



Harnessing ICTs to Scale-Up Agricultural Innovations

Final technical report (30 months)

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Photo: A farmer shows off a t-shirt advertising the “Mlimi” Farmers Hotline in Mchinji, Malawi in April, 2019.

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Executive summary

This project aims to contribute to the overall challenge of scaling agricultural solutions in rural developing regions, specifically in sub-Saharan Africa, through a study focused on the role and contributions of ICT, including design and implementation. This study contributes to understanding the strategic role of information and communication technology in catalysing, enabling and supporting the scaling up of agriculture and food security solutions, including innovation, good practices for transitions from trials and pilot projects, organizational issues and restructuring, and policies. The study analyzes how ICT can best be integrated into agricultural and rural development programs and projects for solutions at scale.

This research has provided some valuable additions to both scale-up and ICT4D research discourse. It has also provided some key best practices for development practitioners based on tangible experiences compiled through various research activities. A major output for the project is a gender-responsive ICT4Scale framework which is aimed at providing consolidated evidence from the research to inform a conceptual approach in the scale-up of agricultural innovations using ICTs. This framework will provide the backbone for future briefing notes and practitioner guides on the topic. Both Farm Radio International and Farm Radio Trust intend to continue engaging key stakeholders in the evidence produced as well as in a community of practice in ICT4Scale.

The three main research activities of the project were (1) a meta-review of 15 international projects using ICTs to scale agricultural innovations; (2) four case studies of projects implemented in Malawi, Uganda, Ethiopia, and Ghana; and (3) field intervention research in Malawi. For the meta-review and case studies, an inductive content analysis was used to identify key themes from interviews of project implementers and project documents. The field intervention research was conducted to test the ICT components of an initiative to scale the uptake of soybean inoculants using interactive radio, text messages, WhatsApp groups, and a call centre. Household and telephone surveys, focus group discussions, key informant interviews and a gender analysis to assess the effectiveness of these ICT interventions.

Findings indicate that scaling through mobile phones and radio could reach thousands of people while contributing to increasing their knowledge and uptake of appropriate agricultural practices. Combinations of complementary ICT interventions also seem more effective than strategies based on a single medium. Results indicate, however, a much lower ICT access and use by women. There also exist important challenges to ensuring the sustainability of these initiatives, highlighting the need for scaling to go beyond the simple idea of reach and address the transformational changes required for the scaling to be successful. Systems change concerns the broader policy and institutional environment but also the social-cultural norms, practices and attitudes that underlie the behaviour of beneficiaries towards the innovation being scaled. This research demonstrates that ICTs can be used to facilitate interactivity, dialogue, and networking among stakeholders, to ensure that the scaling process is locally relevant while mitigating its potential negative impacts.

Building on these findings, a gender-responsive ICT4Scale conceptual framework was developed to guide the use of ICTs in scaling initiatives. Key elements of this framework include:

- The need to embed the ICT4Scale framework within existing frameworks and guidelines that have been recently developed to inform the scaling process. The use of ICTs to enhance scaling can, in effect, be considered a particular case of a broader scaling framework.
- The necessity to apply a responsible scaling lense when designing ICT4Scale initiative in order to anticipate potential negative and positive impacts of the scaling process. Of particular importance in the context of ICT-enhanced scaling initiatives are (i) the risk of exacerbating the digital divide by further excluding vulnerable populations with no or low access to ICTs; and (ii) the need for procedures guiding the responsible handling of the information collected.
- Although ICTs such as mobile phones and radio have the potential to reach large number of beneficiaries we should also consider the potential transformational role that they could play in catalysing changes in the system required for the scaling process to be locally relevant.
 - The field of ICTforAg provides examples of the various pathways by which ICTs can address agricultural system challenges
 - ICTs can support Social and Behaviour Change Communication strategies that can tackle the social-cultural norms and practices affecting how local populations perceived agricultural innovations.
- The use of multichannel communication can 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
- Most ICT4Scale projects tend to adopt gender-responsive approaches by improving women's access to ICTs; facilitating their participation and interactivity; building capacity of women to use ICTs; ensuring relevant content. More work is required, however, on the potential role of ICTs in gender-transformative initiatives addressing the social-cultural norms underlying gender inequality and women's disempowerment.
- Achieving sustainable impact at scale requires that ICT4Scale initiatives go beyond a project-based approach and works toward building a broader institutional/policy enabling environment. Work remains to identify the most appropriate sustainability models: e.g., government support, markets, public-private partnerships.
- Finally, monitoring and evaluation strategies for scaling initiatives need to go beyond the reporting of the number of people reached or adopting innovations and take into account the complex and dynamic nature of the scaling process.

A learning platform was put in place to facilitate the sharing of experiences among development practitioners and researchers involved in the scaling of agricultural innovations. Through the platform, we hope to initiate a continued reflection around the ICT4Scale framework in order to improve it and make it as relevant as possible to all stakeholders involved in scaling initiatives.

The research problem

Farm Radio Trust in collaboration with Farm Radio International, implemented a research project on the challenge of scaling agricultural and other development improvements to achieve sustainable impact. The research project, which ran from 2017-2019, examined the roles and contributions of information and communication technology (ICT) in scaling agriculture improvements for food, nutrition and income security, with a focus on sub-Saharan Africa. Specifically, the study investigated how ICT strategies are designed, implemented and tested in current and past projects to scale up solutions in areas of agricultural development and food security.

The following objectives were identified:

1. Develop a theoretical framework for analyzing and presenting ICT for scale initiatives covering key considerations including gender, type of innovation, types of partners driving and involved, market context, success factors.
2. Research, and propose working models for integrating ICT (and combinations thereof) for innovation at scale that consider partnerships, gender, business models, types of solutions, and institutional, social and political contexts.
3. Conduct field trials to test, refine and validate early findings
4. Extend the use of ICT for innovation at scale through sharing the project lessons and research findings across diverse sets of stakeholders.

These general project rationales remained the same throughout the life of the project. However, the importance of the intervention research increased from the inception period. More resources were allocated to this aspect of the project in order to build more robust novel evidence to back up our meta-review and case study work.

Over the life of the project, scale-up literature and discourse increased in quantity and regularity in the development field. Because of this, the literature review has evolved significantly to include recent studies and thinking. This also helped the project researchers to reorient the novel contribution that this project would make to the fields of scale-up research and ICT4D. The theoretical framework was built in an iterative way due to the ever-changing research landscape in scale-up but also from new information coming to light from our meta-review, case studies and intervention research. Due to this fact, the ICT4Scale framework will be the final project output released in December 2019 or January 2020.

Overall the project has significantly contributed to scale-up research. Specifically it has highlighted the need for practitioners to more carefully consider key communications aspects of projects beyond simple public relations and marketing and instead consider more complex ideas such as Social and Behaviour Change Communication, communication for development, and participatory communication theories. Furthermore, the project has provided some tangible empirical findings which largely supports long-held anecdotal evidence in the development industry. For example, the project clearly identified multi-modal

or multi-channel approaches as being a best practice in scale-up projects. While this is intuitively something that practitioners have championed, there was little empirical evidence to back up this claim outside of self-published grey literature.

The ICT4Scale research project ultimately helps to fill in some pieces in the existing scale-up literature by focusing specifically on the role of ICTs in the scale-up process as opposed to treating this technology as a technical tool at practitioners’ disposal. The communication implications of this view cannot be understated, as the research has demonstrated the importance of building in more robust communication strategy and visioning in the development of scale-up strategies.

Progress towards milestones

Life of project milestone achievement

Milestone	Achievement (in %)	Evidence/Indicator	Comment
6 month reporting period			
1.1 Research staff/team in place, including at least one additional research partner institution	100%	Dr Stanley Khaila, Berhane Gebru (FHI 360), Helene Shilomboleni recruited for research team. FRI and FRT fully staffed research team in place since 6 month mark.	Some changes in personnel occurred during the life of the project but the majority of the research team stayed intact.
1.2 Inception activities complete	100%	An inception meeting was held in Ottawa, Canada in June 2017. Inception report is available as an annex in previous progress reports.	
1.3 Strategic planning documents and start up activities finalized for implementation of research activities	100%	M&E strategy, Communications strategy, Gender strategy all completed and available as annexes in previous progress reports.	
1.4 Research approvals and ethics reviews complete	100%	Approved by the Malawi National Commission for Science & Technology (NCST).	One amendment was made based on shift in agricultural solution from PICS bags to soybean inoculant.
1.5 Literature review complete	100%	Literature review complete and available as an annex in previous progress reports.	Literature review will be used in final ICT4Scale framework.
1.6 Current and past projects reviewed and up to 20 selected for	100%	Meta review narrowed from 196 projects to 71 (inclusion criteria), to 15 chosen projects	15 projects were chosen due to inclusion criteria.

inclusion in meta-research		for meta-review.	
12 month reporting period			
2.1 Meta-research survey completed and meta-analysis planned	100%	All meta review activities completed.	Meta review manuscript currently in peer review process.
2.2 Informal learning platform established among programs, projects and other interested groups	80%	Learning platform engaged in both Malawi and internationally. Database of 819 individuals in learning platform.	Work on learning platform not complete. Learning events to continue beyond end of project.
2.3 Preliminary <i>gender-responsive ICT for Scale framework</i> developed	100%	Preliminary framework document produced, included in previous progress reports.	Update to this framework pending final design in early 2020.
2.4 3-4 case study sites confirmed	100%	Case study locations chosen in: Malawi (SRIIED), Uganda (CHAI), Ethiopia (DIAAE), Ghana (ESOKO) Final case study report included as Annex 1.	
18 month reporting period			
3.1 Meta-research and analysis completed and fed to framework document	100%	Meta review fieldwork completed with 15 diverse projects.	Meta review manuscript currently in peer review process.
3.2 Field work for 3-4 case studies completed	100%	Final case study report included as Annex 1.	
3.3 Preliminary plans for intervention research	100%	Final intervention research report included as Annex 2.	A switch was made from PICS bags to soybean inoculant in Mchinji, Malawi.
24 month reporting period			
4.1 Intervention research tested, completed and ready for analysis/write up	100%	Final intervention research report included as Annex 2.	
4.2 Final mapping of interested organizations	90%	Survey tool administered to online webinar participants.	Survey analysis is ongoing for future webinars. Only first webinar assessment complete

completed			(awaiting some responses) Direct research stakeholders: 45 Direct learning platform: 300 Indirect exposure: 474
4.3 Project demonstrates that ICTs have potential to accelerate scaling of application and, potentially, adoption, of agricultural innovations	100%	Final intervention research report included as Annex 2. Final Case study report is included as Annex 1.	Final Meta review manuscript in peer review process.
4.4 Project has developed best practices in key areas (including partnerships, gender, business models, context-specific considerations and combinations therein) related to ICTs use to enable the scaling up of solutions identified	85%	Final intervention research report included as Annex 2. Final Case study report is included as Annex 1.	Final ICT4Scale framework document pending. Will contain the main findings on best practices for practitioners. Anticipated delivery in December 2019. Final Meta review manuscript in peer review process.
4.5 Project has developed a set of ICT-for-scale models	85%	Delivery of final ICT4Scale framework pending	Final ICT4Scale framework document pending. Will contain the main findings on best practices for practitioners. Anticipated delivery in December 2019.
4.6 Project has documented and demonstrated key pathways and drivers/barriers to using ICTs for scaling up, with particular attention to gender	90%	Gender Assessment report for Malawi intervention research included as Annex 3. Delivery of final ICT4Scale framework pending	Lilongwe University of Agriculture and Natural resources consulted on the Gender Assessment. Final ICT4Scale framework document pending. Will contain the main findings on best practices for practitioners. Anticipated delivery in December 2019.
30 month final reporting period			
5.1 Framework and models developed for ongoing use in the agricultural sector and lessons and strategies relevant for other contexts and sectors	90%	Final research results webinar conducted, presentation slides and video recording available in Annex 5. Delivery of final ICT4Scale	Writeshop conducted in Dar es Salaam, best practices identified.

		framework pending	
5.2 Development of materials reflecting project results and dissemination	85%	<p>Final results blog produced and published on FRI website.</p> <p>Initial briefing note produced (to be updated in 2020 with most recent results)</p> <p>Final research results webinar conducted, presentation slides and video recording available in Annex 5.</p> <p>List of presentations at conferences and meetings included in Annex 5.</p>	<p>Final ICT4Scale practitioner document and companion briefing note to be finished by January 2020.</p> <p>At least 3 more webinars will be conducted as a series in 2020.</p>
5.3 Two papers drafted for submission to relevant journals	75%	One paper submitted (in peer review process at <i>Information Technologies & International Development</i>)	2nd paper to be submitted to journal in 2020.
5.4 Research findings/outputs presented and discussed in two international seminars	100% +	Research presented at 12 international conferences and 3 local Malawi stakeholder meetings. List of presentations and conferences included in Annex 5.	Estimated over 2000 people in attendance for these presentations.
5.5 Evidence that at least 125 organizations have greater awareness and understanding of how ICTs can improve the scaling up agricultural innovations	100%	<p>Survey tool administered to online webinar participants (results pending).</p> <p>Major attendance at results sharing webinar in October 2019.</p>	<p>Live webinar event stats:</p> <ul style="list-style-type: none"> ● 20 in-person attendees ● 122 online attendees ● 142 total attendees ● 131 organizations represented <p>Engagement with webinar recording:</p> <ul style="list-style-type: none"> ● 459 impressions ● 116 views
5.6 Project demonstrates that it has contributed to developing better tools for capturing, and strengthening empowerment impact, as a result of relevant and appropriate uses of ICT for scale	80%	<ul style="list-style-type: none"> ● Delivery of final ICT4Scale framework pending. ● Final intervention research report included as Annex 2. ● Final Case study report is included as Annex 1 ● Final research results webinar conducted, presentation slides and video recording available 	<p>Final results sharing to continue into 2020 with:</p> <ul style="list-style-type: none"> ● Polished final ICT4Scale framework / Practitioner Guide ● 4-page briefing note ● 3 more webinars in 2020 ● Regular email communication with Learning Platform.

		in Annex 5.	Final Meta review manuscript in peer review process.
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Synthesis of research results to date

Research Results by Objective

The main objective of this project is to design a conceptual framework to guide the use of ICTs in gender-responsive scaling-up initiatives – i.e., the ICT4Scale conceptual framework. Several research activities have thus been designed to inform the design of our ICT4Scale framework, including a literature review, a meta-review, case studies and intervention research. Also contributing to the design of the ICT4Scale framework is the interaction with other researchers and development practitioners involved in that field through our learning platform. Below, we describe the progress made during the life of the project on these different research activities. These are presented under the four specific objectives of the project.

Objective 1: Develop a theoretical framework for analysing and presenting ICT for scale initiatives covering key considerations including gender, type of innovation, types of partners driving and involved, market context, success factors.

ICT4Scale framework

A first draft of our ICT4Scale framework was submitted one year ago at the 12 month mark in the project. We anticipate to have a polished final version of this primary output in early 2020 for wide distribution to our learning platform members. The delay in completing this output is due to the intervention research ending later in the project than anticipated.

The framework will build upon existing frameworks and guidelines recently developed to inform the scaling process. In effect, the use of ICTs to enhance scaling can be considered a particular case of a broader scaling framework. The particularity of the ICT4Scale framework will be to highlight and more systematically discuss the potential role of ICTs at different stages of the scaling process. The three research components of the project described below have provided good insight into the drivers and barriers for successful ICT-enhanced scaling initiatives. We will be updating the ICT4Scale framework in both narrative and graphical form to reflect the conclusions from our research activities in early 2020 but here are a few key points to highlight.

- Existing guidelines proposed to inform the design and implementation of scaling initiatives are also relevant to ICT4Scale initiatives and should assist in their design and implementation.
- ICT4Scale initiatives should also consider the issue of responsible scaling and reflect upon potential negative and positive impacts of the scaling process and what is the optimal scale. Of particular importance in the context of ICT-enhanced scaling initiatives are (i) the risk of exacerbating the digital divide by further excluding vulnerable populations with no or low access

to ICTs; and (ii) the need for procedures guiding the responsible handling of the information collected (consent, privacy, security).

- ICTs such as mobile phones and radio have the potential to contribute to reaching large number of beneficiaries but can also play a transformational role in facilitating changes in the system required for the scaling process to be locally relevant. The transformational potential of ICTs is illustrated below:
 - As demonstrated in the field of ICTforAg or e-extension, ICTs can address a number of agricultural system challenges such as (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.
 - More broadly, ICTs can play a key role in supporting social and behaviour change communication (SBCC) strategies that can address the social-cultural norms, practices and attitudes that underlie the behaviour of beneficiaries towards the innovation being scaled. In our view, the transformational role that communication could play in the scaling process has not been fully considered in existing scaling frameworks.
 - The majority of ICT4Scale projects tend to adopt a gender-responsive approach by improving women's access to ICTs; facilitating their participation and interactivity; building capacity of women to use ICTs; ensuring relevant content. These can lead to increased knowledge and adoption of promoted practices and an increased sense of self-confidence. Further work is required, however, to examine the potential role of ICTs (and communication) in gender-transformative initiatives that would tackle the social-cultural norms underlying gender inequality and women's disempowerment.
- Ensuring the sustainability of ICT4Scale initiatives is still a challenge in part because most of them are being designed and implemented within the context of relatively short-term projects. There is therefore a need to examine how the broader institutional/policy environment could support these initiatives in the long term. For example:
 - Innovations being scaled need to be integrated within existing public institutions and infrastructure to garner political agency and support
 - Government policies are required to address low ICT access (power, connectivity, availability, affordability).
 - ICT-enabled market-based approaches can reduce transaction costs and strengthen market linkages
 - Effective multi-stakeholder partnerships, including public-private partnerships, need to be built to support and sustain scaling process - e.g., interactive radio platforms

- Monitoring and evaluation approaches used in ICT4Scale initiatives tend to focus on the “reach” dimension of the scaling process and not on the systems changes required to support the scaling process. Consequently, measures of success is often interpreted in terms of the number of people uptaking the proposed innovation. This is important but not sufficient to assess whether an initiative is successful at achieving sustainable impact at scale. There is a need to develop flexible M&E approaches that will evaluate the scaling process itself and its transformative role. Within that context, ICTs offer an opportunity to collect quality data in real-time and on an on-going basis along the scaling process.

Objective 2: Research, and propose working models for integrating ICT (and combinations thereof) for innovation at scale that consider partnerships, gender, business models, types of solutions, and institutional, social and political contexts.

Meta-Review

The purpose of the meta-Review is to examine several existing and past development initiatives to better understand the processes, constraints, and opportunities characterizing ICT-enhanced scaling-up initiatives. A draft protocol for the meta-Review was prepared one year ago.

From an initial set of about 196 projects identified following an on-line search, a subset of 71 projects was selected on the basis of a set of 20 criteria. These criteria were then converted into ‘scores’ in order to more easily classify or rank the 71 projects. Among others, we put some emphasis on the ‘scaling’ objectives of the projects – number of people they intended to impact; the availability of documents to assess impact; the use of a combination of different types of ICTs; and the relative importance of the gender component. Projects were then ranked using their score on the different criteria leading to the selection of 25 projects for the meta-review. Contacts were initiated with project implementers and, at the end, 15 development projects using ICTs to scale innovations in agricultural and/or food and nutrition security were included in the meta-review analysis and report.

Our meta-review consultant researcher conducted 17 semi-structured interviews with project coordinators and staff from these 15 projects. An inductive content analysis was used to identify key themes from the interviews in addition to 45 project documents and 30 peer-reviewed journal articles and gray literature materials. The paper contributes to the discussion on mapping impact evidence from ICT-enhanced scaling up initiatives and to our overall understanding of the challenges, lessons learned, and opportunities surrounding the activities of ICT for agricultural development (ICT4AD) projects.

Some of the key findings of the meta-review are as follows:

1. Interactive ICT tools and platforms, especially radio, are valuable in their capacity to interpret and translate complex agricultural information, e.g., climate and weather advisories, into relevant and applicable content for farmers’ unique circumstances.
2. Most projects conceptualized and measured impact at scale on the basis of the number of beneficiaries experiencing changes in knowledge, attitudes and practices around specific

innovations. Such approaches may, however, overlook the complex socio-ecological dynamics that affect food security in rural livelihoods.

3. Many of the ICT-enabled projects examined in this study had gender strategies with objectives to empower women, but only a handful have engaged in efforts to tackle social norms, e.g., division of labor and income spending decisions, that create and exacerbate inequalities in the first place.
4. Scaling efforts are more likely to succeed when new innovations are integrated within existing public institutions and infrastructure as this can lend them additional resource support and political agency from authorities.
5. Lasting and meaningful change requires a thorough understanding of specific smallholder agriculture system dynamics, and then a realignment of innovations to contribute positively to such processes, in a manner that works collaboratively with target populations.

The final meta review is currently in the peer-review publishing process and is therefore not yet publicly available.

Case studies

At the first 6-month stage (October 2017), a first draft of the case study protocol was submitted as part of our ethics application to the National Committee on Research in the Social Sciences and Humanities of Malawi. At the February 2018, planning meeting, it was decided to select four case studies from Uganda, Ethiopia, Ghana and Malawi.

The following are the final case studies:

1. Enhancing Resilience to Water-Related Impacts of Climate Change (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.

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.

ICT4Scale researchers travelled to Uganda, Malawi, Ghana and Ethiopia and conducted a total of 32 interviews during the period January 14 – February 15, 2019. The interviews in Uganda, Malawi and Ghana were conducted by Berhane Gebru; and the interviews in Ethiopia were conducted by George Vili and Berhane Gebru. Interview participants with the most direct knowledge of the cases from each partner

organizations were identified by the ICT4Scale researchers and managers of the projects selected for the case study.

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.

Some of the key themes emerging from the case study work are:

1. ICTs can provide improved access to information at a scale not possible by traditional extension
2. Use of ICTs can enhance farmers' ability to use the promoted agricultural solutions especially when ICTs are complemented by traditional face-to-face extension methods
3. ICTs can help improve production and create market opportunities to farmers overcoming barriers related to geography and poor traditional extension infrastructure.
4. 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
5. ICTs are especially good at avoiding "dilution of content" when compared to traditional training models by ensuring consistency in messages exchanged between research institutions, extension, and farmers
6. ICTs can be used to enhance inclusion of women by facilitating their access and use and selecting delivery channels suitable for female audience, and packaging content addressing the types of agricultural activities women are engaged in. Most initiatives do not, however, systematically address the social-cultural norms and practices that may underlie gender inequalities.

The final case study report is attached to this technical report as Annex 1.

Objective 3. Conduct field trials to test, refine and validate early findings

Intervention Research

The Intervention Research component is the main contributor to Objective 3. Its main aim was to assess ICT strategies that are most effective and efficient in scaling agricultural solutions. In the first 18-month report, A Participatory Radio Campaign (PRC), presented as an Annex in the 18-month report, enhanced by ICTs including the call centre¹ and SMS push and pull was deployed for the promotion of soybean inoculant. Content of the PRC was generated from National Agriculture Content Development Committee (NACDC) by experts and knowledge partners based on results from the baseline survey and the rapid assessment. The PRC was modified based on feedback from the other ICT platforms for instance the call

¹ Farm Radio Trust is utilizing its very popular "Mlimi Hotline" call centre as one of the main ICTs that is complementing the radio program.

center and SMS pull messages. This means that the ICT platforms informed each other's content in order to make mid-course corrections based on user-level feedback.

The initial plan was to have the PRC run from 6 November 2018 to 22 January 2019. However, a value chain approach was adopted for the PRC from production to marketing of inoculated soybeans. This was to address messages such as access to inputs, storage and utilization of soybean inoculant; crop stand and management of inoculated soybean in the field; post-harvest preparations and handling & marketing of soybean. Airing of the radio programs commenced on 6 November 2018 on 'Mudzi Wathu' Community radio station in Mchinji and ended 28 May 2019. The last two months of the PRC were an addition that the research team decided to implement. This was to allow for a longer period of time where explicit ICTs were used in a manner where evaluation was possible.

Specifically, the intervention research was guided by the following research questions:

1. Was scale up of soybean inoculation improved?
2. What was the role of the ICT tools in the scale up?
3. What was the relative role of the different ICT tools used for supporting the scale up?
4. What was the role of institutions supporting soybean inoculation in the scale up?
5. What was the impact of inoculation on soybean yield?

The overall findings of the intervention research are as follows:

The ICTs that were used in the project demonstrate that ICTs have the potential to accelerate scaling of application and potentially adoption of agricultural innovations. This is evidenced by the upscale of soybean inoculation in the intervention site.

Different institutions played various roles in the scale up by providing different types of support including physical demonstration on the correct use of soybean inoculant and its benefits to yield, provision of free inoculant and advice on how to use soybean inoculant. Other institutions like farmer organizations aided farmers with the process of acquisition of soybean inoculant through loans/credits. Others still played a major role in content generation for the ICTs and being resource persons for radio programs enhancing credibility. Engagement with the suppliers of soybean in the PRC helped to balance the demand and supply of soybean inoculant by providing relevant information about access and usage.

Inoculation of soybean also had an impact on the yield where there was an increase in yield from 662kg/ha to 1,205kg/ha before and after inoculation among the farmers that had applied inoculant. Government crop production estimates of soybean in the EPAs under which the intervention took place demonstrate that there has been an increase in yield of soybeans in the intervention sites. Despite the difficulty in attributing the increase in soybean yield to soybean inoculant as there were several factors that influence yields that the research did not control, there was more acreage of land under inoculation in Mchinji. It is therefore safe to conclude that inoculation contributed to the increase in yields of soybean in the intervention sites.

In terms of gender considerations, it is best to understand the cultural dynamics of communities involved in ICT based scaling up initiatives for instance ownership of ICTs, decision making process in household expenditure and gender roles. For better participation, it is necessary that all members, including women, have access to the ICT platforms for scale up. As such, both men and women need to be equally involved in scale up initiatives as men are considered culturally superior and control expenses of bigger purchases such as ICTs. Discussions from radio programming with farmers indicate that women are used to letting men lead in decision-making on household expenses despite being given an opportunity to contribute; a push is therefore needed for more empowerment of women.

The gender component of the intervention research identified barriers and opportunities for different gender groups in using ICTs for adoption of agriculture solutions. Opportunities in using ICTs for scale up included access to ICTs, willingness to pay for the ICTs to access agricultural solutions, gender awareness, trust in agricultural messages accessed through ICTs and the message sharing behavior among the farmers. The hindrances were cost of ICTs, lack of knowhow on use of ICTs, cultural and gender barriers, illiteracy, ICT infrastructure, inadequate supply of the technology in this case soybean inoculant due to increased demand and lack of interest.

The conceptual framework illustrates the transformative pathways that enable women, and different gender groups in the rural areas to take advantage of the ICTs for innovative agriculture, and these include: adult literacy training, improving access to ICTs such as radio and phones through provision of loans; provision of training on the use of ICTs for agriculture development; critical examination of gender norms and conducting gender training (husbands and wives trained together) to improve women's access to ICTs, resources and empowerment in decision-making.

Final intervention and gender reports are attached as Annexes 2 and 3

Objective 4. Extend the use of ICT for innovation at scale through sharing the project lessons and research findings across diverse sets of stakeholders.

Learning platform

Objective 4 is associated with the sharing of project findings across multiple stakeholders primarily using a learning platform. It is important to highlight that the purpose of the learning platform is not limited to the dissemination of our results but also to create a space of knowledge co-creation among parties interested in that issue.

During the life of the research project the research team presented our approach and findings at the following events:

- **September 6, 2017 (Ottawa, Canada).** Presentation at the Global Affairs Canada Feminist International Aid Policy Event.

- **October 30, 2017 (Durban, South Africa).** Presentation and booth at the 3rd AFAAS Africa-Wide Agricultural Extension Week.
- **Nov. 2, 2017 (Ottawa, Canada).** Oral Presentation (B.Pelletier) about ICT4Scale project at the University of Ottawa (Department of Geography) as part of the Phips-Langlois Seminar Series, titled Scaling-up agricultural innovations in sub-Saharan Africa: The role of information and communication technologies. Presentation was attended by faculty members and students.
- **Feb. 8, 2018 (Ottawa, Canada).** Learning Event and Webinar held at Farm Radio International, Ottawa titled Going Big for the Long-term. Insights from scaling-up & sustaining ICT-enabled approaches. The event included an oral presentation (B.Pelletier) about the ICT4Scale project and presentations about two CIFS RF projects involving FRI: Achieving Impact at Scale and Economic Viability of Extension Services (AIS) in Ghana, and the Scaling-up Improved Legume Technologies (SILT) in Tanzania.
- **Feb. 21, 2018 (Lilongwe, Malawi).** National Consultative Meeting. Learning Event introducing and launching the ICT4Scale project and its learning platform. A range of stakeholders from the Malawi government and civil society attended the event.
- **March 9, 2018 (Washington, DC).** Panelist (B.Pelletier) in a break-out session at the event Digital Development – the next 10 years, organized by USAID, in Washington, DC. The 75-minute session was titled How Digital Tools are Transforming Agriculture Extension.
- **March 15-16, 2018 (Lusaka, Zambia).** Oral Presentation (C. Mloza-Banda) at the 2nd African Conference of the International Telecommunications Society. The presentation was titled Her Voice on Air: Using Radio and ICTs to support Women Farmers in Africa by Hudson H.E., Hampson K., Leclair M., Montpetit C., Mweruka P., Pelletier B., Mloza-Banda C., and Chapota R.
- **May 8-10, 2018 (Lusaka, Zambia).** ICT4D conference. C. Mloza-Banda participated in a panel titled Digital Agriculture: Scale and Sustainability through Government Partnership and Ownership.
- **June 14, 2018 (Washington, DC).** The ICTforAg conference (June 14, 2018, Washington, DC) where B.Pelletier was a panelist with D. Spielman (IFPRI) and M. Persaud (Viamo) on a session titled: How to Reduce Gender Divides in ICTforAg Programs?
- **September 25-27, 2018 (Purdue University, West Lafayette, IND).** B. Pelletier attended and presented a poster at the Scale-up Conference at Purdue University on some of our preliminary framework ideas.
- **April 11, 2019 (Lilongwe, Malawi).** Harnessing ICT4scale Stakeholder workshop. The entire research team engaged directly with key government, NGO and other stakeholders. Attendees gave feedback on the intervention research and overall research approach.
- **April 31, 2019 (Kampala, Uganda).** ICT4D Conference. G. Vilili presented our approach in our intervention research, focusing on Mlimi Hotline and the participatory radio programming.
- **May 17, 2019 (Montreal, Canada).** Canadian Association of African Studies, Annual Conference: Presentation on ICT4Scale research project as part of a panel of 4 presenters.
- **September 3, 2019 (Accra, Ghana).** AGRA Forum (AGRF). Rex Chapota (FRI staff) general presentation on ICT4Scale at IDRC side meeting.

- **October 24, 2019 (Ottawa, Canada).** Final ICT4Scale results sharing webinar with live and online participants.

Unexpected results

Many of the research findings were in line with what was discussed in the literature about scaling and ICT4D and gender but there were a few ‘surprises’.

1. The issue of responsible data handling was not part of our initial conversations on the use of ICTs in scaling agricultural solutions. Perhaps it should have been as it is one of the nine Principles for Digital Development. In the context of scaling initiatives, there is the potential to collect large amounts of personal data thus further exacerbating the risks for both the end-users and the organizations collecting the information. As a result, the development of procedures and guidelines for the handling of personal data needs to be an integral part of an ICT4Scale framework
2. Although we were well aware of the gender digital divide from both the literature and our own work, the lack of access to ICTs by the women involved in the field intervention research in Mchinji, Malawi was more pronounced than anticipated. This further highlighted the importance of looking at the broader institutional/policy environment and its role in enabling access and connectivity in these rural communities, especially for women.
3. In most of the projects that we examined (including many FRI projects), there was relatively less conceptualisation of the scaling process itself than expected. For example, no clear scalability assessment or visioning exercise about potential impacts or optimal scale were performed. Reflections on scaling strategies and pathways were found in projects that were part of the CIFSRF program but otherwise, scaling was not always explicitly reflected upon. With the recent development of scaling frameworks and guidelines, it is likely that more projects will tackle these issues.

Research partnerships and governance

The capacity of both FRI and FRT to deliver on complex research projects has been bolstered significantly due to this project. Furthermore, FRT in Malawi has further strengthened its position as a thought leader (and policy advocate) for better inclusion of ICTs in agricultural extension in the country. For example, FRT has successfully lobbied for the inclusion of role of ICT innovation in the National Agriculture Policy as well as engaged the Department of Extension Services to spearhead the role of ICT in the National Agriculture Extension Strategy. Furthermore, FRT has played a key coordination role in their co-creation of a National Agriculture Content Development Committee which is tasked with standardization of e-extension content for the yearly agriculture season. These partnerships are of the type that can provide a truly sustainable way forward in institutionalizing the ICT4Scale principles into government policy.

Research ethics

The ICT4Scale project provided an opportunity for both FRI and FRT to go through ethics approval for the collection of data in the intervention research component in Malawi. This was approved by the Malawi

National Commission for Science & Technology (NCST) in 2017 with an amendment in 2018. Furthermore, FRI has developed a Responsible Data framework in order to integrate the latest thinking on responsible data handling into the research recommendations. This has also significantly bolstered FRI's internal capacity to do ethical research and handle large amounts of data.

Use and dissemination of results

A project website has been setup on the FRI corporate website. This will serve as a landing page for interested individuals and will be where we host and track the usage of project research reports.

<https://farmradio.org/ict4scale/>

So far the project researchers have attended a multitude of international conferences to share results (see above). Furthermore, in October 2019 the research team held a final results sharing webinar called "ICT4Scale: A Roadmap for Scaling-Up." This was attended by:

- 20 in-person attendees
- 122 online attendees
- 131 organizations represented

A recorded version of the webinar ([available on Youtube](#)) has so far seen:

- 459 impressions through email
- 116 views

The plan is to continue with momentum from the first webinar to host a series of at least 3 other webinars featuring case study participants and others involved in the research. A short 4 page briefing note will also be shared along with our final ICT4Scale framework/practitioner guide in early 2020. Finally, a second peer-reviewed submission will be made to an open-access journal in 2020.

Progress towards AFS themes

Increasing agricultural productivity (Availability)

The ICT4Scale project is not directly addressing the development of new and improved agricultural solutions. Instead, it has developed a framework which can inform projects that have this goal. Our case study, meta-review and intervention work has provided good evidence around how ICTs can contribute to better agricultural productivity.

Improving access to resources, and/or markets and income (Accessibility)

Similar to above, this research project is not directly trying to address issues around improved access to resources. However, access to resources and markets is a common theme that has appeared across our meta review and case study work. Even in the intervention research on soybean inoculant, access to inputs and monetary resources has been a critical factor that can either drive adoption or constrain it.

Improving nutrition (Utilization)

Four of the meta review projects are directly related to improving nutrition. Our research has shown the importance of nutrition programming particular for maternal and child health. However, structural

barriers remain a significant factor in allowing marginalized groups to access information via mobile phones. The gender analysis by the Lilongwe University of Agriculture and Natural Resources further explores this.

Informing policy

Work with policy makers in both Malawi and more internationally has continued. So far it has been mostly targeted through formal meetings and conferences. Particularly in the case of our Malawi-based key stakeholders, we feel the project has created real sustained relationships between FRT, stakeholders and between one another. These relationships are precisely the types of institutional connections that are critical in creating both impactful and contextualized ICT4Scale interventions.

Currently, with the Malawi based team, we are working with the Department of Agriculture Extension Services (DAES) to develop e-extension strategy to outline detailed process of using ICTs in agriculture extension and advisories. This strategy will ensure that ICTs are given recognition, resources and attention in agriculture transformation. Recent studies on Assessing and Strengthening Malawi's Pluralistic Agricultural Extension System from other institutions have shown a strong positive impact of radio programming on technology awareness and strong association between access to interactive radio programming and women's and men's empowerment scores. With the results from the ICT4Scale project, we have a good grounding to influence the use of ICTs in agriculture being the actors in ICTs. With the Malawi stakeholders, we are also lobbying the government to remove import duty tax on the radios given to ICT hubs so that the cost of the radio sets could be manageable even by farmers on their own. This will help promote greater listenership to agricultural programs.

By working alongside policy-makers, and in particular those involved in agricultural extension, the research team in Malawi has created a level of trust that is necessary to build the enabling environment around ICT scale-up. It is particularly useful in that it provided a forum for FRT to confirm that it intends to enhance the effectiveness of traditional extension workers instead of replacing them with ICT (a major fear that was stated early in the project).

Project outputs

Output	Comment
Fully completed outputs	
Annex 1: Final Case Study Report	Final Case Study Report including 4x case studies.
Annex 2: Final Intervention Research Report	Endline report for the intervention research in Mchinji, Malawi.
Annex 3: Gender Assessment	Gender Assessment completed by the Lilongwe University of Agriculture and Natural resources.
Annex 4: Intervention Research Baseline Report	Original baseline report for the baseline in Mchinji, Malawi.
Annex 5: Conferences and Presentations	A list of 10+ conferences and seminars that the research team presented at (including slides).
Annex 6: Briefing note v2	An early output in the project, available publicly here .
ICT4Scale website	The website http://farmradio.org/ict4scale will be used into 2020 to post project reports, videos etc.
First ICT4Scale webinar	Conducted on October 24, 2019. Slides publicly available here . A recording of the webinar is available on Youtube here .
Completed but publicly unavailable at the time of this report	
Meta-Review Manuscript	Currently in the peer review process with the open access journal <i>Information Technologies & International Development</i>
FRI Responsible Data Guidelines	These guidelines, while critical for building our framework design, contain internal information about FRI. Once a final policy is complete this will be made available publicly on FRI's website.
FRI Responsible Data Rapid Assessment	
Incomplete at the time of this report	
ICT4Scale Framework and Practitioner Guide	We anticipate completing a version of this in December 2019 with a fully designed/published version in early 2020. This will inform both the peer reviewed article and briefing note below.
Second peer reviewed article	It was anticipated that some academic publishing would take place well after the end of the project. We will be publishing an article on the ICT4Scale framework in 2020.
Final 4-6 page briefing note	To go with the longer practitioner guide, we will be designing a short briefing note with our final findings in early 2020. We had hoped to have this ready earlier but wanted to have all of our findings available first.
Future webinar recordings	We anticipate at least 3 more ICT4Scale webinars to be hosted by FRI and FRT in 2020.

Problems and challenges

Research staff turnover

Throughout the project the research team experienced some turnover in key staff. With Farm Radio Trust the senior coordinator as well as program officer/researcher left the organization mid-project. However, the transition to new research staff occurred very smoothly, with little impact on project timelines. This is a credit to the leadership at FRT. For FRI, there were two changes in financial assistants on the project which caused some discontinuity in year-over-year financial reporting. Ultimately this was remedied in the final year of the project.

Political instability in Malawi

In 2019 post election political instability caused significant disruptions to project activities in Malawi. Protests in Lilongwe and beyond caused some delays in data collection and the general ease of travel around the country for research meetings. For example, in July 2019 the team was to meet in Lilongwe for a final write-shop. Due to protests in Lilongwe it was decided to move this event to Dar es Salaam to avoid any safety or logistical issues. While it was more expensive to run the meeting in Tanzania, it was ultimately the right decision in order to move project activities forward while keeping all of the research staff safe.

Delays in key activities

Early in the project the meta-review took longer than anticipated to complete. Due to this, the research team decided to engage an independent researcher to finish the actual field work on the meta-review, allowing this activity to be completed. Similarly, the intervention research continued several months longer than the initial work plan indicated. This was due to the decision by the research team to lengthen the radio programming in order to collect more rigorous data on ICT use. This extension of the intervention research was in the end a good decision. Because of both of these delays, there were some issues with finishing some of the final outputs since data analysis was needed before publishing these documents. The main ICT4Scale framework will be published and disseminated after the end of the project period due to the effect of these delays.

Confounding factors

The intervention research focused on soybean inoculant in Mchinji, Malawi. The reality is that there was already an information ecosystem in place around this topic through various other radio programs and on-the-ground work by USAID Feed The Future. This caused some issues in disentangling the results from the ICTs in the intervention research from other confounding factors. However, we believe that this more realistic scenario provides a more true-to-life situation that reflects real world challenges for practitioners. Real projects will never have “lab like” attribution for their intervention so this situation has given the research team a good idea of what to include in scale-up practitioner tools.

Late engagement of international learning platform

The team wanted to wait to engage a large international audience until some tangible research results were available. The final results-sharing webinar occurred in October 2019, giving little time for more interaction with this learning platform. However, both FRI and FRT have identified the continuing of webinars, outreach and general promotion of ICT4Scale as a strategic goal for both organizations moving even beyond the end of this project. We therefore will be continuing engagement with the international learning platform well into 2020 to share more results and continue the significant momentum from our first webinar.

Reflecting on ethics

As mentioned in the synthesis section of this report, data privacy and responsible data handling emerged as major issues in scale-up projects during this research. We did not intend to delve into this topic but it was clear that the risks and impact from poorly conceived data policies could be significantly magnified when innovations are scaled to large numbers and over large geographies. Therefore the FRI team decided to work with a world leader consultant on a Responsible Data Framework which will inform our final practitioner guide on ICT4Scale.

Overall assessment and recommendations

Overall this research project was a success in the sense that it has clearly demonstrated novel findings for the field scale-up as well as it has built the capacity of both FRI and FRT to deliver on complex research outputs. However, the project is not without its drawbacks. The time horizon for a scale-up project likely needs to be longer if it is to contain an intervention research component. Following farmers through a single season in Malawi simply was not enough time to disentangle the multitude of factors that go into farmer decision-making. Similarly, this project had a strong focus on informing and actually changing the practice of practitioners in the development space. While we made some inroads with our learning platform, the reality is that this type of engagement only works well when you have solid research results in-hand already. This means there is not adequate time to do ongoing and meaningful engagement with stakeholders and measure long term changes in knowledge and uptake of research models. Because this project was largely focused on meta-review of other projects, it was not easily fit into IDRC's AFS grant reporting structure which was clearly designed to report on specific agricultural innovations as opposed to meta review and the uptake of new theoretical frameworks. Projects like these likely need to have different reporting requirements than more focused agriculture and food security projects.

The research team found working with the team from IDRC helpful and the reporting reasonable in terms of regularity and depth. Having project officers at the grant-making agency that truly understand the subject matter is a major strength in the context of this project.

Key project numbers

Final tally of engaged stakeholder contacts

	Direct (actively involved)	Direct (Learning platform)	Indirect (passively involved)	Grand Total
Academic/Research	1	74	37	112
Civil society (NGO or Donor)	2	164	400	566
Extension staff	31	31	4	66
General public	2	1	1	4
Media	3		11	14
Other (please specify)	1	4	1	6
Policymaker	3	20	19	42
Private sector	2	6	1	9
Grand Total	45	300	474	819