Lessons Learned in Developing a Digital Advisory Tool for Agriculture Extension Officers in Uganda

Sustainable Optimization of Agricultural Production (SOAP) Project

Project Overview

Uganda hosts the largest number of refugees in Africa. Over 1.5 million people, mainly from South Sudan and the Democratic Republic of the Congo live in settlements in the north and west of the country. Refugees in Uganda are given their own small (30m x 30m) plot of land and have the freedom to work and access to education and health services. However, the majority of refugee households depend on food aid assistance and have limited livelihood options. Refugees are able to plant crops on their small plot of land, and can rent other land to engage in agriculture, but many have limited farming knowledge and skills, and face further challenges of counterfeit seeds, lack of credit and insurance services, fair access to markets, and the increasingly erratic rainfall resulting from climate change.

Agricultural extension workers provide guidance, information, services, and connections to farmers in Uganda, both among the host community and the refugees. These extension workers can be from the local government (often focused on standards enforcement), non-governmental organizations (who focus on individual and organizational capacity building), and the private sector (who sell seeds and equipment, or provide specialized services, such as milling). Extension workers give advice to individuals or groups based on their interest and situation to improve the productivity and quality of their crops. Action Against Hunger identified a need for a digital advisory tool that could be used by these extension workers to provide more accurate and tailored advice to farmers, with a view to strengthening farmers' long term food security and household resilience.

Action Against Hunger (ACF) implemented the one-year "Sustainable Optimization of Agricultural Production (SOAP)" project in partnership with Wageningen University in the Netherlands, and Cabral Tech, a software application start-up company in Uganda. The project was implemented in the Adjumani Refugee Settlement and surrounding host community villages in Northern Uganda.

SOAP has three primary areas of focus, all of which build on Action Against Hunger and partners' experience: Farmer profiling or segmentation: For the past two years, Action Against Hunger has invested in the use of digital tools and data-driven optimization of livelihoods programs for smallholder farmers in refugee-hosting districts of Uganda and

adopted the segmentation process to increase the efficiency of quality inputs available. The farmer segmentation process, involving big data solutions, helps to categorize farmers according to their needs, allowing resources to be tailored to address those specific needs of each beneficiary category.

The project's goal was to develop a digital advisory tool, that extension workers in Uganda could use to access information on improved optimization of farmland to be more productive. Action Against Hunger explored this by:

- Identifying optimal small farm models through modelling and human-centered design.
- Developing and piloting a small-scale farm diagnostic advisory tool, in the form of a web-based tool, to improve data-driven decision-making.
- Explore approaches to ensure wider uptake of small farm optimization approaches and tools.

The project was an ambitious collaboration that brought together the farm modelling expertise of Wageningen University, the web-based tool technical experience of Cabral Tech, and the community engagement and mobilization capacity of Action Against Hunger. ACF has developed a culturally contextualized Optimized Land Use Model (OLUM) for use by refugee households with limited land availability. Wageningen University has developed a whole farm data-driven modelling software with the ability to analyze trade-offs on multiple outcomes including income, nutrition, labor, soil fertility and resilience. Together, this project aims to combine these efforts, and work with Cabral Tech to develop an innovative web-based tool for extension farmers. Cabral Tech is an agriculture software development company with extensive expertise in design, development and distribution of specialized farm management software and mobile applications that provide decision-making solutions and innovative tools dedicated to agriculture.

During implementation, Action Against Hunger collected primary data from 18 households, with three households selected as a representative for each of the six different farm typologies identified in a 2019 survey conducted. ACF tested ten soil samples and the test results were submitted to Wageningen University. Wageningen University utilized the primary and secondary data provided by Action Against Hunger for identification and validation of the optimal farm models in each farmer segment and scenarios were generated and presented. The University designed relevant farm models using their Farm Design software, and these were then transferred to Cabral Tech Ltd in order to develop a web-based tool. Cabral Tech Ltd developed a smartphone application that could be downloaded from the Google Play store, so extension workers could access the tool on their mobile phones or smart devices and provide it to farmers. After extensive exploration, Action Against Hunger found that the smartphone application developed for this project did not fully match the actual and envisioned features of the browser-based Farm Design tool.

Lessons Learned

While the project did not result as anticipated, ACF felt the initiative was a worthwhile exploration of an innovative approach. There were some key lessons learned and insights that can be applied to other endeavors looking to create a digital advisory tool. Some key lessons were learned within the project design and assumptions, the project approach, and the project delivery.

Project Design and Assumptions

The timeline for the project was very ambitious, and at the mid-point it was recognized that one year was insufficient time to design, develop, test, refine, deploy, and scale-up a specialized smartphone application. The work plan required constant adaptation to achieve quantifiable and tangible results within the project period.

The project was designed to include some training and provision of inputs to farmers participating in the development of the farm modelling and tool testing. This was important as it is widely recognized that poverty is the main barrier to farmers using improved inputs or seeking commercial advisory services. It would also encourage participation and compensate farmers for their support. As a result of the compressed timeline however, the training and inputs had to be provided to farmers while the advisory tool was still being completed. A further challenge of this approach was in communicating the purpose and scope of the project to the wide variety of stakeholders involved in the project. For the project staff too, it was difficult at times to connect to the traditional provision of training and inputs in the short term, with a parallel focus on improving the quality and impact of agricultural extension services to smallholder farmers.

A common misunderstanding throughout the project was that it was designing a smartphone application for farmers to use. This often manifested in the observation that the project was not so relevant as less than 5% of refugees have smartphones. This was particularly the case among non-sectoral stakeholders, like local leaders, and notably, among other teams within Action Against Hunger. It was not a challenge for communicating with core sectoral stakeholders though, i.e., government, NGO, and private sector agricultural extension service providers. There was immediate recognition of the purpose and benefit of developing a tool for extension workers rather than farmers.

There were a series of long gaps between the project being designed, approved and started, and in that time the market did not stay still so there was some concern among the project team that other similar applications were appearing or being spoken about. Would our innovation still be relevant? It was quickly realized that other apps were usually targeted at farmers themselves. When the project was underway interest in the application was high, and when the project ended the developer was convinced of the commercial viability and potential of a future product. The relevance therefore of the gap or need identified by the project and innovative solution proposed was valid.

Project Approaches and Innovation

The engagement of key external stakeholders, such as local government technical staff and agricultural dealers and advisors, went very well, and the investment in time greatly helped in the refinement of the project approach and development of the digital tool. Action Against Hunger designed consultations and workshops to gather as much information and suggestions in a way that would be useful and actionable. This meant that the prototype was able to include a lot of user feedback from early in the process, meaning that less work was needed to refine it.

The project team learned that the development of a smartphone app version of an advisory tool, from a web-based version, requires a lot of time and expertise. The development of the Android app required highly technical data collection, analysis, discussion, and testing. The development process requires a lot of consultation and clarifications between partners and working between different countries and through non-technical intermediaries was not efficient as it could be, resulting in delayed tool development extending initial workplan timelines.

The adaptation and contextualization of the existing farm modelling analysis and diagnostic software of Wageningen University required a good understanding of the local context. Studies, such as farm surveys and soil analysis, as well as focus group discussions and key information interviews were important tools to help gather the data needed to establish the operating parameters of the tool. Through data collection, the project found nutrition, income, soil organic matter, labor, crop resilience, and soil fertility to be the most appropriate parameters to be considered for optimization because they were contextually the most relevant for end-users and aligned well with longer-term objectives of preventing malnutrition and ensuring sustainability.

The farm surveys and interviews confirmed the assumption that the socio-economic status of farmers plays a big role in their priorities for farm optimization, e.g., whether they are seeking a short-term return or long-term growth of their enterprise. Their current situation drove decision-making about operating profits and tradeoffs with other factors, like producing more nutritionally beneficial food crops to improve their own diet. It is therefore important to involve farmers and other stakeholders when determining the different types of farm segments and the criteria to be used.

The scenarios generated through farm modelling and optimization were highly informative on how the different parameters can affect operating profit and nutrition. The model showed that even the small plots where refugees live can be optimized.

Project Delivery

The project was slow to start due to difficulty in recruiting the right staff. Initial mobilization of stakeholders was also slow due to ongoing movement and gathering restrictions for COVID-19 prevention. These factors could have been better accounted for during the kick-off of the project.

While it was not possible to bring a fully functioning smartphone app to the market and have it in widespread use within a year, the project did successfully adapt the web based FarmDesign software of Wageningen for the context of smallholder farmers in Uganda, and use it to provide analysis, diagnostics, and advice in a handheld device. The project also showed there was great interest in the product and that it was commercially viable. This learning will continue to be leveraged as the software developer has committed to continuing to develop and release a version of the application with their own funding.

The engagement and involvement of a diverse range of stakeholders was the key factor in the project's success. Refugees, farmers, local government, academics, digital innovation organizations, local businesses, and potential user organizations, provided highly actionable information, feedback and a tool more tailored to identified and expressed preferences and behaviors.

Recommendations

The following recommendations were reached through several reflection events and exercises conducted during and after the project[1], an analysis of project documentation, and further refined and iterated on through discussion with key internal and external stakeholders. Each recommendation is derived from one or more of the above lessons learned, however they are synthesized for brevity and so do not necessarily have a one-to-one relationship with a particular lesson.

1. Make every effort to understand how much time is needed to undertake highly technical innovations, such as the development of an interactive digital agricultural advisory tool, during the initial design phase. Actions could include more in-depth consultation with technical partners at proposal stage; speaking to other organizations/companies who have worked on similar products or in similar partnerships; and involving a more diverse group of specialists in review and planning activities. Additionally, if there has been a significant time gap between proposal development and project implementation, time should be spent to review all assumptions and timelines before work starts,

2. If many activities in a project are connected to one key milestone (such as the availability of a prototype for testing), that milestone should receive the most focus in planning discussions. The project inception phase should closely examine the assumptions and contingencies between activities to prioritize time investments and sequencing of activities.

3. If a project involves the provision of inputs or incentives in order to test the innovation, it should be clearly communicated to all stakeholders, internal and

[1] This included reflection session during workshops for different activities, the end of project close out event, and post-project review meetings and evaluation workshop.

external, constantly, that this is the purpose. This is particularly so in a humanitarian setting, where the provision of inputs like training or seeds is the main way NGOs interact with beneficiaries.

4. A short inception phase for staff should be factored into work plans, particularly when staff with specialized technical skills or particular experience are being sought. Time should be allocated for more in-depth discussion of project assumptions, workplan and timeline, validity of approaches, required inputs and roles of key stakeholders.

5. Where complex projects are being implemented by field practitioners, develop tailored internal project briefing or planning documents in addition to the proposal to guide and support teams.

6. When problematic misunderstandings about the project's purpose or outputs are noted, they should be immediately addressed. If these reappear then the project should reconsider its communication strategy and messaging. It is vitally important that all stakeholders share the same expectations.

7. Think beyond the end of the project and be ready to leverage successes. Always keep the purpose or long-term desired outcome of the innovation in mind so that you can make quick adaptations to the design to strengthen the chances of success or be able to build on unforeseen learnings or opportunities.

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