry and Fisheries (MAAIF)</li> <li>• FHI 360</li> <li>• Makerere University, Zoology Department</li> </ul>
Digital Integration to Amplify Agricultural Extension, Ethiopia	<ul style="list-style-type: none"> <li>• Ministry of Agriculture and Natural Resources</li> <li>• Ethiopian Industrial Inputs Development Enterprise</li> </ul>
ESOKO Digital Farmer Services, Ghana	<ul style="list-style-type: none"> <li>• Ghana Agricultural Development and Value Chain Enhancement (ADVANCE)</li> <li>• Ministry of Food and Agriculture</li> <li>• Savanna Agriculture Research Institute (SARI)</li> <li>• Climate Change, Agriculture and Food Security (CCAFS)</li> </ul>

Key informant interviews were conducted using an interview guide developed by the research team (**Annex I**) that included questions about the agricultural solutions scaled up by the project, the combinations of ICT tools used for supporting the scale up, the roles and contributions of ICTs and the institutional arrangements for supporting the scale up of agricultural solutions, the approaches to gender-responsive ICT use, and the enabling factors that enhanced or the barriers that limited the effective use of ICTs for scaling up agricultural solutions.

All key informant interviews were recorded using digital audio recorders and transcribed verbatim for analysis. The average duration of the interviews was one

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hour. Interviews were analyzed thematically using a qualitative descriptive approach.

## **Data Analysis**

All transcripts from the key informant interviews (n=31) were uploaded as a Word document into NVivo 12 software. The research team used the interview guides and transcripts to ground the development of themes based on top-level codes and sub-codes. Thematic coding was systematically done using NVivo and themes and patterns were identified and organized into coherent categories that summarized and brought meaning to the text. Case study findings were organized by the main research questions and described in terms of the most common themes emerging from the different sources.

# Summary of Findings

## Roles of ICTs in scaling up agricultural solutions

### Improving Adoption of Agricultural Solutions

In the context of this study, agricultural solutions or technologies consist of agricultural inputs such as seeds, fertilizers, and inoculants, and new farming methods such as conservation tillage or drip irrigation. The agricultural solution that is being scaled up may not be novel, but new to the farmers to whom the solution is being introduced. Factors affecting the adoption of agricultural solutions include **access** to the solution, knowledge on how to **use** the solution, and the **income** generation potential for farmers (Baumüller, 2012).

The study finds that the use of ICTs helped in the adoption of agricultural solutions by increasing access to information related to the solution, increasing use of the solution, and increasing the income generation potential for farmers (**Figure 1**).

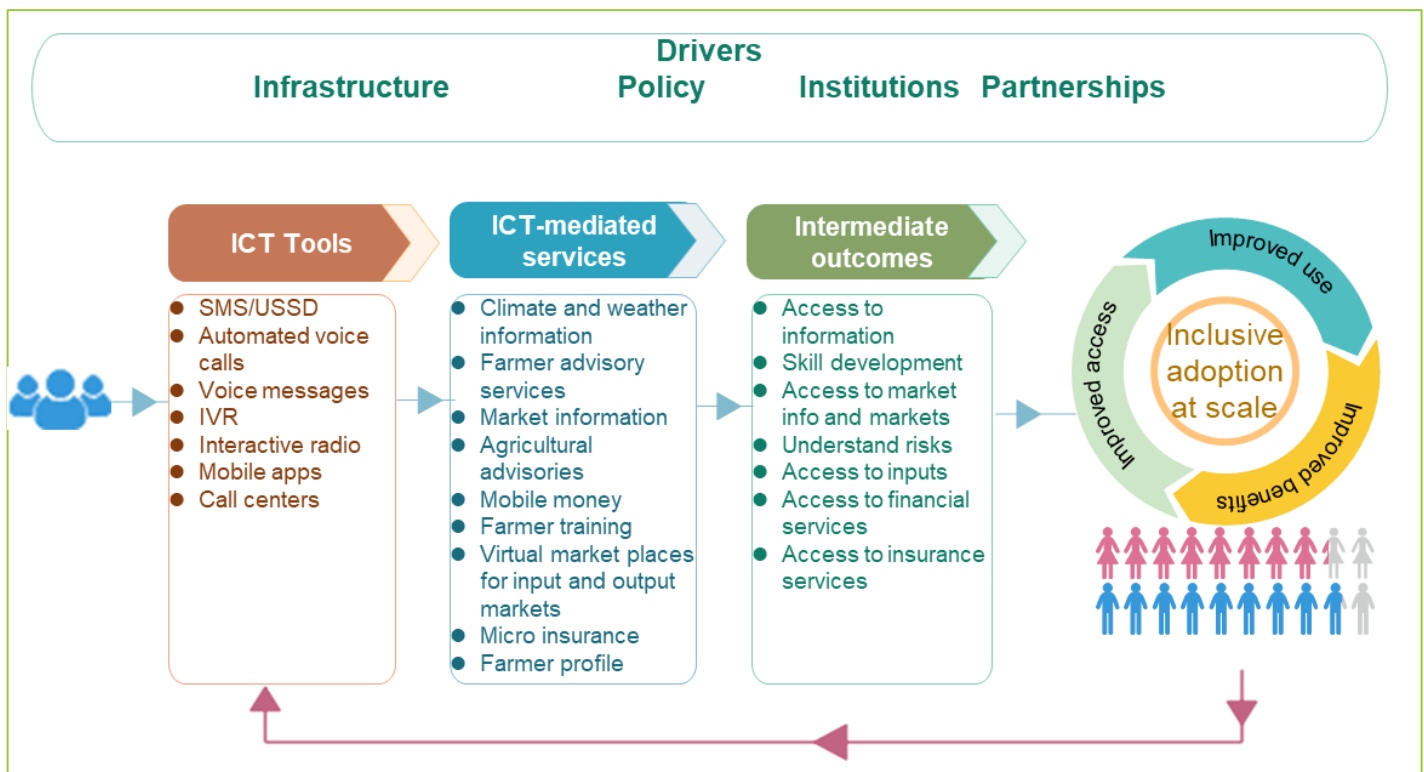


Figure 1: The role of ICTs in facilitating the adoption of agricultural solutions

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**Improved access to information:** To be able to apply a solution or agricultural technology, access to information regarding the solution is the starting point. To support their decisions to adopt or reject a solution, farmers also need information regarding the suitability of the solution for their context, the risks, the benefits compared to what they currently use, and the resources needed for adoption.

The study showed that the use of ICTs improved access to agricultural information. In Malawi, the Scaling Up Radio and ICTs in Enhancing Extension Delivery (SRIEED) provided ICT-enabled extension services to over 500,000 farming households in seven engagement districts. The SRIEED/Malawi project provided ICT-enabled extension services focusing on ground nuts, soya beans, legumes, potatoes and dairy value chains. In Uganda, the Climate Change Adaptation and ICT (CHAI) project provided agricultural advisories and crop and livestock market information to over 250,000 farmers enabling 6 out of 10 households to have access to agricultural solutions; only 1 out of 10 households had access to agricultural solutions-related information in a control district. In Ethiopia, the Digital Integration to Amplify Agricultural Extension project provided ICT-enabled improved agronomic practice information to over 800,000 farmers. In Ghana, ESOKO provided market information, weather and smart agricultural tips to over 500,000 farmers and provided its services to an additional 500,000 in Kenya, Tanzania, Benin, Burkina Faso, Nigeria, Malawi, Zimbabwe and Uganda.

According to the FAO, the recommended farmer - extension agent ratio one extension agent for every 400 farmers ((Batchelor et al. 2014). However, the extension agent to farmer ratio is in the examined cases in Ghana, Malawi and Uganda was one extension agent for approximately 3,000 farmers. It is virtually impossible to provide information similar to what is described above to farmers without the use of ICTs and only through extension agents. A government official in Ghana noted that "you can't rely on traditional service delivery because it will take forever for farmers to access that information." Overall, the study shows that the use of ICTs improved farmers access to agricultural solutions, however, as will be explained later in this report, access to information doesn't necessarily lead to adoption.

**Ability to use the solution:** The second important factor that affects adoption is ability to apply the solution into action. The knowledge base of the farmers on how to use the solution should be strengthened. Farmers should get ongoing support to use the solution and enable them manage risks associated with it. For rainfed agriculture, the



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issue of climate change and variability adds to the uncertainties faced by farmers and it is imperative that they have access to information that would minimize climatic risks. Farmers should also have access to the resources required for the adoption of the solution such as seeds, fertilizers and other inputs.

The examined cases showed that the use of ICTs enhanced farmers' ability to use the promoted agricultural solutions. The four cases provided ICT-mediated information for educating farmers on how to use agricultural technologies such as improved varieties related to ground nuts, soya beans, legumes, potatoes and dairy valued chains (Malawi); rice and maize (Ghana); sesame, chick pea, maize and wheat (Ethiopia); and drought-resistant crops suitable for current and forecasted weather conditions (Uganda). They also provided information on managing risks and accessing resources related to the new technology. The study showed that ICT-mediated information delivery was complemented by extension agents' support to farmers (all cases) and call centers (SRIIED and ESOKO) to ensure that farmers' questions are addressed in a timely manner.

However, the study showed that, the delivery of agricultural information alone does not guarantee that the farmers will use the solution. The study finds that the key factors affecting the ability of the farmers to apply acquired knowledge into action include the availability of ongoing extension agent and peer support to help farmers get answers to their questions, help farmers better understand the risks and benefits, and boost their confidence of using the agricultural solution; access to resources such as agricultural inputs and affordable loans; and availability of farmers who already have used the solution and can attest to the favorable outcomes of using the solution. To help farmers better understand the benefits and risks of using the solution, the four projects examined in this study worked with respective government extension service delivery infrastructure. The projects engaged locally available extension agents to provide face-to-face support and respond to farmers' questions as they arise. The examined cases showed that the use of ICTs did not completely replace the role of extension agents but made their engagement with farmers less intensive and more manageable. To spur discussions among farmers and strengthen the networking of farmers with similar interests, two of the examined cases (SRIIED/Malawi and DIAAE/Ethiopia) established and provided ongoing support to "farmer listening groups". The projects organized radio listening groups, provided the groups with FM radio receivers and encouraged them to listen to pertinent radio programs that broadcast agricultural information to stimulate dialogue, experience sharing, collaboration and action among the farmers. In addition, the SRIIED/Malawi

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project provided smartphones to farmer groups especially to female-only groups and established a “WhatsApp Group” to further bolster understanding of promoted agricultural solutions. The study finds that, in contrast to SMS which enables content sharing via text only, the use of WhatsApp enabled the sharing of content in text, audio and video formats making the content more understandable and to the farmers. The SRIEED/Malawi project used WhatsApp for sharing multi-media content related to ground nuts, soya beans, legumes, potatoes and dairy value chains to farmers on the group. The study further finds that the use of WhatsApp group enabled farmers in the group to interact with each other and bolstered the confidence of farmers to apply promoted agricultural solutions into use.

For applying acquired information into action, the literature shows that information delivery using ICT tools alone cannot provide a meaningful contribution to development if the farmers do not have access to resources that will enable them to act on decisions made with the acquired information (Heeks 2005). The study finds that, to support the farmers in the application of acquired knowledge of new agricultural solutions, SRIEED/Malawi, CHAI/Uganda and the Digital Integration to Amplify Agricultural Extension in Ethiopia partnered with government entities, NGOs and CBOs to provide farmers with the required inputs and resources. The examined projects used different approaches to identify support institutions who can provide farmers with inputs needed for applying the agricultural solution. The CHAI/Uganda project conducted a “support institution” mapping exercise to identify support institutions, type of support that can be rendered to farmers by the support institutions, and determine the type of institutional collaboration needed to engage the support institutions. The support institutions included international NGOs (such as World Vision and Lutheran World Federation), local NGOs and CBOs, input dealers and suppliers, and micro-financial institutions. To link farmers with the locally-based support institutions, content disseminated by the project included the contact information of the support institutions and the type of support provided by them to farmers for implementing specific agricultural solutions. Likewise, the SRIEED/Malawi and DIAAE/Ethiopia projects conducted a stakeholder mapping exercise to identify key partners in the implementation of the project and the roles each stakeholder may play especially in supporting farmers apply promoted agricultural solutions into action. The SRIEED/Malawi and DIAAE/Ethiopia projects engaged best-fit actors from government extension service delivery infrastructure for providing farmers with the required inputs from government and private sector entities. The study finds that collaborating with multiple institutions and marshalling the focus of the institutions to support the scaling up of the promoted agricultural solutions was not a linear process

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and it required flexible and adaptive approaches to maintain their engagement. On the other hand, ESOKO worked with “outgrowers” instead of directly dealing with individual farmers. The outgrowers are small, locally-based agribusinesses that enter into contract with a group of farmers (usually between 20 to 40) where each farmer agrees to supply an agreed volume of produce and the outgrower agrees to provide the inputs needed by the farmer (such as seeds, fertilizers, pesticides, ICT-mediated agricultural information) and to offtake the crops at prevailing prices after harvest. The farmer pays the loans in kind.

**Generate income:** Access to markets is a key factor that affects farmers' ability to sell surplus production profitably. Farmers in rural areas often lack market prices information at different market outlets and end up selling their produce at low prices to traders who are better informed of the market situation. Bridging such information asymmetry is crucial to improve farmer's income from the sale of their surplus production.

Two of the examined projects (CHAI/Uganda and ESOKO/Ghana) provided market information related to different crops at different market outlets to farmers to enable them to decide what, when, where and how much to sell. Local traders traveling to villages usually buy crop and livestock on their terms because the farmers do not know the market price in urban or semi-urban market outlets. The study finds the farmers used market information received on their mobile devices for price negotiations with the local traders. The two projects indicated that the ability to sell their produce at competitive prices enabled farmers to appreciate the economic benefits accrued from the promoted agricultural solutions and encouraged them to adopt the solution(s). In addition, ESOKO/Ghana provided a virtual marketplace platform where surplus production of farmers and buyers' demand for crops are advertised and traded. Using such platform, the farmers sell their produce to highest bidder and platform is providing farmers an avenue for selling their produce at premium prices.

The study finds that farmers' access to market information and virtual marketing platforms enhanced arbitrage opportunities, reduced spatial price dispersion, lowered wastage, increased both consumer and producer welfare, and encouraged farmers to adopt agricultural solutions that result in better yield of crops. Overall, the study finds that the use of ICT supports the adoption of agricultural solutions from improving the supply of inputs to farmers to supporting improved

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production and through to creating market opportunities to farmers overcoming barriers related to geography and poor traditional extension infrastructure.

### ***Avoid Dilution of Content***

Dilution of content is a major concern where a team of experts' trains extension agent trainers who then build the capacity of extension agents who in turn offer advisory services to farmers. As information is passed from one layer to the other, there is a risk of watering down the content.

The study finds that one of the major benefits of using ICTs is minimizing the dilution of content typical in cascading training models. The projects showed that they avoided dilution of content between the source of approved content (research agencies) and extension partners. It helped in the enhancement of the credibility and relevance of knowledge and data exchanged between research institutions, extension, and farmers leading to improved adoption. There was consistency in the messages delivered to farmers and extension agents as both entities received the same information.

### ***Enhanced Inclusion of Women***

The 2019 “Mobile Gender Gap” report of the Global System for Mobile Communications Association (GSMA) indicated that while women's mobile phone ownership has significantly increased in low- and middle-income countries (LMIC) since 2014, there is still a persistent mobile gender gap. The report notes that Women in LMICs “are 10% less likely than men to own a mobile, which translates into 197 million fewer women than men owning a mobile phone” (GSMA, 2019). While there was no conclusive data that shows the national mobile gender gap in the countries where the examined projects operated, surveys conducted by the projects confirm the glaring gender gap reported by the GSMA. Because less women own mobile phones compared to men, women's access to information delivered through mobile phones will also be less.

To address the gap in women's access to agricultural information, two of the examined cases (SRIEED/Malawi and DIAAE/Ethiopia) organized women radio listener groups that were equipped with radio receivers provided by the projects to enhance their access to agricultural information. In addition, the SRIEED/Malawi project established female “WhatsApp Groups” by providing smartphones to women

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groups for receiving agricultural information in text and video formats. The project trained the female WhatsApp groups on how they can use the platform for networking and experience sharing among themselves and with extension support agencies. The examined projects in Malawi, Uganda and Ethiopia assessed the information and communication need of women during the design and implementation of the projects. The outcomes of the assessments were used for selecting delivery channels suitable for female audience, and packaging content addressing the types of agricultural activities women are engaged in. Such efforts enhanced the inclusion of women who have less access to technology compared to men.

The study finds that, while the provision of free radio sets and mobile phones to women farmers is important for minimizing the gender gap and increasing women's access to agricultural information, their ability and/or willingness to maintain and replace the devices was limited. The project's resources were also very limited, and the devices were provided to about 100 women, which is very small compared to the need. While the provision of free radio sets and mobile phones is useful for showcasing the benefits of the technology to women farmers, the approach is not sustainable and can only support a very small proportion of the female farmer population.

One of the examined cases (ESOKO/Ghana) followed a "Business to Business" (B2B) model where responsibility for targeting women lies with the business entity using the ESOKO services (such outgrowers, NGOs or government entities).

Overall, the examined projects focused on providing women with agricultural information resources. None of the examined projects focused on gender outcomes that strengthen women's capacities to make choices or derived benefits from the use of the information. The study shows that, gender-transformative actions that will promote the shared control of resources and decision making, are beyond their mandate and primarily focused on establishing information access for women.

## **ICT Tools Used by the Cases**

The four projects examined in this study employed a combination of ICT tools including mobile phones for the delivery of information through text messaging (Short Message Services (SMS) and Unstructured Supplementary Service Data (USSD)), automated voice calls, and Interactive Voice Response (IVR); community videos; call

centers; and radio broadcasts augmented by the use of IVR and SMS for engaging listeners with hosts of the broadcast (interactive radio).

The ICT platforms used by the projects include SMS, voice messages (Interactive Voice Response/IVR, automated voice calls and voice messages), interactive FM radio broadcasts and call centers for providing live support to farmers.

All examined cases used SMS and IVR for the delivery of agricultural information. The use of call center was practiced by all cases except the CHAI project in Uganda. One of the examined projects, ESOKO/Ghana, employed automated voice messages which involves the pre-recording of messages in multiple languages and calling farmers in their database at a pre-scheduled time. Recipients of the automated calls listen to the pre-recorded agricultural information on their mobile phone in their local language.

Project	SMS	Automated call/ message	Community video	IVR	Interactive radio	Call Center
SRIIED	✓			✓	✓	✓
CHAI	✓			✓	✓	
DIAAE	✓		✓	✓	✓	✓
ESOKO	✓	✓		✓		✓

Figure 2: ICT tools used by examined projects

The study finds that the examined projects used multichannel communication to ensure that agricultural information reaches a wide population in a cost-effective manner, is delivered using the preferred channel of the farmers, enhances interactivity and dialogue between content providers and farmers, and responds to farmers' questions in a timely manner.

The examined projects exchanged information using the ICT platforms as “push” where information was broadcast to thousands of users by the service providers, “pull” where demand for information was initiated by the user, “interactive” where the communication allowed live exchange of information, and “transactional” where financial information is transacted (such as mobile money and virtual marketplace).

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The study finds that push SMS was used primarily for the delivery of market information, weather notifications, and brief information about agricultural solutions and encouraging farmers to access more information about the solution through other channels such as radio, local extension agent, call center or IVR services. The SMA platforms deployed by the examined projects used short or long codes to enable users to access agricultural tips and market information on demand. One of the examined cases, ESOKO/Ghana, started with SMS for the delivery of market information climate smart agricultural tips. User feedbacks indicated that, due to illiteracy issues and the 160-character limitations of SMS, some of the farmers were not able to understand the messages. To overcome this challenge, ESOKO introduced voice-based services, specifically automated voice calls and messages and IVR. ESOKO reaches over 20,000 farmers in a day using automated voice calls. The study finds that, while bulk SMS enables pushing content to thousands of farmers, the character limitations and no-interactivity limits its usefulness to convey complex information on the details of using agricultural solutions. The study further finds that the use of push SMS was particularly useful for sharing market information to farmers as it helped the farmers to better negotiate with traders by showing the prices received via SMS as an evidence supporting their asking price.

The study finds that interactive mode of communication was more effective for educating farmers on the benefits and risks of the promoted agricultural solution, and the desired farmer actions during pre-cultivation, cultivation and post-cultivation stages. Three of the examined projects (SRIEED, DIAAE and CHAI) used interactive radio broadcasts for the dissemination of agricultural information. Four of the examined projects used interactive voice response for providing interactive information access to farmers. The examined projects indicated that voice-based communication channels are more effective (compared to push SMS) for the promotion and adoption of agricultural solutions. However, the cost IVR and automated voice messaging is much more expensive than text messaging and the projects attempted to integrate the push and interactive mode of communication in an optimal manner by using push SMS for market information and sending alerts and using interactive communication for a deeper dive on the promoted solution.

Three of the examined projects (SRIEED/Malawi, ESOKO/Ghana and DIAAE/Ethiopia) provided interactive agricultural information through call centers. The call centers are staffed by professionally trained multi-lingual extension officers on crop and livestock. Information provided to farmers through the call centers include on pre-cultivation, cultivation and post-cultivation of promoted crops. The study finds that the call

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centers were crucial in the adoption of promoted agricultural solutions. Except for ESOKO call centers that operate on a market-oriented business model where ESOKO is paid by a government entity, an NGO or outgrowers for its call center services, the others (SRIEED/Malawi and DIAAE/Ethiopia) relied on donor funding. The SRIEED/Malawi project was developing a sustainable business model for service delivery via call centers, however, the services provided by DIAA/Ethiopia stopped when the project ended in 2018. While call centers play crucial role in the promotion, adoption and scale up of agricultural solutions, the high cost of running the centers and the lack of a sustainable business model was in impediment.

One of the examined projects, ESOKO/Ghana, used 'transactional' mode of communication using SMS/USDD for providing mobile money services and virtual marketplace platform for supporting financial transactions between farmers and traders or outgrowers. In addition, ESOKO has started an individualized farmer service that provides an integrated or "connected" type of information delivery. Attempts are made to provide farmers with integrated ICT-mediated information including market, weather, extension services customized to farmer-level farm data, financial services and agricultural inputs. However, this approach has not matured.

## **Classification of ICT4Ag Interventions**

In this context, ICT4Ag or eAgriculture (used interchangeably) is the use of innovative ways of ICTs in the agriculture sector encompassing all ICTs that are or can be used in agriculture (Awuor et al. 2016). This study focused on the use of ICTs for scaling up agricultural technologies or solutions and not on agricultural solutions or technologies per se. For example, a sensor that monitors moisture content is an important ICT-based agricultural technology and various ICT tools can be used for educating farmers to use the sensor technology and support its scale up. The primary focus of this study was on the ICT-based tools and processes for supporting the scale up of the sensor and not on the sensor.

The examined projects used various ICT-based interventions for scaling up agricultural solutions addressing specific agricultural system challenges. The projects applied various ICT systems to provide different types of services and support to farmers to enhance the scale up of promoted agricultural solutions. The study identified five categories of agricultural system challenges that were addressed using various ICT4Ag interventions including: (i) lack of access to extension and advisory services;



(ii) lack of access to early warning and disaster management information; (iii) insufficient access to inputs and market; (iv) limited access to financial and insurance services; and (v) lack of access to capital intensive agricultural equipment such as tractors (**Figure 3**). The studied cases did not address the challenge of limited access to capital intensive agricultural equipment, however, this challenge was mentioned by most of the studied projects and the literature shows that innovative solutions such as “Hello Tractor” in Kenya that run a shared economy model for providing smallholder farmers with access to tractors on demand.

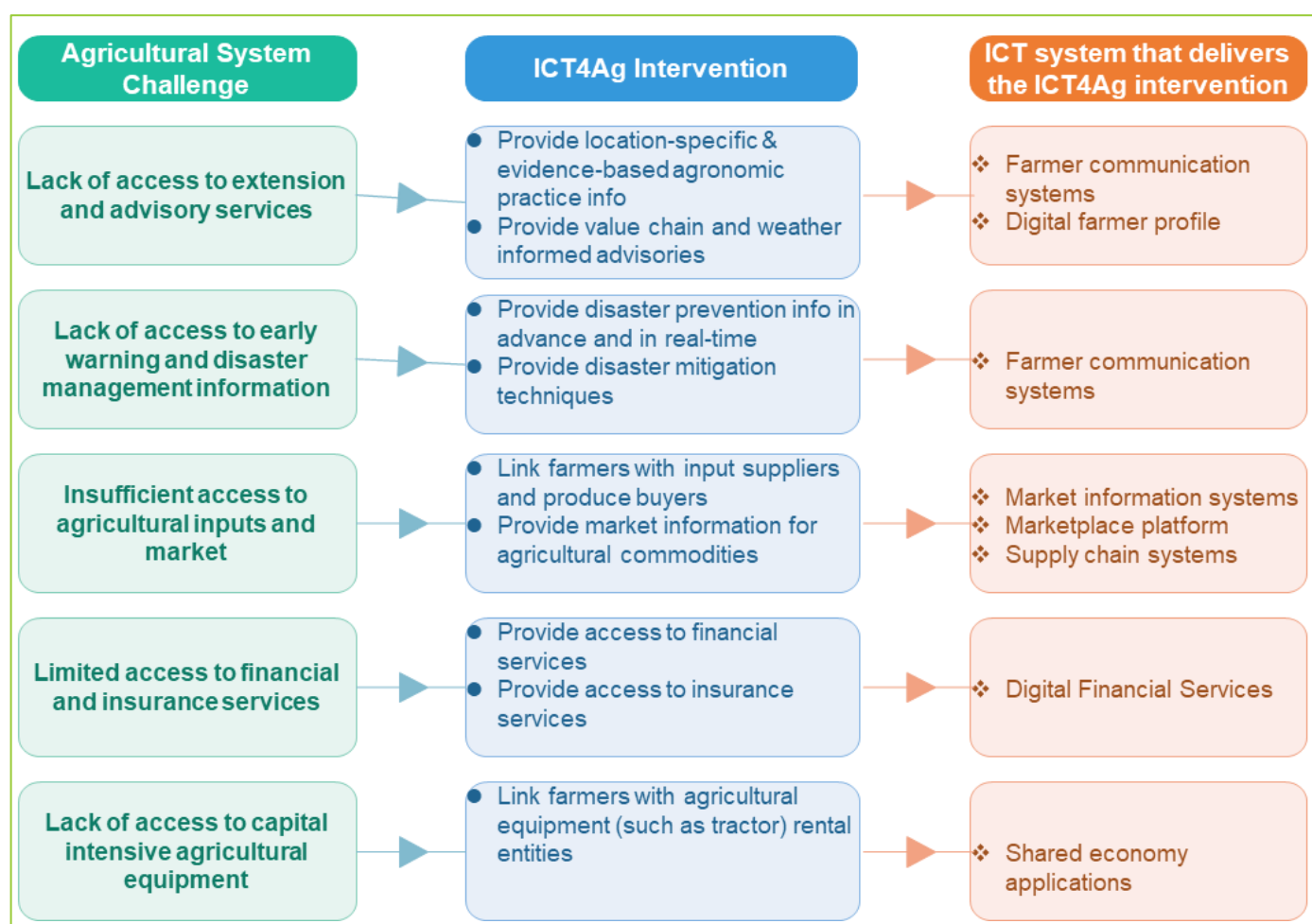


Figure 3: Classification of ICT4Ag interventions, agricultural system challenges and the ICT systems that address the challenges

The examined projects used various digital interventions for addressing the agricultural system challenges. All four projects used ICT tools for providing location-specific and evidence-based agronomic information, value chain- and weather informed agricultural advisories, link farmers with input suppliers, and provide farmers

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with market information for agricultural commodities. One of the examined projects (CHAI/Uganda) provided disaster prevention information in advance of the anticipated event and in real time (such as information on damaging rainfalls as it happens), and information on disaster mitigation techniques. ESOKO/Ghana provided access to financial and micro health insurance services.

The examined cases used farmer communications systems that consisted of push SMS, on-demand and interactive SMS, interactive voice response, community video screenings, interactive radio broadcasts and call centers. Two of the examined cases (ESOKO and CHAI) established market information system for the collection and dissemination of crop and livestock market prices. ESOKO was the only case that used digital financial services for the facilitating payments to or from farmers, credit and insurance using digital channels.

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## Case 1: Enhancing Resilience to Water-Related Impacts of Climate Change, Uganda

<b>Project name:</b>	Enhancing Resilience to Water-Related Impacts of Climate Change in Uganda's Cattle Corridor, also known as Climate Change Adaptation and ICT (CHAI)
<b>Period of performance:</b>	2012 – 2018
<b>Implementing Agency:</b>	Uganda Chartered HealthNet and FHI 360
<b>Funding agency:</b>	International Development Research Centre (IDRC)

### Project Overview

#### *Project Overview*

Like the rest of Africa, Uganda's economy is dependent on agriculture. Agriculture accounts for 41% of the GDP, employs 80% of the labor force, and supplies 85% of exports. In addition, over 80% of the population lives in rural areas and depends mainly on agriculture for their livelihood. However, crop yields in Uganda have stagnated over the years leading to a decline in per capita food production. Cereal yields rarely exceed 1.5 tons per hectare. The low per capita food production is mainly due to reliance on rain-fed agriculture, which is vulnerable to climate variability and change; occurrence of more frequent and intense droughts; low investment in the sector; limited access to technology; and poor rural infrastructure among other reasons (Grebmer et al., 2017). During the 80-year period from 1911 to 1990, eight droughts occurred, while in the 10 years between 1991 and 2000, Uganda experienced seven droughts (Magrath 2008). Since 1960 mean annual temperatures in Uganda have increased by 1.3°C, rainfall has become more unpredictable, and extreme events such as droughts and floods have increased in frequency and intensity (Uganda NDC 2018).

The 2011-12 annual performance report of the Government of Uganda (GOU) cites drought as one of the main reasons for achieving only 3.2% GDP growth against a projected growth of 7% for the reporting period (GOU 2012).

The “cattle corridor” of Uganda is one of the hardest hit areas due to the impacts of climate change and variability. A semi-arid ecosystem that covers 40% of Uganda's land, the cattle corridor is characterized by scanty, unreliable rainfall (450 – 800

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mm/year) compared to other areas such as Entebbe (1,574 mm/year). It is subject to recurrent droughts and has sparse vegetation.

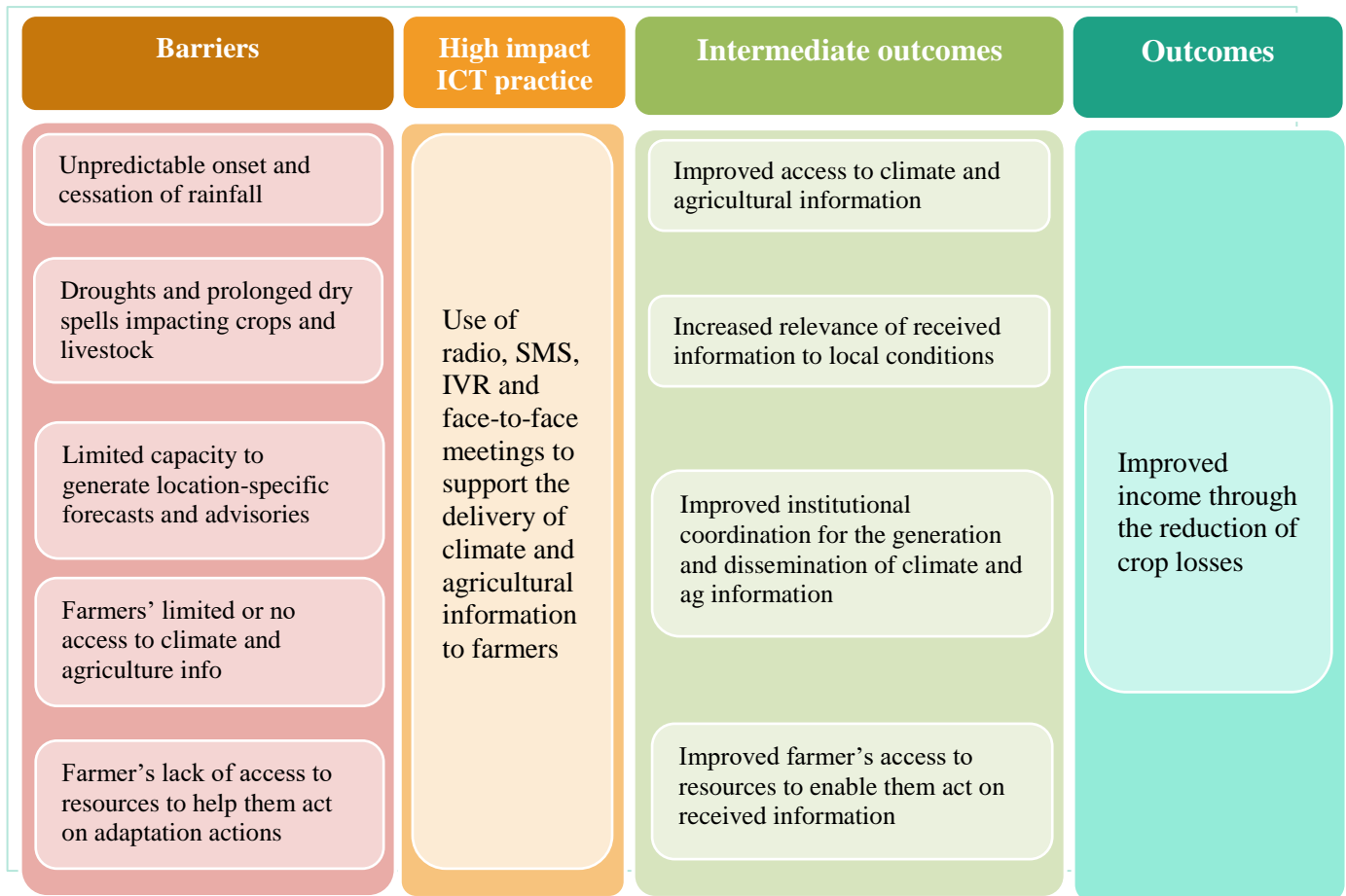
The *Enhancing Resilience to Water-Related Impacts of Climate Change in Uganda's Cattle Corridor*, also known as *Climate Change Adaptation and ICT (CHAI)* aimed to improve the productivity of smallholder farmers exposed to climatic hazards in the cattle-corridor of Uganda by providing actionable climate and agricultural information using ICT tools and processes.

Funded by the International Development Research Centre, Canada, the project was implemented in three intervention districts (Nakasongola, Sembabule and Soroti) in two phases. The first phase was implemented from 2012 to 2014; the second phase ran from 2015 to 2018. The project was co-implemented by Uganda HealthNet and FHI 360 in partnership with Uganda's Ministry of Water and Environment and Makerere University.

The project disseminated to over 250,000 farmers climate and agricultural information including seasonal (three months duration), one month and 10-day forecasts specific to sub-counties, agricultural advisories to help farmers plan their crop farming in response to forecasted climate/weather conditions, weekly market information reports, low-cost water harvesting techniques, and termite control measures identified, packaged, and disseminated to smallholder farmers.

### ***CHAI Theory of Change***

From the reviewed documentation, the project didn't have an explicit theory of change. However, the project had clearly defined outcomes with a clear logic and results hierarchy and this information was used to facilitate the construction of a theory of change. The project aimed to increase the income of smallholder farmers by reducing crop losses. The project identified unpredictable onset and cessation of rainfall, droughts, lack of location-specific weather forecasts and agricultural advisories, and farmers' limited access to climate, agricultural and market information as the key barriers limiting effective crop production. The project theory of change posits that by using ICT tools to improve access to location-specific climate and agricultural information and strengthening institutional capacity to support farmers to act on information received, crop loss and damage will be reduced leading to improved income of the farming households.



## Information Dissemination Platforms

To better understand the information and communication needs and preferences of target communities, the project conducted a baseline survey involving 640 households in 2012. The study showed about 49% of the respondents indicated receiving seasonal weather forecasts and agricultural advisories, however, the information was about a large area spanning multiple districts, not specific to their location, and was rarely used by the farmers (Gebru et al., 2014). Farmers expressed the need for receiving seasonal (3-months duration) and short-term (one-month and 10-day forecast) localized to the subcounty level and agricultural advisories informed by the forecasts to guide their practice. The baseline study showed that 97% of the farmers who receive weather forecasts and agricultural advisories received it through local or national radio stations.

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The study further showed that the most trusted source of information for the farmers was information received through radio broadcasts. The study showed that the surveyed farming population had little trust in information received through text messaging on mobile phones. Several companies and individuals send bulk SMS messages promoting products and/or offering an “easy to win” lottery. Most of the lottery offerings were scam messages and when the recipients responded to the message, they were automatically charged an SMS transmission fee without any warning. The unexpected expense became a major disappointment to the users and such experience made them suspicious of unsolicited text messages received on their phones. Many choose to ignore messages on the mobile device to avoid unexpected financial loss.

The project used the findings of the baseline study to determine the types of climate and agricultural information for dissemination to farmers, information dissemination platforms and strategies for increasing usefulness and trustworthiness of information from the project. As such, the following information dissemination platforms were used.

- **Interactive radio** broadcasts in local languages in collaboration with local FM radio stations through monthly talk shows and weekly broadcast of information during planting and harvesting seasons. As the most trusted information delivery channel for the farmers, radio talk shows were used to dispel the mistrust of information received through mobile phones.
- Weekly broadcast of **SMS** message;
- On-demand broadcast of information **through Interactive Voice Response (IVR)**;
- Broadcast of information using **community loudspeakers** (megaphones) that are widely used in urban and semi-urban settings for making public announcements especially during market days; and
- **Face-to-face meetings** between extension agents and farmers.

## **ICT-mediated agricultural solutions**

The project provided climate and agricultural information to farmers using interactive radio, SMS, IVR, community loudspeakers and face-to-face meetings. Information delivered to farmers included:

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**Location-specific weather forecasts:** Seasonal (three-month duration), one-month and ten-day weather forecasts were sent to farmers, district-level agricultural officers and subcounty-level extension agents. Weather forecasts were generated by the Uganda National Meteorological Authority (UNMA).

**Climate-based agricultural advisories:** UNMA was responsible for generating climate-based agricultural advisories such as crop planning advice (crop varieties suitable for the season, sowing/harvesting times, and other crop husbandry operations); crop management advice based on updated weather forecasts and how it will affect sowing, weed management, pest and disease incidence and control, harvest and post-harvest handling of crops; and crop and livestock management under unfavorable weather conditions such as heavy rains, floods, and strong winds. The advisories were generated for each sub-county in the intervention districts. The advisories were sent to members of district-level Climate Information Committees. The members of District Climate Information Committees included Production Officers, Water Officers, Commercial Officers, Natural Resources/Environment Officers, Commercial Officers, Community Development Officers, Communications Officers, District Chairpersons, and Chief Administrative Officers. The district Production Officer adapted the advisories to local languages and settings. The localized advisories were broadcast via interactive FM radio transmissions where farmers are encouraged to call or use text-messaging to ask questions or request for clarification. A dedicated multi-team call attendant queued calls in order received and callers' questions and the responses to them were aired live. Summarized versions of the advisories were disseminated via text messages to approximately 50,000 farming households who use mobile phones. The full content of the advisories was also posted in community bulletin boards and used by extension agents to guide face-to-face discussions with community members.

**Crop and livestock market information:** Working with the district-level local government, the project collected livestock and crop market prices from 46 market outlets in the three districts. Weekly market information was transmitted via local FM radio stations and posted on community bulletin boards. A summary of the weekly market information was sent via text messaging to community members who use mobile phones.

**Rain water harvesting techniques:** Working with district-level water and production officers, the project generated guidance on low-cost water harvesting techniques

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including the design, cost, operation and maintenance of such systems and suggested uses for the harvested water.

**Termite control:** Termites that feed on live plants and organic matter and that cause significant damage to crop, seedlings, grass, trees, wood fence pickets, and wood houses are a major problem in Nakasongola district. Termites' foraging activity in this district is intensified during water stress. The project worked with Nakasongola district Production Officer to generate termite control information.

## Partnerships and Institutional Arrangement

The implementation of CHAI is jointly led by Uganda HealthNet, a local NGO in Uganda, and FHI 360, an International nonprofit organization that works for the health and wellbeing of communities in over 60 countries. The key implementing partners of the project include the Climate Change Department and Wetlands Management Department (both under the Ministry of Water and Environment), the Uganda National Meteorological Authority, Makerere University's Zoology Department, and district local governments especially the Production Departments that are responsible for supporting agricultural activities in the district.

In addition, the project had service contracts with local FM radio stations for supporting interactive radio transmissions in local languages, mobile network operators for providing voice and Internet connection, and bulk SMS and locally-based IVR service providers.

The project used an elaborate institutional arrangement to support the generation, dissemination, and use of climate and agricultural information.

- At the national-level, a steering committee composed of the project partners and chaired by the Ministry of Water and Environment was established to oversee coordination of the project with government entities.
- The Uganda National Meteorological Authority (UNMA) was responsible for the generation of seasonal, one month and 10-day weather forecasts specific to sub-counties and the generation of weather-informed agricultural advisories.
- At the district-level, a Climate Information Committee composed of the district-level technical departments was responsible to oversee the localization of climate and agricultural information to local needs and priorities.
- At the subcounty level, extension agents provided ongoing advice and consultations to farmers.



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- Public and non-governmental organizations working in the districts were linked with households and encouraged to provide support that enables households to act on the information received.

## **Role of ICTs in Scaling-up Agricultural Solutions**

The combined use of multiple delivery channels including interactive radio, SMS and IVR and the institutional arrangement for supporting farmers to apply received information into action improved farmers' access to agricultural information and its adoption leading to improved income.

### ***Improved access and timeliness of information***

Improved access to climate and agricultural information, available agriculture technology options that are a good fit for the existing and projected weather conditions, improved access to inputs and resources are a necessary condition for supporting adoption. The CHAI project disseminated such information to over 250,000 farming households in Uganda

To better understand the role of ICTs in improving access to timely climate and agricultural information, the CHAI project conducted a study involving three treatment districts (Nakasongola, Sembabule and Soroti) and a comparison district (Rakai). The treatment districts received ICT-mediated climate and agricultural information including weather forecasts, agricultural advisories, crop market information and were linked with institutions that can provide them with the inputs such as seeds and fertilizers. Baseline, midline and endline surveys involving 640 households were conducted to understand the differences in access to information and the adoption of improved seeds and complementary inputs advocated by the project. The study showed a significant variation in the proportion of respondents with access to climate and agricultural information by treatment and comparison district ( $p < 0.05$ ). On average, 60% of the farmers (6 out of 10 households) in the intervention districts had improved access to climate and agricultural information whereas the on 10% of the farmers (1 out of 10 households) in the comparison district received climate and agricultural information through traditional means which includes one-way radio broadcast, word of mouth and face-to-face meetings with extension agents.

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### ***Improved Effectiveness and Adoption***

For climate and agricultural information to be relevant to farmers, farmers must receive the information before the start of the rainy season. The CHAI study showed that whereas the farmers in the treatment districts received seasonal forecasts and associated agricultural advisories one month before the start of the season, the farmers in the comparison district received after the start of the season or at a time when the information was obsolete. The timely delivery of climate and agricultural information in the treatment districts enabled them to make farm decisions on time resulting in a better adoption rate of the agricultural technologies (improved seeds and complementary inputs such as fertilizer). On average, 83% of the farmers applied received information into action of which 84% found it effective; while only 58% of the farmers in the control district applied it into action of which 57% found it effective.

The main factors that contributed to the improved effectiveness and adoption of disseminated agriculture information include timely delivery of content, localization of information to subcounty level, and availability of local farmer support agencies that provided seeds and complementary inputs to help farmers adopt recommended agricultural technologies.

### ***Improved income***

The climate and agricultural information package disseminated by the project is designed to improve the income of farmers by improving yield as a result of adopting promoted agricultural solutions. The project conducted a study to understand the impacts of ICT-mediated climate and agricultural information in minimizing crop losses and subsequently improve the income of households. The studies showed that farmers in the treatment districts increased yield by up to 65% compared to the farmers in comparison district. In monetary terms, in the year 2017, the average monetary value of crop for the intervention districts was higher by about \$195/year/household compared to households in the control district of Rakai.

## **Enabling and Limiting Factors**

### ***Enabling Factors***

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The enabling factors that facilitated the use of ICTs for supporting the scale up of agricultural solutions (drought resistant seeds, complementary inputs and market information) included the following.

**Strong partnerships:** The project established strong partnerships with government entities at national, district and subcounty levels, mobile network operators, local FM radio stations, agricultural input suppliers and community-based farmer support groups. Such partnerships facilitated the generation of climate and agricultural information, its dissemination to farmers and supporting farmers to act on received information. Local and international NGOs and community-based farmer support groups provided farmers with the inputs needed for the adoption of the technologies.

**Good cellular coverage:** According to the Global System for Mobile Communications (GSMA) 2018 annual report, Uganda has 44% Internet penetration rate ranking it the 15<sup>th</sup> in Internet usage in Africa and with a 70% penetration rate which means that there are 7 active SIM cards for every 10 individuals. The relatively good cellular coverage provided an opportunity for the use of SMS and IVR as a channel for disseminating climate and agricultural information and receiving feedback from farmers.

### **Limiting Factors**

**Limited availability of localized content:** The availability of well-maintained and dense observational networks for weather and climate is of critical importance for seasonal forecasting and other weather-dependent sectoral applications especially for the agriculture sector. UNMA assessments show that, currently, out of 20 agrometeorological zones in Uganda, only 8 have observation stations; out of 20 hydro-meteorological zones, only 6 have observation stations; out of 600 rainfall zones, only 150 have stations. The limited density of observational network was an impediment for the generation of relevant content localized to subcounty level.

**SMS broadcasts are expensive:** A Total Cost of Ownership (TCO) conducted by the project showed that, assuming a full national rollout of the system in Uganda, the average TCO for the generation and dissemination of climate and agricultural information is US \$3.59/household/year. The analysis further showed that over 88% (\$3.17) of this amount was for supporting the dissemination of information via SMS while interactive radio broadcasts allocation was under 4% of the TCO. While the

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dissemination of climate and agricultural information is an important channel for improving access and use, the relatively high cost was a limiting factor for expanding the use of SMS to additional users.

**Low willingness to pay for climate and agricultural information:** A survey involving 640 households indicated that only 35% of the respondents are willing to pay for climate and agricultural information services. The remaining 65% are of the view that such information is a public good and should be provided free of cost from the government. The project and its partners from the Ugandan government are assessing the financing options for supporting the generation and dissemination of such information, however, at the time of writing this report, the lack of a viable financing option was an impediment for scaling up the service to new users.

## Best Practices and Lessons Learned

**Strengthen local institutional capacity:** Effective climate-based agricultural information generation, dissemination and utilization require a combination of innovative technological and institutional arrangements. A baseline study conducted by the project showed that there was no strong institutional coordination to support the generation, dissemination and use of such information. To support the generation, dissemination and use of climate-based agricultural information, the project brought together national, district and village level institutions. This process was incorporated into the routine activities of participating institutions such as the Meteorological Authority, the Climate Change Department, and district government departments, who are responsible for crop production, water, agricultural advice, natural resource management, community development, commerce, and communications. Bringing the stakeholders together enabled the timely generation and dissemination of climate and agricultural information to farmers, providing households with the support they needed to apply their acquired knowledge.

Discussions with the project personnel indicated that building partnerships takes time, requires dedicated people, resources and an ongoing effort by all partners involved. The study finds that building effective partnerships cannot be rushed. For the CHAI/Uganda project, it took over one year to bring the partners onboard, negotiate and sign memorandum of understanding (MOU), establish coordination committees at national and district levels, and allocate resources for supporting the partnership (such as for convening coordination meetings at different levels). To support the negotiations with different partners that have diverse interests and signing of MOUs,

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the project identified champions and established a strong alliance of supporters within each partnering institution who were key in diluting any institutional inertia.

**Provide hyper-local climate and agricultural information:** seasonal weather forecasts and agricultural information must be localized to the sub-county level for improving adoption of drought resistant crops and complementary inputs.

**Use every communication channel:** The project provided information through a mix of established and new ICT mediums, including interactive FM radio (broadcasts that allow farmers to ask questions or make comments through voice mail and text messaging, with responses later aired live during radio talk shows), text messaging, email and community loudspeakers. The use of multiple channels improved access to climate and agricultural information.

**Strengthen and use existing systems:** The project invested in improving institutional processes to accept and respond to greater interest and inquiries by farmers. Agriculture extension agents and other existing service providers were incorporated from the start of the project, and each communication activity also directed farmers to existing national systems.

**Gather feedback and improve:** The project actively sought feedback from the users and adapted the program communication mediums and messaging to optimize its impact. The initiative provided updated agricultural advisories twice a week in response to user needs; and engaged local chiefs, religious leaders and other authority figures who helped by sharing adaptation information through their own channels. This reinforced the credibility of the information and encouraged farmers to use it.

**Build trust on communication channels used for delivery of content:** The use of “push” SMS where content such as market information is sent to farmers is important to directly reach farmers. However, the message can be viewed as a spam and disregarded by the user. To minimize this risk, the project “branded” its SMS messages with the name of the project to enable the farmers to easily identify that the message is not a spam.

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## Case 2: Scaling up Radio and ICTs for Enhanced Extension Delivery, Malawi

<b>Project name:</b>	Scaling Up Radio and ICTs in Enhancing Extension Delivery (SRIEED)
<b>Period of performance:</b>	July 2014 – June 2019
<b>Implementing Agency:</b>	Farm Radio Trust, Malawi
<b>Funding agency:</b>	Flanders International Cooperation Agency

### Project Overview

Agriculture is the mainstay of Malawi's economy, accounting for about 32% of GDP, over 64% of the labor force and about 80% of export revenues. The leading major cash crops are tobacco, contributing about 65% of export earnings, tea and sugar respectively contributing 8% and 6% of export earnings. The major food crop is maize which is cultivated in approximately 60% of the country's arable land. Therefore, the country's overall economic growth is primarily determined by the efficiency of agriculture.

Smallholder farming accounts to more than 70% while commercial farming contributes to about 30% of the GDP. The smallholder farmers primarily cultivate food crops such as maize, cassava and sweet potatoes for domestic food consumption while commercial farmers focus on cash crops such as tobacco, tea, sugar, coffee and macadamia for export. Smallholder farmers' farming is rainfed, vulnerable to climate variability especially droughts and prolonged dry spells. On average, they cultivate less than 1 hectare per household and often produce insufficient to meet annual consumption needs. Agricultural productivity among smallholder farmers has been much below its potential. For example, the yield for local maize hardly reaches 1.5 tons per hectare; and hybrid maize yields have been between 1.5 and 2.5 tons per hectare while potential yield ranges from 5 to 8 tons per hectare (Techale 2009).

To improve the overall productivity of the country and its economy, it is imperative that the efficiency of the smallholder subsector is significantly improved. Agricultural extension plays a pivotal role in improving agricultural productivity and promoting agriculture as driving force of economic growth. To improve the national extension system and thus improve the efficiency of agricultural productivity, the government made a major revision of its agricultural extension approach in 2000 by introducing a policy direction that supported a pluralistic and demand-driven extension system.

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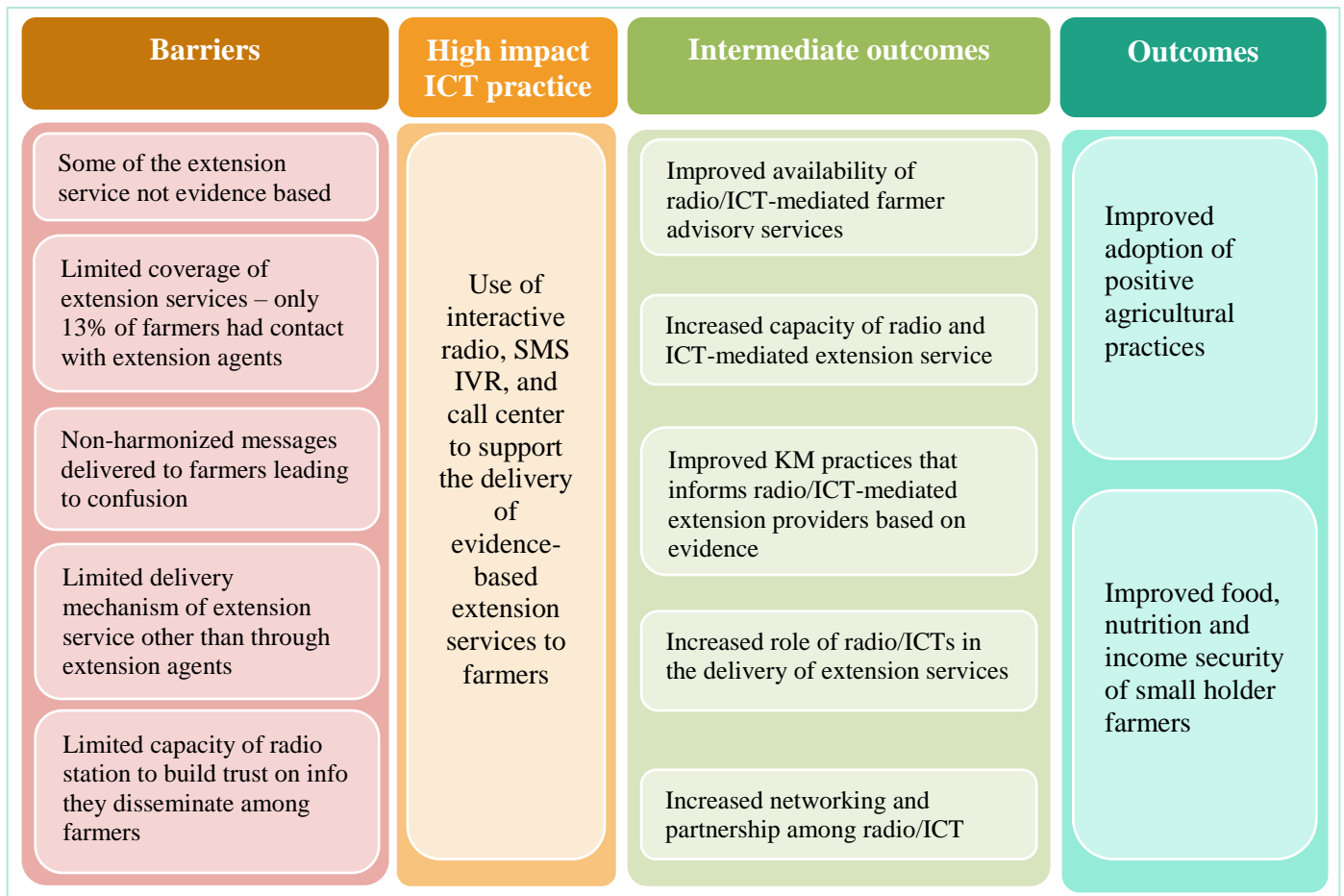
The policy was introduced to enable non-governmental players to provide demand-driven extension services to farmers. However, despite the conducive policy, agricultural extension services in Malawi are weak and struggling with a very a disproportionately low number of extension workers. According to the World Bank (1984), the recommended farmer - extension agent ratio ranges from 300 to 800 farmers to one extension agent depending on the farm size, mode of settlement of farmers. However, the extension agent to farmer ratio in Malawi is approximately 1:3,000. Therefore, the existing number of extension agents will not be able to provide extension services to farmers at the required pace and quality.

The SRIEED project aimed to improve food, nutrition and income security of smallholder farmers in Malawi through increased availability of radio and ICT-enabled farmer advisory services; strengthened capacity of key players in the radio and ICT-based extension service ecosystem; improved agricultural extension knowledge management practices; enhanced advocacy for increased role of radio and ICTs in agricultural extension delivery; and strengthened networking and partnership development among radio and ICT service providers.

Funded by the Flanders International Cooperation Agency, SRIEED is five-year project (2014 – 2019) implemented in seven engagement districts (Lilongwe, Mchinji, Nkhosakota, Kasungu, Mzimba, Salima and Mangochi districts). The project provided ICT-enabled extension services focusing on ground nuts, soya beans, legumes, potatoes and dairy value chains to over 500,000 farming households in the seven engagement districts. In collaboration with national radio programs, the project reached over 1 million additional farming households.

## **SRIEED theory of change**

SRIEED theory of change posits that radio, in combination with new information communication technologies, such as mobile phones, offers an inclusive, personable and multi-dimensional communication platform. If farmers are provided with accurate, timely, evidence-based information, and then they will gain knowledge which would lead to the adoption of positive agricultural and nutrition practices leading to improved food, nutrition and income security of smallholder farmers.



## Information Dissemination Platforms

SRIEED used the following information dissemination platforms to support the delivery of extension services such as improved agronomic practices, post-harvest handling of crops, and market information services to farmers.

- **Interactive radio** broadcasts in local language in collaboration with 18 radio stations in Malawi;
- **SMS** message broadcasts;
- On-demand broadcast of information **through Interactive Voice Response (IVR)** and for supporting the interactivity of radio broadcasts by allowing farmers to leave questions to dedicated radio programs of the project; and
- **Call centers** as an additional information pathway for farmers. The front end of FRT's call center (tier-1) were staffed by trained extension workers specializing in livestock and crop agriculture and who speak different local languages. If



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the call center staff is not able to answer the farmer's question, it is escalated to subject matter specialists (tier-2) with the required expertise. The SRIED/FRT senior management team serves as the third-tier user support to ensure that all questions from farmer's questions escalated to tier-2 are resolved in a timely manner. Farmers can access the call center through toll-free numbers associated with the two major mobile network operators in Malawi (Airtel and TNM).

## ICT-mediated agricultural solutions

SRIEED used a value chain approach to provide farmers with advisory services for selected agricultural products from input selection and accessing inputs through using and /or the marketing the produce. The major value chains supported by SRIEED include ground nuts, soya beans, legumes, potatoes and dairy. In addition, using ICTs, SRIEED provided farmers with information on the benefits of using Purdue Improved Crop Storage (PICS) bags for storing grain and seed without using chemicals to control insect pests, climate and weather information, and information for pest control especially fall armyworms.

## Partnerships and Institutional Arrangement

SRIEED is a partnership between FRT (lead organization), Malawi Ministry of Agriculture and Food Security (Department of Agricultural Extension Services, Department of Agricultural Research Services), Lilongwe University of Agriculture and Natural Resources, radio broadcasters, and mobile network operators. SRIEED partners have clearly articulated shares of responsibilities.

### Ministry of Agriculture and Food Security (MoAFS)

- *Department of Agricultural Extension Services (DAES)* supported the development of standards and the harmonization of advisory messages. On the other hand, SRIEED strengthened the capacity of DAES on the methods of ICT and radio-based extension service delivery.
- *Department of Agricultural Research Services (DARS)* provided evidence-based content on selected technologies and ensured that content was not diluted when delivered through radio and other dissemination platforms.
- *Crop, livestock and land resources departments of MoAFS* provided evidence-based content related to specific value chain promoted by the project.

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## Radio Stations and Broadcasters

- FRT engaged 18 radio stations for broadcasting content interactively to small holder farmers.

## Training Institutions

- *Lilongwe University of Agriculture and Natural Resources (LUANAR)* worked with FRT on the development and review of short courses curriculum on the delivery of extension and advisory services using radio and ICTs.

## Farmer Organizations

- Farmers Union of Malawi (FUM) and National Association of Smallholder Framers in Malawi (NASFAM) provided database of farmers to enable the project to provide directed content to the farmers. FUM and NASFAM also provided an avenue for linking farmers with suppliers of agricultural inputs and for the marketing of farmer's surplus produce.

## Role of ICTs in Scaling-up Agricultural Solutions

### ***Improved access and timeliness of information***

The SRIEED project disseminated information for supporting ground nuts, soya beans, legumes, potatoes and dairy value chain to over 500,000 farmers. In addition, the project provided information on how to respond to pests such as fall armyworm. In addition to providing live agricultural advisories to farmers, daily calls made by farmers to FRT call center were used as a way of receiving current information on pests and diseases that are affecting crop and livestock. For example, the incidence of fall armyworm was first reported through the FRT call center and information about the destructive worm was escalated to government entities. The ability to receive real-time information from smallholder farmers located in remote areas through interactive radio programs and the call center, and the strong partnerships built with pertinent government entities who have the capacity to produce content for addressing field issues enabled the project to generate and disseminate timely and locally-relevant content to farmers.

A base line study conducted by the project indicated that about 59% of the farmers in the engagement districts had access to agricultural extension. A mid-term evaluation of the project conducted by external researchers in 2017 that involved a household survey involving 377 households showed 84% of the respondents reported improved access to extension services (25% increase compared to baseline).

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### ***Improved inclusion***

SRIEED focused on the delivery of agricultural solutions and management practices for increasing productivity of smallholder farmers who are resource-constrained rather than to commercial farmers. Women make up at least half of the labor workforce in the smallholder agriculture sector. However, limited access to agricultural extension services and training have been a major impediment limiting women's opportunities to gain knowledge on new agricultural solutions/technologies that would increase their productivity. To bridge this gap, content transmitted through radio and other channels was prepared in a way that addresses the needs and priorities of men and women. In addition, the SRIEED project dedicated at least 25% of its interactive radio programs to address gender issues and deliver agricultural advisories focusing on women.

To enable farmers who do not own mobile phones access agricultural information, SRIEED piloted the provision of smartphones to a group of farmers (15 – 20 members in each group). A total of 60 farmers groups received smartphones loaded with WhatsApp for accessing information in text and video formats. As women's access to technology is lower than men, of the 60 farmer groups provided with smartphones and training by the project, 35 of them were women.

### ***Improved Effectiveness and Adoption***

The delivery of extension services using interactive radio, SMS, IVR and call center improved the adoption of good agricultural practices. A study conducted in 2017 showed that 82% of the farmers in the engagement districts reported the adoption of good agricultural practices compared to 66% at baseline (16% increase). Over 91% of the households in the study (n=377) indicated satisfaction with the ICT-mediated extension services provided by SRIEED.

The ability to receive feedback from farmers on the efficacy of the communication channels and usefulness of received content for improving farming practices is vitally important to increase adoption rate. Towards this end, SRIEED developed a feedback delivery mechanism for farmers to communicate their experiences (both negative and positive) and questions with experts. Farmer feedback were received through interactive radio programs and call centers. A survey conducted by the project showed that 22% of the farmers indicated receiving conflicting agricultural

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information through radio. This finding reinforces the need for a strong feedback system to enable farmers communicate their questions and concerns with experts.

### ***Enabling and Limiting Factors***

The enabling factors that facilitated the use of ICTs for supporting the delivering extension services to smallholder farmers included the following.

#### ***Enabling Factors***

**Strong partnerships:** The project established strong partnerships with government entities at national and subcounty levels, mobile network operators, local FM radio stations, agricultural input suppliers and community-based farmer support groups. Such partnerships facilitated the generation of localized agricultural information for the promoted value chains and providing ongoing support to farmers based on emerging needs. Through partnerships with government, research and training institutes, the project was able to respond to farmers questions received through call center within 24 hours of receiving the request.

#### ***Challenges/Limiting Factors***

**Lack of mechanism for standardizing extension-related content:** To enable multiple agencies to provide demand-driven extension services to farmers, the government introduced a policy direction that supported a pluralistic and demand-driven extension system. This policy is very useful for expanding the delivery of extension services in Malawi. However, there is no mechanism for ensuring that all extension services providers in the country provide evidence-based content that has been tested through a rigorous research and approved for use in the country. This void is resulting in the dissemination of conflicting advisories to farmers. It is imperative that the government introduces a mechanism for standardizing agricultural extension content in the country.

#### ***Best Practices and Lessons Learned***

**Establish effective multi-stakeholder partnership:** Establishing an effective partnership that involves multiple partners costs time and, at the beginning of new projects, it may slow down progress. However, establishing strong partnerships with government entities involved in supporting extension services, mobile network operators and other

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value chain actors based on shared vision and mutual understanding is the basis for the effective implementation of ICT-enabled extension service delivery. There is no shortcut to establishing a strong and effective partnership and initiatives who plan on using ICTs for supporting extension services must take their time to establish and continually strengthen partnerships with public and private enterprises.

**Disseminate evidence-based agricultural practices:** While the dissemination of evidence-based agricultural practices to farmers seems self-evident, some agencies promote practices that may not necessarily be evidence-based. Content for dissemination through ICT-based channels should be developed from evidence-based agronomic practices and customized to the localized to farmer's needs.

**Use multiple communication channel:** SRIEED provided information through interactive radio, SMS, IVR and call center. The use of multiple channels improved access to extension services.

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## Case 3: Digital Integration to Amplify Agricultural Extension, Ethiopia

<b>Project name:</b>	Digital Integration to Amplify Agricultural Extension
<b>Period of performance:</b>	2015 – 2017
<b>Implementing Agency:</b>	Digital Green and Farm Radio International
<b>Funding agency:</b>	USAID

### Project Overview

Agriculture is the backbone of Ethiopia's economy. It contributed 50% of GDP, employs about 85% of the workforce, contributes 90% of export earnings, and provides 70% of the raw materials needed for medium to large gro-processing industries in the country.

Smallholder farming accounts to 94% of food crops production and 98% of coffee which is the primary export commodity of the country. Smallholder farmers practice rainfed farming using traditional old tillage tools (primarily drawn by ox) and is characterized by low-input and low-output production system.

Recognizing the importance of agriculture for the economic security of the country, the sector has received a very high political commitment since 1991. The government anchored its growth and transformation plan on "Agriculture Development Led Industrialization" (ADLI) which also pivoted on the transformation of smallholder farming. As a result, the agriculture sector received favorable government budget allocations resulting in an extensive extension system. As of 2010, the extension agent (called "Development Agent" or DA in Ethiopia) to farmer ration was estimated at 1:476 which is way superior to other African countries such as Ghana and Malawi where the ratio is nearly 1:3,000 and Tanzania 1:2,500. Additional DAs has been trained in the past eight years and the DA-farmer ratio is expected to have further improved.

One of the pillars of Ethiopia's agricultural extension strategy is enhancing agricultural knowledge and information systems. Towards this end, the government has introduced the use of IVR through the Agricultural Transformation Agency that provides agricultural information to farmers using a toll-free short code.

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The Digital Integration to Amplify Agricultural Extension project is designed to support Ethiopia's agricultural extension strategy and aimed to improve small holder farmer's crop production by providing improved access to evidence-based information on agronomic practices such as improved seeds, fertilizers, other agricultural technologies and related good agricultural practices in line with the Scaling Seeds and Technologies Partnership<sup>1</sup> (SSTP) goals.

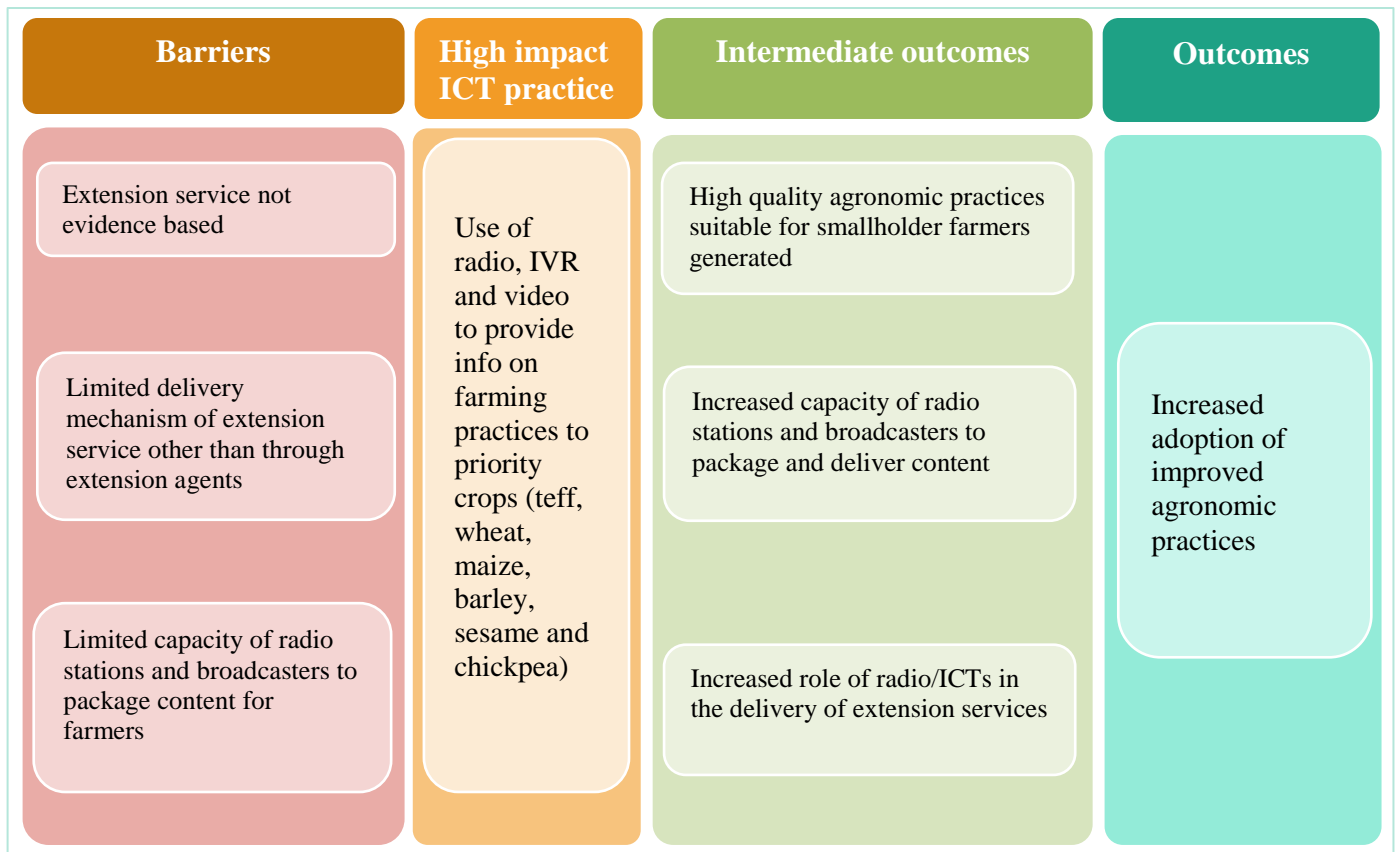
Funded by USAID, the Digital Integration to Amplify Agricultural Extension was a three-year project (2015 – 2017). The project provided ICT-enabled improved agronomic practice information to over 800,000 farmers in Ethiopia's three largest regional states (Oromia, Amhara and Tigray Regional State Governments). Household surveys conducted by the project showed that about 130,000 farmers adopted improved agronomic practices promoted by the initiative.

## **Project Theory of Change**

The Digital Integration to Amplify Agricultural Extension preliminary theory of change was constructed from the reviewed documents and interviews and is provided in the following chart. The project theory of change posits that adoption of improved agronomic practices will be improved by delivering evidence-based agronomic practices suitable for smallholder farmers using a mix of communication platforms including radio, IVR and low-cost videos.

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<sup>1</sup> The Scaling Seeds and Technologies Partnership in Africa (SSTP) was established in 2013 through a partnership between USAID and the Alliance for a Green Revolution in Africa (AGRA). It partners with governments, local seed companies, farmer and development organizations to overcome the challenges restricting farmer access to improved agricultural technologies.



## Information Dissemination Platforms

The Digital Integration to Amplify Agricultural Extension project used the following information dissemination platforms to support the delivery improved agronomic practices to smallholder farmers.

- **Interactive radio** broadcasts in local language in collaboration with 7 radio stations in Ethiopia;
- **Interactive Voice Response (IVR)** for providing farmers with access to information on-demand. A recorded version of content which was broadcast on radio was made available through IVR. The system allowed farmers to ask questions, provide feedback and conduct survey listeners' demand for the promoted technologies.
- **Videos** on improved agronomic practices featuring local farmers and tailored to local needs. The screening of the videos to smallholder farmers is facilitated by extension agents at the village level. The project collected monitoring data on the performance of the videos for supporting the adoption of improved



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agronomic practices and used the feedback for improving the content and packaging of the videos.

## **ICT-mediated agricultural solutions**

The project used video, radio and IVR to disseminate information related to improved agronomic practices to over 800,000 smallholder farmers. The project provided indepth information on key extension topics including agronomic practices and nutrition behaviors and strengthening value-chain interventions of target crops, including teff, wheat, maize, sesame and chickpea.

The project provided information for the adoption of blended fertilizers, biofertilizers, and “Aybar BBM”, a low-cost farming tool for draining excess water from waterlogged fields by creating drainage furrows for excess water drainage and building a broad bed for planting.

## **Partnerships and Institutional Arrangement**

The Digital Integration to Amplify Agricultural Extension project was led by Digital Green and implemented in collaboration with Farm Radio International, Awaaz De Infosystems<sup>2</sup> and Dimagi<sup>3</sup>. The project worked closely with the Government of Ethiopia's Ministry of Agriculture and Natural Resources and regional bureaus of agriculture in the regions of Oromia, Amhara and Tigray. Farm Radio International implemented the IVR-enhanced radio component of the project including the training of local radio broadcasters to produce participatory and engaging radio programs.

## **Role of ICTs in Scaling-up Agricultural Solutions**

### ***Improved access to information***

The Digital Integration to Amplify Agricultural Extension project disseminated information on improved agronomic practices to 814,764 farmers in three of the largest regional states in Ethiopia.

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<sup>2</sup> Awaaz De Infosystems is India-based technology company that develops mobile solutions.

<sup>3</sup> Dimagi is a USA-based technology company that develops mobile solutions based on open-source platforms.

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### ***Improved adoption of improved agronomic practices***

An endline study conducted by the project showed that of the 814,764 farmers who received information through the initiative, 131,241 farmers adopted the promoted agronomic practices (16% adoption rate).

The study also conducted a household survey (n=1,200) to understand the adoption rate of Aybar Broad Bed and furrow Maker (BBM), blended fertilizers, and biofertilizers by comparing the uptake of the technologies among listeners and non-listeners of the project's ICT-enabled radio programs. The study provided the following results.

- Adoption rate of Aybar BBM for listeners was 28%, and 14% for non-listeners
- Adoption rate for blended fertilizers for listeners was 76%, and 61% for non-listeners
- Adoption rate for biofertilizers for listeners was 40%, and 12% for non-listeners

Overall, the adoption rate for listeners of the ICT-mediated radio programs of the project was higher by 14% for Aybar BBM, 5% for blended fertilizers, and 28% for biofertilizers.

### ***Enabling and Limiting Factors***

#### ***Enabling Factors***

**High political commitment and Strong national extension system:** Ethiopia's development strategy is pivoted on the development of agriculture with a strong focus on smallholder farmers. This commitment resulted in a very extensive extension network and favorable extension agent to farmer ratio of 1:476. The strong extension system was an enabling factor for improving the adoption rate of agricultural solutions promoted by the project.

**Strong partnerships:** The project established strong partnerships with government entities at national, regional and district levels, multiple local FM radio stations, agricultural input suppliers and community-based farmer support groups. The partnerships facilitated the generation of locally relevant agronomic practices for the selected crops and provide farmers with ongoing support.

#### ***Challenges/Limiting Factors***

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**Limited cellular coverage:** Telecommunication in Ethiopia is a monopoly owned by the government. In 2017, mobile penetration was 34% which is low compared to other countries in the region such as Kenya (59%) and Uganda (41%) (GSMA 2017). The low cellular coverage, especially in rural area, was an impediment for farmers to access information via SMS and IVR.

**Public unrest:** There were security concerns some of the intervention areas of the project during 2016 – 2017. State of emergency were declared in some of the intervention areas which limited the project's ability to render its services to farmers.

**Poor supply chain for agricultural inputs:** The promotion of agricultural solutions by the project accelerated the demand for the inputs needed to implement the solutions. The increase in demand for the agricultural inputs resulted in the shortage of supply and became a demotivating factor to farmers who wanted to adopt the improved agronomic practices.

### ***Best Practices and Lessons Learned***

**Prepare for increased demand of agricultural inputs:** ICT-mediated delivery of extension services increases demand for agricultural inputs that are necessary for the adoption of the practice. When designing ICT-enabled extension delivery, it is important to anticipate and prepare for increased demand for agricultural inputs.

**Allow enough time to build partnerships:** Forging strong partnerships with private and public enterprises and community-based organizations adds value to the intervention and is important for the success of such program. However, establishing effective and inclusive partnership takes time. Programs that use ICTs for improving the adoption of agricultural solutions should create the right partnership framework from the start, create and review the structure of the partnership, assess its efficacy and improve, and realize that the benefits of effective partnerships do not appear overnight.

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## Case 4: ESOKO Digital Farmer Services, Ghana

### Overview

ESOKO is a for-profit private company that started in 2008 with providing market prices to smallholder farmers over SMS. Through time, ESOKO diversified its ICT-mediated offerings and it currently provides market information (primarily crop), connecting farmers with buyers (virtual marketplace), weather information (daily and two-day forecasts), smart agricultural tips informed by seasonal weather forecasts, and micro-health insurance. ESOKO obtains weather information and agricultural tips from aWhere, a US-based company that operates a global-scale agronomic modeling environment for the development of locally-relevant weather and agricultural information.

ESOKO's primary clients include businesses, such as agribusinesses, NGOs, governments and mobile operators. ESOKO is based in Ghana with resellers in Kenya, Tanzania, Mexico, Benin, Burkina Faso, Nigeria, Malawi, Senegal, Cameroon, Zimbabwe and Uganda who sell, operate and provide ESOKO services to clients. ESOKO services reach an estimated 1 million farmers of which 500,000 are in Ghana and the remaining in other parts of Africa (Kenya, Tanzania, Benin, Burkina Faso, Nigeria, Malawi, Zimbabwe, Uganda).

### ESOKO Business Model

ESOKO is primarily directed at business following a business-to-business (B2B) model for the delivery of its services while individual farmers constitute a secondary market for the company. With the B2B model, donor-funded projects, government programs or agribusinesses pay for farmers' access to ESOKO services. The B2B model minimizes the investment needed for creating awareness of the services among users and drive regular usage. With the B2B model, the business interacting with farmers is responsible to do uptake and usage marketing.

Though limited in scope, ESOKO also supports a business-to-client (B2C) business model such as for its micro-health insurance program where it sells the insurance directly to smallholder farmers.

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## **Agricultural Solutions and Information Dissemination Platforms**

ESOKO provides farmers with market information (primarily crop), weather information and climate-smart agricultural tips through voice messages, SMS messages (push and pull) sent to farmer's mobile phone or to a direct response to a question that the farmers submits through IVR to ESOKO call center.

ESOKO provides farmers with a virtual marketplace for connecting sellers and buyers to post their marketing needs, negotiate price and process the transactions through mobile money.

Through its B2C business model, ESOKO provides micro-health insurance to smallholder farmers. Insurance coverage includes: 'health cash voucher' claim provided if insured is hospitalized; is on maternity, insured dies or is sustains accidental injury. The objective of the productivity insurance is to minimize farmer's farm losses incurred when the insured is not able to attend the farm because of child birth, accident or death.

### **ESOKO Partnerships**

Through its B2B model, ESOKO works with donor-funded projects such as the USAID funded Ghana Agricultural Development and Value Chain Enhancement (ADVANCE) project, with government entities such as the Ministry of Agriculture and with privately owned agribusinesses.

The agribusiness that ESOKO works with are locally-based "outgrowers". The outgrowers are small, locally-based agribusinesses that enter into contract with a group of farmers (usually between 20 to 40) where each farmer agrees to supply an agreed volume of produce and the outgrower agrees to provide the inputs needed by the farmer (such as seeds, fertilizers, pesticides, ICT-mediated agricultural information) and to offtake the crops at prevailing prices after harvest. The farmer pays the loans in kind to the outgrower. ESOKO receives payment for its services from the outgrower.

### **Role of ICTs in Scaling-up Agricultural Solutions**

ESOKO/Ghana work shows that the use of ICTs tremendously improves access to agricultural information and the adoption of improved agricultural practices.

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## ***Improved access to information***

ESOKO ICT-mediated services reach an estimated 1 million farmers of which 500,000 are in Ghana and the remaining in other parts of Africa (Kenya, Tanzania, Benin, Burkina Faso, Nigeria, Malawi, Zimbabwe, Uganda). Information services provided by ESKO/Ghana include market prices information which is updated every two weeks, climate-smart agricultural tips, digital financial services including micro-health insurance.

## ***Improved income***

While there is no empirical evidence from the project that shows an increased income as a result of improved access to agricultural information, ESOKO has conducted surveys that show the increased arbitrage of farmers when dealing with traders resulting with increased revenue from the sale of their produce. In addition, the virtual market place offered by ESOKO allowed farmers to sell their produce to highest bidder with a net effect of increasing the farmer's revenue from the sale of their produce.

## ***Enabling and Limiting Factors***

### *Enabling Factors*

**Conducive policy environment:** The policy environment in Ghana allows private companies to provide extension services to farmers at a fee. This allowed ESOKO and other similar companies to offer their ICT-mediated agricultural solutions at competitive rates to agribusiness, NGOs, government entities and to some extent directly to farmers.

**Good mobile coverage and service:** With six major mobile network providers operating in Ghana, network coverage is reasonably good even in rural areas and SMS/voice prices are competitive.

### *Challenges/Limiting Factors*

**Farmers willingness to pay in cash is low:** A survey conducted by ESOKO/Ghana and the Agricultural Development and Value Chain Enhancement (ADVANCE-II) project involving 479 households indicate that about 61% of the respondents were willing to pay for ICT-mediated information services provided by ESOKO/Ghana. Of the 61%

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farmers who are willing to pay, the majority (71%) indicated that they are willing to pay below 1 GSH (below US \$0.18 cents) per month. Furthermore, farmers are reluctant to pay cash for agricultural information. This is an impediment for expanding the B2C model. However, farmers are more willing to pay for ESOKO services in kind. The outgrowers that ESOKO works with through its B2B model receive grains as a form of payment for ESOKO services (and then pay ESOKO cash).

**High cost of localizing content:** The localization of content especially when there are several languages and dialects is very expensive.

### ***Best Practices and Lessons Learned***

- Establish a thorough understanding of the user and design technology solution that addresses user needs and preferences.
- Use multiple ICT channels for the delivery of information to maximize reach and use.
- Voice messages are more effective compared to SMS but also require more resources for packaging and delivery of the messages.
- For market prices, SMS are more effective as farmers use the information as evidence when negotiating with traders.
- Collecting money directly from farmers for information services is very difficult. Building the infrastructure for manually collecting money from farmers will make service delivery very expensive and unfordable to farmers. It is possible to embed the payments for information services in airtime through a special agreement with mobile network operators and farmers, however, Ghana imposes an airtime excise of 9% on usage of calls and SMS and embedding information service fee in airtime will increase farmer payment by at least 9%. Cash transactions for paying information service fee is not practical until the use of mobile money becomes ubiquitous.

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## Annex I: Key Informant Interview Guide

1. Agricultural Solution(s)
  - i. What agricultural solution(s) is/are scaled up?
  - ii. Is it a new solution or a solution adopted and adapted from prior practice elsewhere?
  - iii. Have the solution(s) been tested and evaluated?
2. ICT Platforms and Tools and Roles in Scale up
  - i. What types of ICT platforms/tools are used for supporting the scale up of the agricultural solution(s)? How are they used? [*Probe: do they support one-way or two-way communication?*]
  - ii. How and why were the ICT platforms/tools selected?
  - iii. Have the solution(s) been tested and evaluated? What are the expected benefits of the solution(s)?
  - iv. What roles did ICTs play in scaling the agricultural solution?
  - v. If you were to scale up the agricultural solution without the use of the ICT platforms/tools you used for the project, how would it impact the intervention?
3. Current Reach and Scale-up Plan
  - i. Who are the end beneficiaries?
  - ii. Do you have a gender strategy? Are there impediments implementing the strategy? What are the impediments and how do/did you overcome them?
  - iii. How many beneficiaries did you reach? How was this quantified?
  - iv. Do you have a scale up plan? What are the key highlights of the scale up plan? If not, why not?
  - v. What is the ultimate scale of the intervention in [Malawi/Uganda/Ghana/Ethiopia]? [*Probe: how many people, households, provinces/districts are expected to be reached – by the project as well as when rolled out nationally?*]
  - vi. When/if the intervention is scaled up, which government entity will be responsible for hosting the initiative and scaling it up?
  - vii. When scaling up the intervention, will it be expanded in a decentralized fashion (for example expanded district by district) or to the whole country? Why is this approach chosen?
4. Gender

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- i. Do you have a gender strategy? Are there impediments implementing the strategy? What are the impediments and how do/did you overcome them?
  - ii. Do men and women have equitable access to technology (both agricultural and ICT)? If not, how do you ensure equitable access?
  - iii. Do women have access to the benefits accrued from the intervention? How was this measured?
5. Partnerships
- i. Who are the partners and what were their roles?
  - ii. What instruments are used to establish the partnership(s)?
  - iii. What are the coordination and enforcement mechanisms? [Probe: What is the level of integration of activities of the partners?]
6. Institutional / Implementation Approach
- i. How did the project coordinate its activities with national and local (such as district) level institutions?
  - ii. How was the private sector engaged? If not, why not?
  - iii. What was the level of integration with “user government” entities at different levels of the administrative structure of the country? [Probe: Was project office co-located? Embedded? Fully integrated with the business processes of user organization(s)?]
  - iv. Who was responsible for operational funding of the project? [Probe: Fully donor funded? Fully government funded? Co-financing arrangement? Partial/full cost recovery from users?]
7. Impacts
- i. What impacts are attributed to the intervention? How were impacts measured? [Probe: Farmer-level impacts? Institutional impacts? Policy level impacts?]
8. Spaces for Scaling-up
- i. **Financial:** What financial resources need to be mobilized to support the scale up of the intervention? What business model will be used? [Probe: government body paying for services as part of its mandate? Costs covered by user fees and other revenue such as from advertisements?]
  - ii. **Policy:** Does the policy and legal framework of the country support the scaling up of the intervention? If not, why not?
  - iii. **Institutional / organizational:** Is the government “user organization” ready to scale up the intervention? Does it have the capacity to scale up the intervention?

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9. Opportunities and Barriers

- i. **Opportunities:** What favorable opportunities contributed to the success of the intervention?
- ii. **Barriers:** What barriers limited the growth of the intervention? How were the barriers overcome? What barriers still exist? [Probe: probe for institutional, technological, policy/legal, financial, cultural and trained workforce barriers.]

10. Lessons and Best Practices

- i. What are the key lessons?
- ii. What are the best practices that can be replicated in other similar settings?