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Activity Report 2018
CSV Monitoring and Evaluation Plan

Deliverable D5265:
Improved Smart Monitoring App (v1) and regional training

By Anton Eitzinger, Osana Bonilla-Findji, Nadine Andrieu, Christian Feil, Gustavo Bejarano

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Activity report: CSV Monitoring and Evaluation Plan

2018 Deliverable (D5265): Improved Smart Monitoring App (v1) and regional training

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Summary description

This research activity selected and adapted an internet communication tool (ICT) for efficient data collection for the Climate-Smart Village (CSV) Monitoring plan, currently being implemented across all regions of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) CSV network. After selecting the GeoCitizen as the underlying framework, the GeoFarmer App (v1) was developed as a sub-system that can be used as Smart-Monitoring tool in agricultural research and development projects. The activity focused on improving usability, adding new functionalities and providing a training plan for local users at the CSV level. The modified/new functionalities consisted of a registration module for farmers, a facilitator role to act on behalf of farmers, logical survey trees using connectors between questions, and a smart on/off for data sync functionality to upload data to the cloud server. We organized training where we invited the regional CCAFS coordinator, local enumerators, and local research partners. We implemented the monitoring plan in nine CCAFS sites and collected about 300,000 data records; each data record is a farmer's response to a question which is linked to defined indicators. For the next phase of further developing and improving the monitoring plan on CCAFS sites, we will develop a new version of GeoFarmer (v2), enhanced the survey module with new functionalities, and develop an online course on how to use Geofarmer for smart-monitoring (sm) on CCAFS sites.

I. Scope and rationale: Why GeoFarmer?

With the growing field of digital agriculture, ICT-based approaches are becoming more relevant also in agricultural development projects. Mainly, because they are: i) more cost-effective for data collection, ii) better suitable for large scale monitoring and evaluation of agriculture development projects than traditional methods, and iii) becoming more and more accepted by farmers (Hammond et al. 2016; Jarvis et al. 2015). Thus, ICT-based solutions can play a significant role in efficient data collection and be the future basis for better decisions by farmers and policymakers (Delerce et al. 2016).

Geofarmer is an ICT tool that provides “near real-time, two-way data flows that support processes of co-innovation in agricultural development projects,” and it is, “a cost-effective means of providing and sharing opportune indicators of on-farm performance” (Eitzinger et al. 2019, pp 1). GeoFarmer was developed as a subsystem of GeoCitizen (Atzmanstorfer et al. 2014). The Geocitizen framework provides modular functionalities for community support, and it is a helpful tool for practitioners to guide participatory processes. It provides modules such as georeferenced surveys, geolocation of context-relevant information and structured and transparent discussion and feedback loops. The GeoCitizen framework as developer environment, using multilayer architecture with a system of modular components (functionalities and interfaces) that communicate with a central cloud application, fitted well with our aim of developing a system that combines data collection, processes of co-innovation, and that can further be used to collect feedback from participants.

We also evaluated other existing tools regarding their suitability for the monitoring purposes on CCAFS CSVs, for example, the Open Data Kit (ODK) is widely used in development work, and others have integrated ODK into new applications. It has also been used for CCAFS household baseline data collection. Furthermore, the Rural Household Multi-Indicator Survey (RHoMIS) (Hammond et al. 2016) uses ODK as survey module for a standardized and rapid characterization of households. We considered using ODK instead of GeoFarmer but decided to use the GeoCitizen framework because of its additional functionalities and modular architecture.

The advantages of using digital tools for data collection are clear; however, to implement ICT tools for smart-monitoring and collecting indicators through survey questions, we cannot merely throw ICT solutions at implementers: we need to design a plan which provides capacity building, piloting and accompany the process.

The first release of GeoFarmer (V1) was built based on the GeoCitizen framework, and we continuously made improvements while implementing the CCAFS monitoring plan throughout the reporting period, getting feedback from trained practitioners.

II. Making GeoFarmer a SmartMonitoring tool

In 2017, CCAFS started using GeoFarmer to monitor and evaluate outcomes on its CSV agricultural research for development (AR4D) approach, where CCAFS is testing since 2011 climate-smart agriculture (CSA) practices with farmers, local experts from the national extension service and researchers alike. We adapted existing modules and ICT components of GeoCitizen to handle data and information in the context of agricultural development and developed the first version of GeoFarmer (V1). We also added new complementary modules for GeoFarmer to the GeoCitizen application framework and developed new user interfaces for GeoFarmer, which includes a smartphone application (see Figure 1) and a web-dashboard (see Figure 2).

The modified/new functionalities consisted of:

- A registration module for farmers; including an electronic consent for farmers
- A new user-role *facilitator was created*; a facilitator can act on behalf of farmers and fill surveys for registered farmers (Eitzinger et al. 2019)
- Surveys as *logical trees* (see Figure 3), with connectors between questions that follow a condition for its connection to the next question (Jarvis et al. 2015).
- Smart on/off for data sync to cloud server (Bartling et al. 2016).

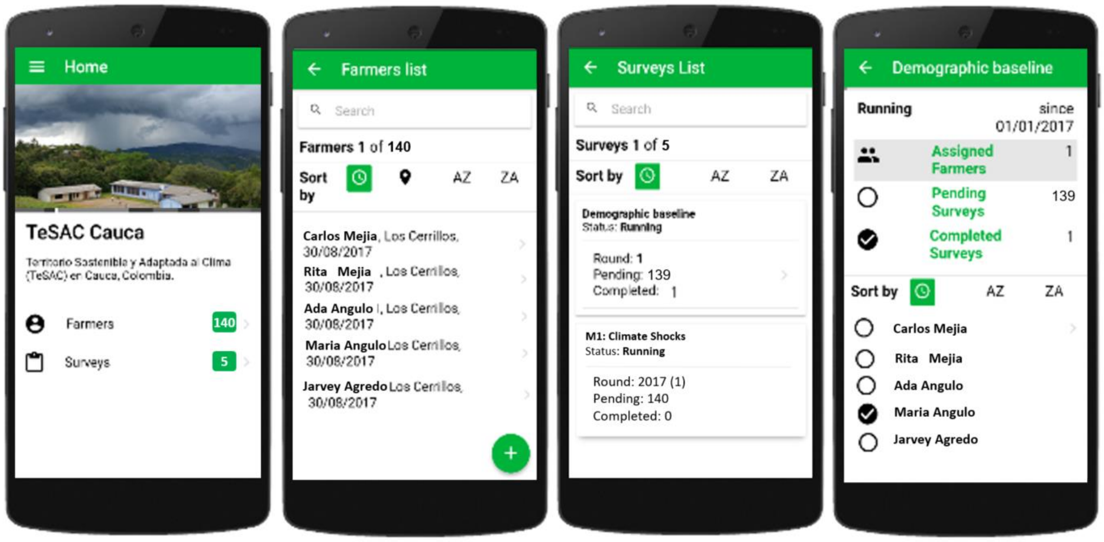

Figure 1. View of main screens of GeoFarmer mobile app.

Together with the CCAFS team, we designed a set of standard indicators to be tracked yearly on different levels:

1. Farm performance: How affect CSA the farm performance? It consists of 7 indicators, covering farm productivity, adaptation, and mitigation
2. Effects on household: How CSA affects income, food security, adaptive capacity, and gender? This level consists of 20 indicators, including indicators on food security status, incomes and livelihoods, adaptation strategies, risk management actions, and gender impacts.

3. Adoption trends: Who adopts? Why? Why not? The level includes 17 indicators, from the frequency of CSA implementation, farmers motivations for and barriers to adoption, the frequency of climate-related events, access to financial services, CSA awareness, the source of knowledge, and farmer to a farmer learning effect.

After defining the indicators for the different levels, we designed surveys that consist of questions that provide data to calculate each indicator. We organized questions in different surveys:

- M0 – Demographic baseline
- M1 – Climate Events
- M2 – Climate Services
- M3 – Livelihood Security
- M4 – Food Security
- M5 – CSA options
- FC – Farm Calculator
- AC – Animal Calculator
- CC – Crop Calculator
- TC – Tree Calculator

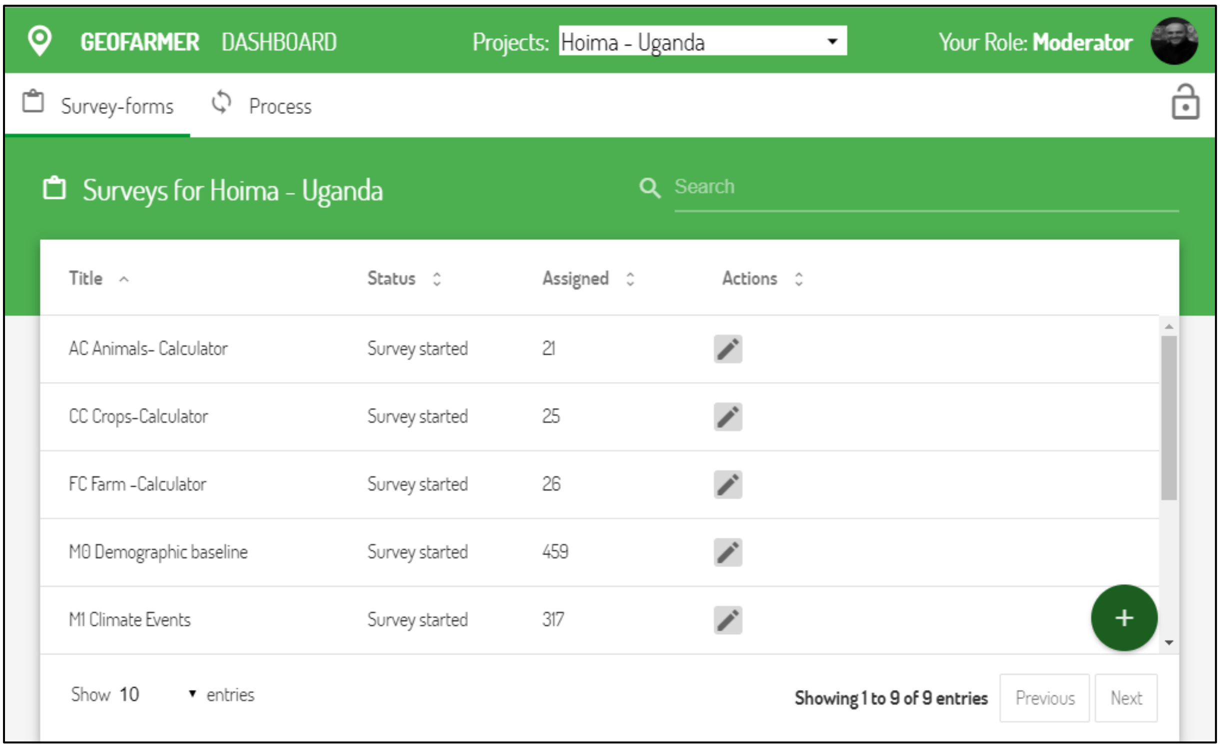

Figure 2. GeoFarmer dashboard with survey modules for CSAV monitoring.

Each survey module was designed as a logical survey tree (see Figure 3), connecting questions based on selected answer options, and guiding the facilitator through the survey tree during the interview. We had to define the connectors as a logical operator on defined criteria, e.g.:

- If a farmer responds **'yes'** to the questions **'Have you heard about the practice of using solar-based irrigation for your home gardens?**'; the connector will connect to the following next questions **'Have you implemented these practice on your farm?'**

- If he responds **'no'** to the question **'Have you heard about the practice of using solar-based irrigation for your home gardens?'**, the connector would lead to the next question **'Would you like to receive information about this practice?'**.

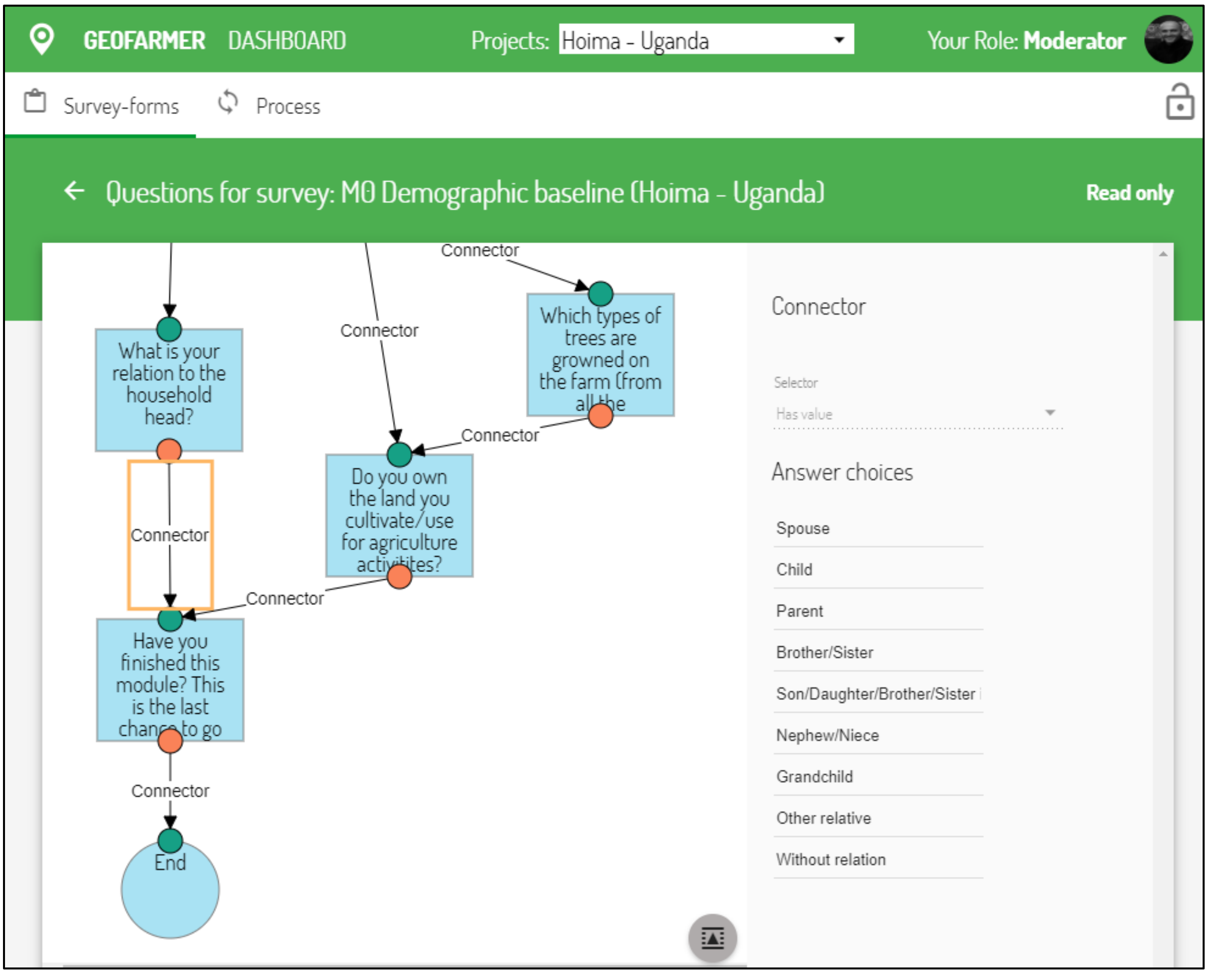

Figure 3. Design of question trees, with logical connectors and survey endpoint.

The logical survey trees follow the idea of the 5Q approach (Jarvis et al. 2015), trying to make surveys effective and avoid redundant questions. The connectors are defined in configuration records in the database, using a logical operator syntax for guarding the flow through a survey.

For choice questions, the user can define, for example, 'has value', 'has no value', 'value is' guards to connect to the next logical question; for numeric questions, the user can define, for example, 'is greater than', 'is lower than', 'is equal', or 'is empty'.

In this current version of GeoFarmer, the answer type of questions can be:

- Boolean (yes/no)
- Single choice
- Multiple choices
- Number
- Open text
- Likert scale

Once we had collected all data from a CSV, we analyzed the collected data. We developed a script in R language which calculated based on a codification all indicators from the collected data. We provide descriptive statistics and upload the graphs to our GeoFarmer dashboard (see Figure 4).

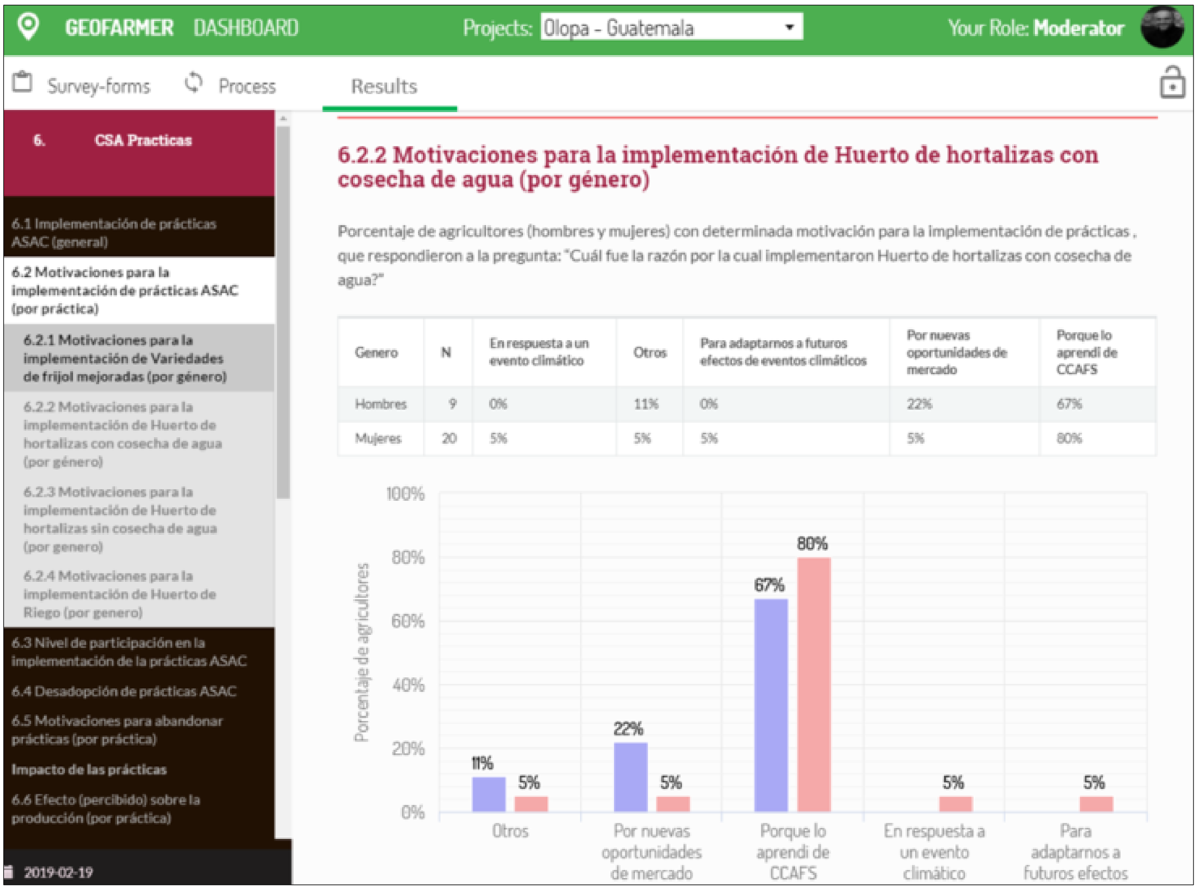

Figure 4. Results are calculated using R language and codification of collected data.

III. Training with local experts from CSVs

After setting up the surveys for each CCAFS site, we organized a training where we invited the regional CCAFS coordinator, local enumerators (user: facilitator) and local research partners. The training took one week each site and consisted of the following components that are shown in Figure 5.

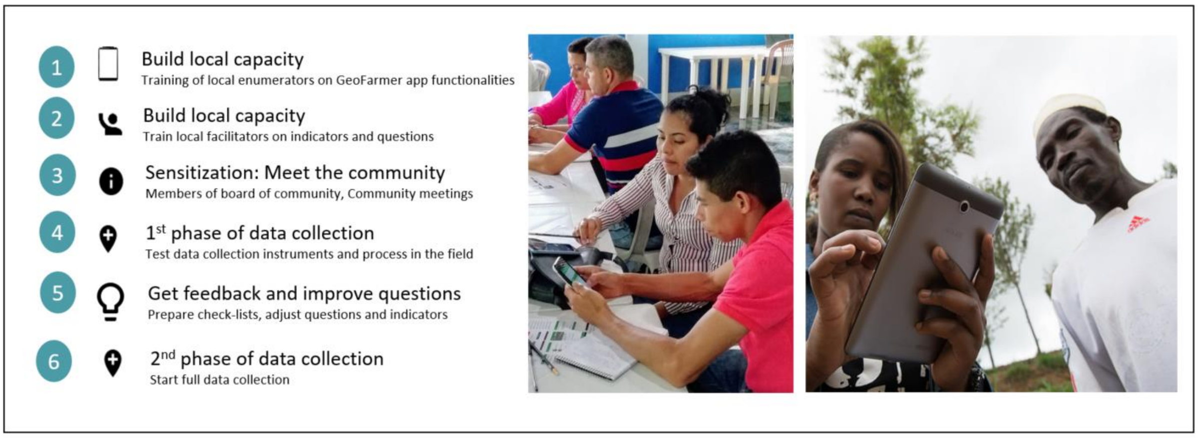

Figure 5. Capacity buildings of local enumerators in CSVs.

IV. Preliminary results across-sites: Data collection protocol

Since 2017, we implemented the monitoring plan in nine CCAFS sites. Table 1 shows the number of collected data records; each data record is a farmer's response to a question, question answers are used to calculate defined indicators.

Table 1. Collected data records from nine CSVs in five CCAFS regions.

CCAFS site	**farmers**			**Collected data records**
	total	**men**	**women**	
Cauca - Colombia	300	123	131	19,869 *
Lawra-Jirapa - Ghana	357	189	168	66,841
Olopa - Guatemala	301	124	156	31,225
Santa Rita - Honduras	295	129	128	19,736
Tuma Dalia - Nicaragua	316	121	142	34,109
Hoima - Uganda	458	229	229	53,177
Nawalparasi - Nepal	259	127	132	31,347
Barisal - Bangladesh	420	210	210	24,515
Khulna - Bangladesh	410	141	146	21,712

* not including data from farm calculator

V. Main challenges found during the first year of using GeoFarmer

The main challenges we found the following:

In order to translate the meaning of the question to a farmers' local language and cultural context, it is essential that the enumerator fully understand the meaning of each question.

During the capacity building week, this was the most important achievement to be made by the trainer's team.

Furthermore, the data synchronization is a necessary functionality, which was not available in the first pilot in Cauca, Colombia, carried already in 2017. Mobile internet coverage is rarely available for rural areas in most regions where CCAFS has installed CSVs; however, for that reason, we developed the on/off synchronization functionality and tested it first in Ghana.

VI. VII. Perspectives

For the next phase of implementing the monitoring plan on CCAFS sites, we will focus on the following improvements:

- We will develop a new version of GeoFarmer (V2); the new version follows the GeoCitizen developer community, which has changed the technological platform to Progressive Web Apps (PWA). PWA is self-installable and independent from app stores. They run on the devices own internet browser, and there is no need for separate source codes for each operating system, which means, the same source code for android-, iPhone-, and (any) desktop-browser.
- The enhanced survey module will include functionalities from lessons learned during the implementation of pilots in 2018. New functionalities will include me) adding a picture to each question, ii) organizing surveys in sections, which will allow for making logical conditions between questions from different sections (not able between survey modules now), iii) filling surveys anonymously, iv) creating complex mathematical operators for connectors between questions, and v) defining units for numeric questions, vi) adding new survey-answer-types like, geographic selectors, matrix answers, pick order, and among others.
- GeoFarmer V2 will also incorporate experiences from usability studies that have been carried out during the year 2018, and in CCAFS bilateral projects in Uganda and Colombia.
- We will develop an online course on how to use Geofarmer for Smart monitoring on CCAFS sites.

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