Building Resilience of Coconut Smallholder Farmers in the Philippines: Final Evaluation Report of the FarmerLink Program

Ana Herrera, Beverly Brul, Ramiro Cadavid, and Eliana Chavarría

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EXECUTIVE SUMMARY

Despite being part of a multi-billion export industry in the Philippines, smallholder coconut farmers remain to be some of the poorest and most vulnerable households in the agriculture sector. Economic stresses brought by uncertain market conditions and environmental shocks due to climate change continue to pose significant threat to their livelihood.

In December of 2015, Grameen Foundation, in collaboration with implementing partners the Philippine Coconut Authority (government agency), Franklin Baker Company of the Philippines (coconut buyer), and People's Bank of Caraga (financial services provider), launched the pilot for the FarmerLink Program. Combining the power of mobile technology and trusted human intermediaries, FarmerLink was conceived with the primary goal of increasing coconut farming households' incomes by improving productivity, providing access to appropriate financial services, linking farmers directly to markets, and reducing their losses to pests, diseases and weather calamities.

The pilot program utilized the existing field officer networks of the implementing partners and equipped them with a suite of mobile agricultural extension tools to help monitor farmer progress, promote good agricultural practices (GAPs), and deliver financial advice. The program also sought the participation of various technology service providers including aWhere, Palantir and EngageSpark in the development of an early warning system (EWS) prototype that sends alert messages directly to participant farmers' phones for extreme weather events and potential pest and disease outbreaks.

The program employed two different intervention approaches in the field within the 18-month implementation. The first one was a standard intervention approach consisting of the provision of short message service (SMS)-based agricultural extension services to farmers, as well as EWS alerts on extreme weather events and potential pest and disease outbreaks. The other was an intensive intervention approach consisting of the standard approach services (SMS and EWS) bundled with additional extension services such as regular farm visits and coaching sessions with field agents from the government agency, the coconut buyer, or the financial service provider. To assess the effectiveness of the FarmerLink program, a quasi-experimental difference-in-difference (DiD) analysis was used to estimate treatment effects on the three farmer groups in our evaluation:

1. **All-solutions group:** Farmers who received the intensive intervention approach (SMS, EWS alerts, and one-to-one extension support)
2. **EWS group:** Farmers who received the standard intervention approach (SMS and EWS alerts)
3. **Control group:** Farmers who were not included in the program but were expected to have similar traits as those in either treatment group.

The endline results and analysis focused on adoption of GAPs and behavior change rather than changes in productivity and income given that there were only 7 months between the baseline and endline. A longer-term implementation period would have allowed for greater detection of these two latter outcomes. Adoption rates were measured in terms of their full adoption, which means that all practices associated with a GAP were implemented, and in terms of partial adoption, which means that some, but not all practices associated with a GAP were put into practice.

There were five promising early outcomes from the FarmerLink pilot:

Result 1: Technology-based extension models can enable behavior change in the effective adoption of GAPs. Results show that the all-solutions group outperformed the control group in the (1) full adoption rates for 6 of 9 practices (67% of GAPs); and (2) partial adoption rates for 7 of 9 practices (78% of GAPs). Results also show that the two GAPs that contribute 93% of overall coconut productivity (salt fertilizer application and mulching) also saw the highest increases in adoption among the all-solutions group. The EWS cohort outperformed the control group in the full adoption of 4 of 9 GAPs and in partial adoption of 2 of 9 GAPs. Given these promising short-term results on GAPs adoption and the known associations between the adoption of GAPs and coconut farming productivity, it is probable that provided a longer implementation period, the farmers participating in the program would have seen measurable improvements in their productivity and income.

Result 2: GAP adoption appears influenced by access to financial services, to some degree influenced by GAP awareness, while the gender of the farmer interviewed does not appear to be particularly influential. Participants who reportedly had bank accounts appeared more likely to fully adopt 3 out of 9 GAPs and partially adopt 4 of 9 of GAPs promoted in the program.

Result 3: SMS alone can drive action as seen in the deployment of the EWS for weather and pests. As of June 30, 2017 3,291 farmers received an SMS alert on 'too dry' weather conditions via the EWS. Farmers received SMS stating the unfavorable weather condition and the appropriate action they could take to mitigate risks. There were 128 farmers in the sample who responded to the monitoring system that was set up to capture feedback. Results show that (1) 85% of farmers confirmed that the alerts reflected the reality around them, (2) 86% indicated they learned how they could take appropriate actions to mitigate the risk of drought and pests, and (3) 58% reported putting into practice the recommended actions promoted by the alert.

As of September 29, 2017, 10,471 farmers have received alerts on 'too dry' weather conditions and potential pests (coconut scale insect and brontispa). About 626 farmers shared their responses and the results were consistent with the findings above.

Result 4: Farmers were very satisfied with the program and agreed that they will gain new skills if FarmerLink is sustained. 93% of the farmers in the treatment groups responded that they either agree or strongly agree that they will gain skills if FarmerLink is continued. 80% of the farmers reported that they are satisfied with the project.

Result 5: Partners saved money and increased efficiencies using mobile technology. An activity-based costing methodology was utilized to measure potential efficiency gains from employing the FarmerLink mobile tools to Franklin Baker's farm organic inspection processes. The results showed that (1) a 62% time saving in the digital farm inspection process compared to manual processes; (2) that field officers doubled their farmer outreach for farm inspection with the help of the tools; and (3) that the value of the efficiency gain is $3,676 per field officer per year or $47,788 per year if the tools are used by all current field officers.

The FarmerLink project was an ambitious, 18-month pilot program that set out to demonstrate that by leveraging the strengths of different organizations representing the private sector (Franklin Baker and People's Bank of Caraga), the public sector (Philippine Coconut Authority), and civil society (Grameen Foundation), smallholder coconut farmers stand to gain from an integrated agricultural extension support ecosystem. Despite being constrained by the relatively short duration of the pilot stage, the outcomes that emerged suggest that the farmer participants made progress in terms of GAP adoption with the personal assistance received from the agricultural field officers as well as with the introduction of various technology-based channels that enhance the farmer-agent interaction. These results, along with the efficiencies gained through the digital transformation of Franklin Baker's farm inspection process, provide a strong business case to sustain the program post-grant for both the private sector and the government.

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ACRONYMS and ABBREVIATIONS

ABC	Activity Based Costing
Brgy.	Barangay
CKW	Community Knowledge Worker
DiD	Difference in Difference
EWS	Early Warning System
FGD	Focus Group Discussion
FDP	Farm Development Plan
FMP	Farm Management Plan
GAPs	Good Agricultural Practices
GPS	Global Positioning System
HH	Household
ICT	Information Communication Technology
IVR	Interactive Voice Response
M&E	Monitoring and Evaluation
Mtrs.	Meters
NaCL	Sodium Chloride
PHP	Philippine Peso
SHF	Smallholder Farmers
SMS	Short Message Service
TOC	Theory of Change

INTRODUCTION

Background

Coconut smallholder farmers (SHF) are among the poorest households in the Philippines with 60 percent living at or below the national poverty line of PHP 20,000 (US $444) per year[1]. Coconut farmers are also among the least resilient in the face of environmental and economic shocks, such as natural calamities, market volatility, and crop failure. Their ability to build assets, and to manage and mitigate risks is constrained by the following four barriers:

1. **Low productivity** due to lack of information, inefficient agricultural practices and vulnerability to calamities (i.e. typhoons) at the farm level

2. **Lack of direct market access and low market prices** that increase exposure to economic stresses that put food security at risk

3. **Lack of access to appropriate financial services** (i.e. loans, savings, household and crop insurance products) that can provide a critical safety net in the face of environmental and economic shocks and increase investment in farming activities often resulting in low farming returns

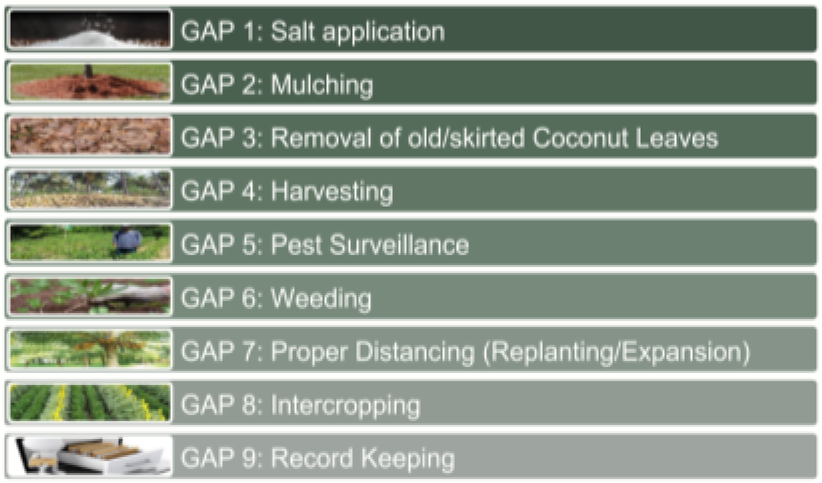
4. **Unpredictable weather extremes and pests and diseases outbreaks** as well as the lack of understanding of effective mitigation practices lead to farmer inability to reduce losses.

Coconut Farming and Good Agricultural Practices (GAPs)

A coconut cropping cycle occurs within 60 to 90 days during which a farmer must implement good agricultural practices (GAPs) to ensure good production. The Philippine Coconut Authority (PCA) is promoting nine GAPs (Figure 1) that make up the foundation for most coconut farmer extension support activities. The first two, if applied, account for 93% of overall coconut productivity[2].

[1] "REFINED PROBLEM STATEMENT." Global Resilience Partnership, www.globalresiliencepartnership.org/assets/downloads/GRP_Grameen%20Foundation_Refined-Problem-Statement.pdf. Accessed 29 September 2017.
[2] Source: Philippine Coconut Authority

Figure 1: Coconut Farming Good Agricultural Practices



Within each of these GAPs, there are specific steps and activities that determine whether a farmer fully or only partially adopts a GAP. These are covered in the annex. Below, basic descriptions of each GAP is provided:

GAP 1 Salt Application: The use of sodium chloride (NaCl) or common salt as fertilizer is a practical means of increasing coconut production. Salt is the cheapest and best source of chlorine to increase yield. Full adoption of this practice requires applying 2kg of salt per tree per year. When sustained, this practice increases coconut production by at least 30% (at least 25% increase in copra yield after the first year).[3]

GAP 2 Mulching: Mulching involves the use of ground cover, preferably organic materials, around the base of plants and trees to prevent soil erosion and loss of soil moisture. It also adds nutrients to the soil once decomposed. It requires very minimal labor, taking about a quarter of an hour to pile coconut husks, which are readily available in any coconut farm, around the base of each coconut tree.

GAP 3 Removal of old/skirted coconut leaves: Practiced regularly, this deprives pests of a place where they can harbor and infest the crown. This also facilitates harvest since damaged or old fronds can hamper the harvester reaching the mature fronds.

GAP 4 Harvesting: Harvest can be done within 45 to 60 days for whole nuts and 60 to 90 days for copra production (the process of coconut oil extraction). This is the typical schedule when the quality of meat and oil content of the coconut are at an optimum.

GAP 5 Pest Surveillance: Early detection of pest or disease presence can prevent serious infestations. This requires regular monitoring of coconut leaves, nuts and trunk to observe if there are any symptoms such as holes, abnormalities or discoloration.

GAP 6 Weeding: This refers to the control of wild undergrowth beneath the trees by clearing weeds that compete for soil nutrients and impede farm work facilitation. However, retaining some ground cover is necessary in the prevention of soil erosion.

GAP 7 Proper Distancing (Replanting/Expansion): For a fair distribution of sunlight and soil nutrients, the recommended distance between one tree and the next is 10m (applied on all sides). This spacing also allows for the integration of high-value crops and rearing of livestock, and accommodates better facilitation of farm work.

[3] Salt, An Effective and Cheap Fertilizer for Coconut. 2014. Entrepinoys. Accessed January 2019 at: http://www.mixph.com/salt-an-effective-and-cheap-fertilizer-for-coconut/

Other recommended variations are arranged in a triangular or rectangular manner with one side at 10m and the other sides with at least 5m distance between trees.

GAP 8 Intercropping: With the proper distancing between coconut trees observed, intercropping can be practiced and it offers opportunities for the expansion of the farm's production and the household's income. The variation in farm operation calendar and the household cash flow allows farmers to have more diversity and liquidity.

GAP 9 Recordkeeping: This exercise instills the idea that farming is, in fact, a business and not something solely dependent on nature's whims but mostly to the farmer's actions. The farmers are encouraged to list all their farm and household transactions regularly.

FARMERLINK PROGRAM

FarmerLink's program approach applied the fundamentals of Grameen Foundation's agricultural extension programs implemented in Africa and Latin America, which focused on the formation of strategic alliances that leverage digital solution sets delivered to farmer beneficiaries through field officers or agents.

FarmerLink's Strategic Alliance

FarmerLink was a multi-sectoral collaboration of Grameen Foundation and its implementing partners, the Philippine Coconut Authority (government agency), Franklin Baker Company of the Philippines (coconut buyer), and People's Bank of Caraga (financial services provider) whose field agents were all equipped with mobile agricultural extension tools to help monitor farmer progress, promote the GAPs, and deliver financial advice. The program also worked with technology service providers including aWhere, Palantir and engageSpark to develop an early warning system (EWS) prototype that provided alerts directly to the farmer's phone for extreme weather events and potential pest and disease outbreaks.

FarmerLink's Digital Solutions Set for Field Agents

In the FarmerLink program, the team developed android-based mobile tools that were used by different types of field agents to coach farmers and provide effective training services. These mobile tools include:

- **Farmer profiles**: The profiles contain socio-economic information gathered from the farmers including data on production, access and use of financial services, and adoption of GAPs. These enable partners to target interventions based on the actual conditions and needs of individual farmers.

- **Farm management plan (FMP)**: After agents assess GAPs knowledge, farmers are monitored in their application of the practices using the FMP tool. Farmers are provided immediate feedback and coaching on how to fully adopt GAPs.

- **Organic inspection tool**: Like the FMP, agents utilize the organic inspection tool to track farmers' adherence to organic certification standards and to provide coaching on how to comply with the standards.

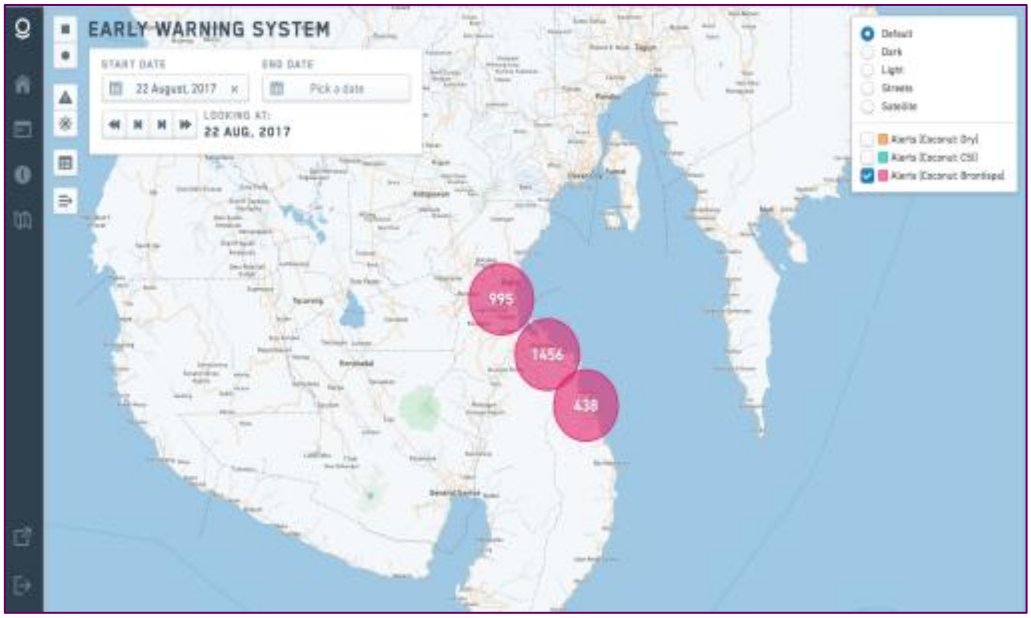
- **Harvest monitoring**: The harvest monitoring tool tracks production data and forecasts the anticipated volume of the next harvest cycle, enabling FarmerLink partners to use specific and timely information on where and from whom they can source coconuts.

- **CKW Search**: The Community Knowledge Worker (CKW) mobile tool is a digital encyclopedia containing a wealth of information on GAPs and financial practices among others.

FarmerLink's Digital Solutions for Farmers

In addition to the mobile tools used by the field agents, Grameen also developed a prototype of an **early warning system (EWS)** which makes use of weather data provided by aWhere, and GPS coordinates and other data pulled from farmer profiles to alert farmers that are likely to be affected by extreme weather events and pest and disease outbreaks. The alert is an SMS sent directly to the farmer's phone via the engageSpark SMS platform and is coupled with practical tips and recommendations on how to reduce these risks. The EWS also has reports and dashboards developed by Palantir (see Figure 2 below) to enable government agencies like the Philippine Coconut Authority to quickly identify affected municipalities and provinces for implementation of targeted response programs, if needed.

Figure 2: Early Warning System Dashboard



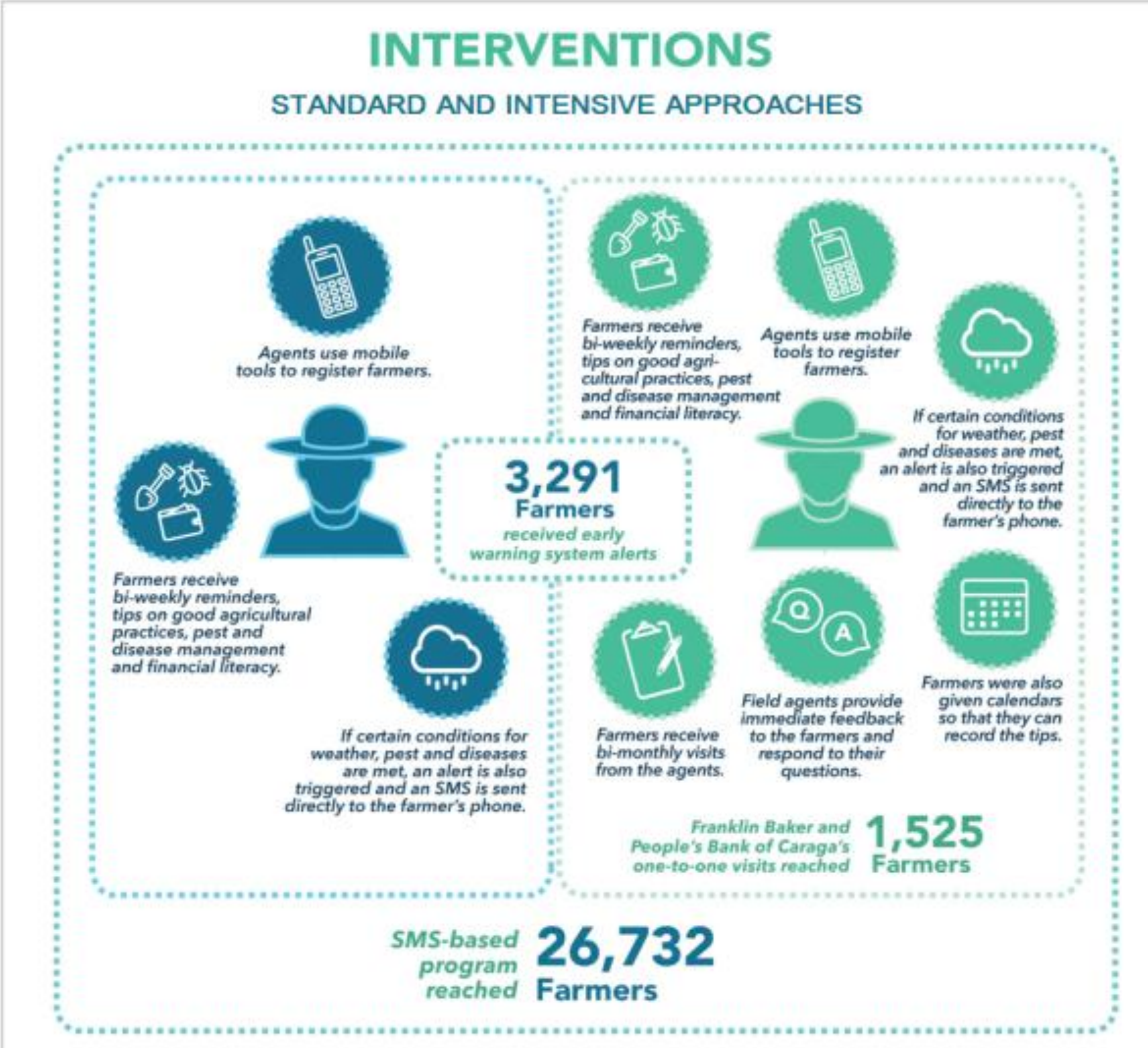
FarmerLink Pilot Program

Given the complexity of FarmerLink's program design and the farmer target outreach, Grameen Foundation deployed two types of interventions with the partners on the ground.

The first intervention was a standard approach that involved providing **SMS-based agricultural extension to farmers** (see Figure 3 below). Philippine Coconut Authority field agents used the mobile tools to register farmers for the intervention. Once farmers were registered, they received a welcome message from FarmerLink followed by bi-weekly reminders and tips on good agricultural practices, pest and disease management and financial literacy. When unfavorable weather conditions and potential pest and disease outbreak are on the radar, farmers receive an SMS alerting them of the phenomenon along with, more importantly, the practical recommendation on how to mitigate damage to their farm. From September 2016 to June 2017, the program registered 26,732 farmers with this intervention across the 5 provinces in the Davao region. A subset of 3,291 farmers received EWS alerts primarily in the Davao del Sur and Davao Oriental provinces.

The second intervention was a much more intensive process where **SMS-based extension was coupled with one-to-one visits and coaching sessions with agents.** Franklin Baker and People's Bank of Caraga were tasked to provide agents who would perform bi-monthly visits to the farmers registered in the program. During the visits, the farm management plan, the organic inspection tool, harvest monitoring and CKW Search mobile tools were all used by the field agents to provide immediate assistance to the farmers and respond to their questions, especially those related to pests and diseases, and finance management. Farmers were also given calendars so that they could record the tips given to them during these interactions. At the end of the grant, the combined effort reached a total of 1,525 farmers.

Figure 3: FarmerLink Interventions



FarmerLink Theory of Change

The FarmerLink theory of change (TOC) highlights the logical change pathways that link project activities to the social and agronomic goals of the project, both at the smallholder farmers and partner level. The TOC demonstrates the business case for this type of multi-sector, multi-component project that is important for long-term sustainability, scalability and replication (Figure 4).

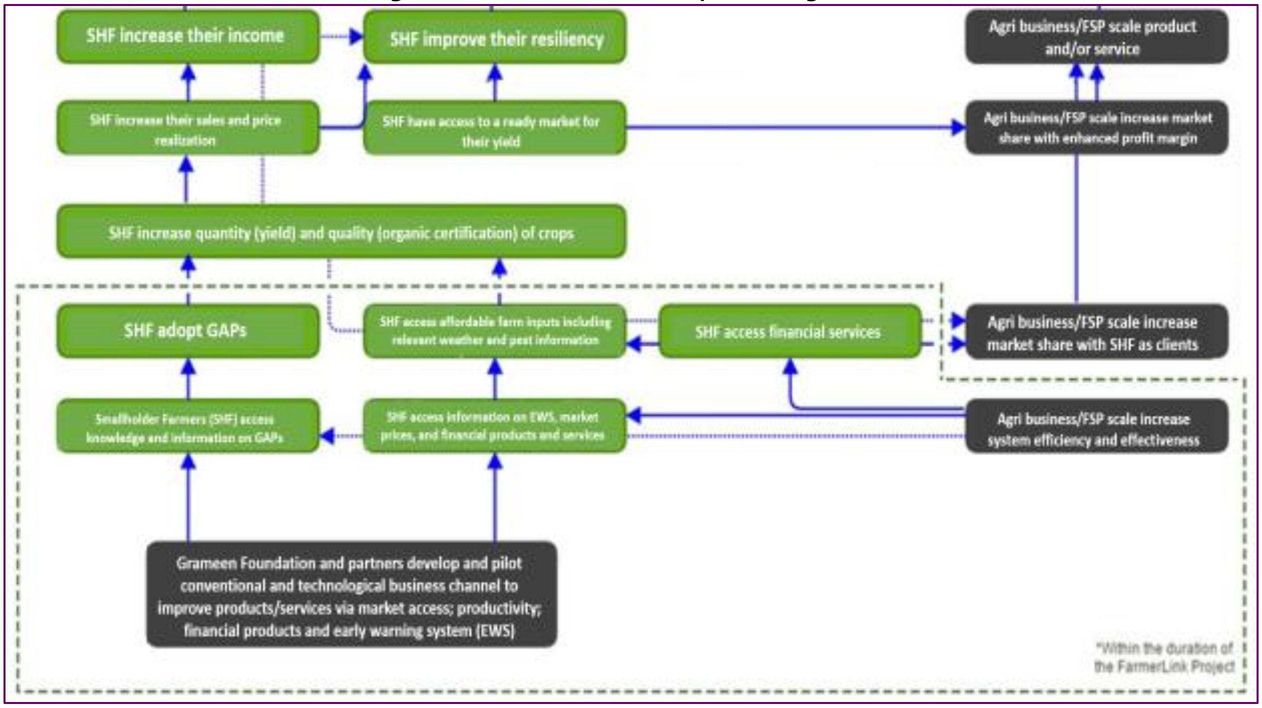
Through FarmerLink, public-private partnerships were developed to determine the critical capacity gaps of smallholder farmers and identify subsequent application of data-driven analytics for real time decisions during implementation. The TOC for the FarmerLink project assumed that:

- Farmer access to knowledge and information on good agricultural practices (GAPs), market information, EWS alerts and financial literacy could potentially pave the way to short-term positive outcomes that include: GAPs adoption, access to affordable farm inputs, direct market interaction, and access to appropriate financial products.

- The short-term outcomes, considered to be the vehicles to enhance productivity in terms of both quantity (yield) and quality (certification), lead to the smallholder farmers' ability to realize higher product prices and to be seen as reliable suppliers within the value chain. These outcomes, captured within the dashed green line in the figure below, represent those that the FarmerLink project aimed to influence during the project-period.

- As a result of achieving the short-term outcomes, the smallholder farmers in the long-term would achieve increased income and resilience by building household adaptive capacity to respond to shocks and stresses through diversified income, assets and safety nets, and decreased vulnerability to climatic conditions and pest and diseases outbreaks.

Figure 4: FarmerLink's Theory of Change

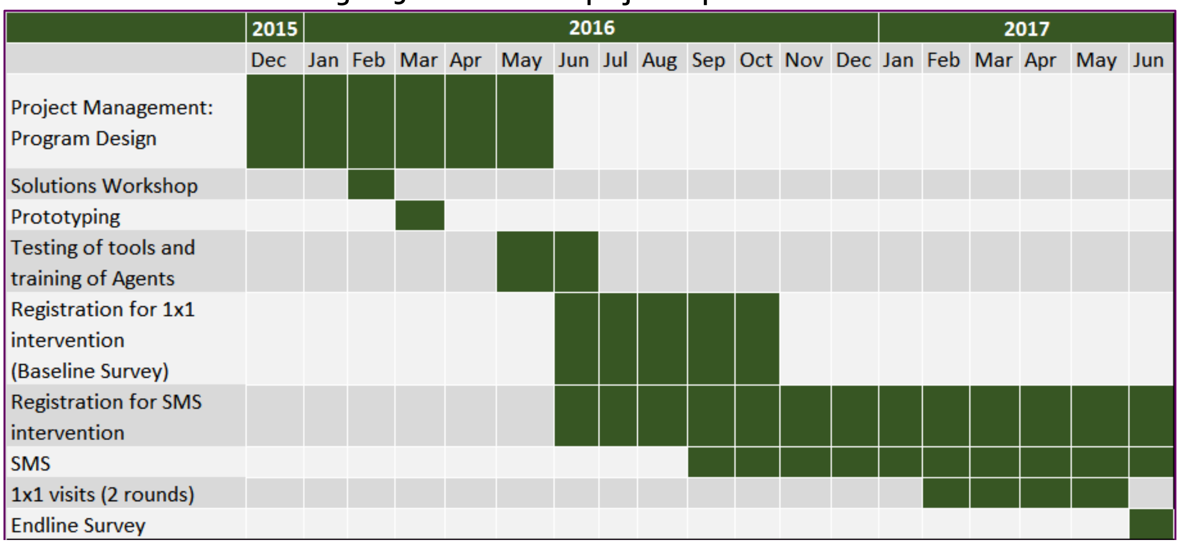


Moreover, the project had a complementary impact pathway for partners. By facilitating operational efficiencies through technology and integrated efforts among stakeholders, partners would experience increased market share with the growth of their farmer supplier pool, and increased profits with the improvement of produce quality.

Main outcomes of interest

Due to the short time frame of field implementation and measurement (7 months), the endline results and analysis for farmer outcomes focused on adoption of good agricultural practices and behavior change rather than on changes in productivity and income (see Figure 5). A longer-term implementation period would have allowed for greater detection of these two latter outcomes. Adoption rates were measured in terms of their full adoption, which means that all practices associated with a GAP were implemented, and in terms of partial adoption, which means that some, but not all practices associated with a GAP were put into practice. For partner outcomes, the focus was measuring efficiency gains within the partner's operations.

Figure 5: Time frame of project implementation

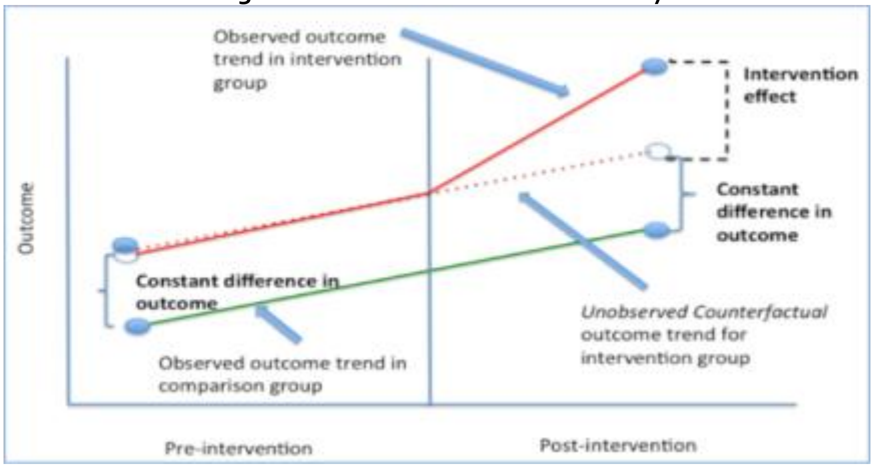


Methodology to measure farmer outcomes

Quasi-experimental Evaluation

For farmer outcomes, difference-in-difference (DiD) analysis was used to estimate treatment effects. DiD compares pre-treatment and post-treatment differences between the treatment and control groups, to obtain a counterfactual to estimate a causal effect (intervention effect), as shown in Figure 6 below.

Figure 6: Difference-in-difference analysis



Source: Difference-in-difference Estimation. Colombia University[4]

Thus, the intervention effect can be estimated through the steps contained in the Table 1 below.

Table 1: Treatment estimation

	Before Change (Baseline)	After Change (End line)	Difference
Group 1 (Treatment)	Y_{t1}	Y_{t2}	$\Delta Y_t = Y_{t2} - Y_{t1}$
Group 2 (Control)	Y_{c1}	Y_{c2}	$\Delta Y_c = Y_{c2} - Y_{c1}$
	Difference-in-Difference		$\Delta\Delta Y = \Delta Y_t - \Delta Y_c$

Assignment to the treatment groups was determined with the help of our implementing partners. Franklin Baker and People's Bank of Caraga identified a pool of farmers, who either had past or current affiliation with them. These farmers were registered into the program. In addition, the Philippine Coconut Authority has connections with different farmer organizations as well as municipalities assigned under each development officer. The database of the ongoing National Survey of Coconut Farmers was also used to register farmers. The control group was comprised of farmers who were unaffiliated with any of the implementing partners (Franklin Baker, People's Bank of Caraga and the Philippine Coconut Authority). The farmers lived primarily in Davao region XI[2], which comprises the provinces of Compostela Valley, Davao Del Sur, Davao Oriental and Davao Del Norte. See Figure 7 further below for a map depicting these provinces.

Of the farmers under the control and treatment groups, a total of 830 SHFs were randomly sampled from each, 433 (52%) female farmers and 397 (48%) male farmers. These percentages reflect the gender disaggregation of the total number of registered farmers in the program. The composition of the farmer groups and the corresponding intervention approach applied to each is as follows:

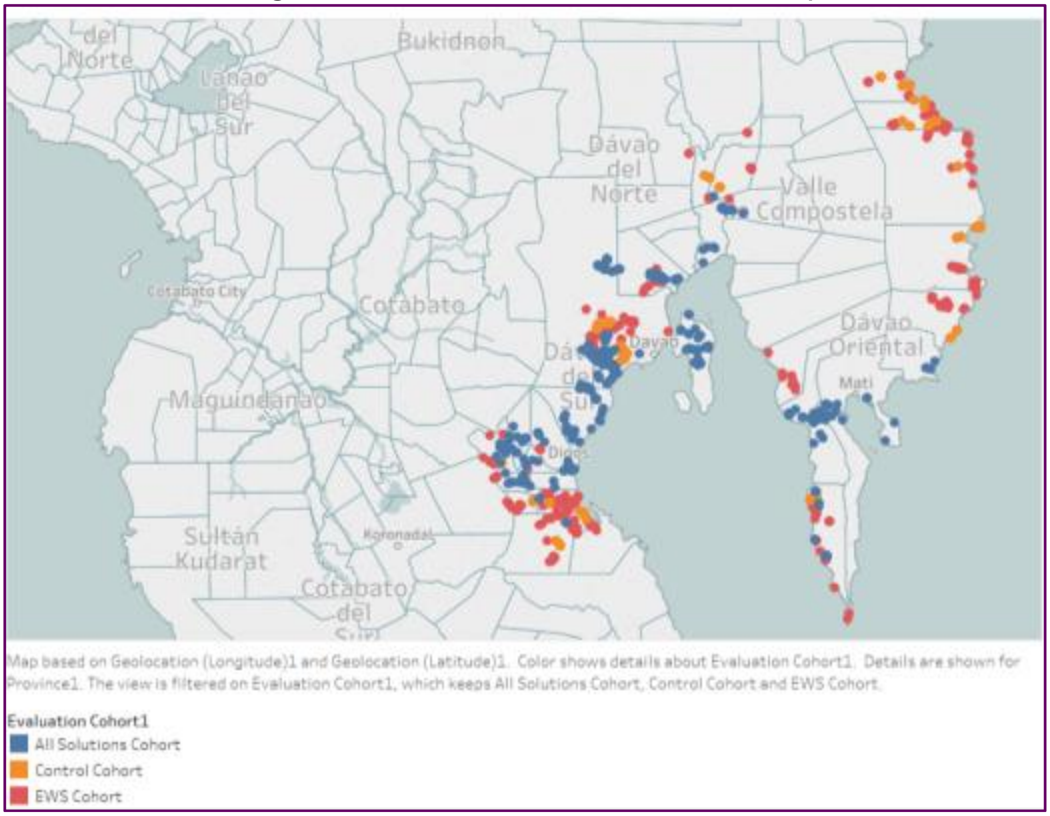
- *All solutions group:* comprised of 320 farmers who received the intensive approach, which included the SMS and EWS alerts as well as the one-to-one extension service with field agents
- *EWS group:* comprised of 216 farmers who received the standard approach, which included only the SMS and EWS alerts
- *Control group:* comprised of 294 farmers who did not receive any intervention from the FarmerLink program

The evaluation method followed two separate engagements. The first was a collection of baseline data conducted in October 2016. The second was the endline data collection completed in June 2017. Both engagements were

[4] Difference-in-Difference Estimation. 2019. Population Health Methods. Colombia University. Accessed January 2019 at https://www.mailman.columbia.edu/research/population-health-methods/difference-difference-estimation

conducted by external parties and field officers of implementing partners. Data collection for the DiD analysis used digital baseline and endline surveys using the TaroWorks mobile applications. For data analysis, Salesforce.com and STATA were used. Figure 7 below depicts the locations of the interviews among the three cohorts.

Figure 7: Location of farmers included in the sample



Qualitative Assessment

To complement the DiD analysis, *focus group discussions (FGDs)* and *key informant interviews* were organized, and case studies from these activities were produced. The main objective was to obtain insights on the resiliency of farmers and, more specifically, to learn how they work together as a community to be able to withstand different challenges be it agricultural or economic, and how the FarmerLink intervention helps them to do so. There were two rounds of FGDs conducted with two groups (one FGD of 6 farmers and the other of 8 farmers) that were selected from the different saving centers of the People's Bank of Caraga. Members of Center Toothbrush of Brgy. Bandira and Center Condiments of Brgy. Binaton, both located in Digos City, participated in discussions on FarmerLink intervention and community resilience. For the interviews, five smallholder farmers from Toril, Davao City, who were then participating under the program, served as key informants on topics such as one-on-one farm coaching and the agronomic and financial literacy messages.

Interactive voice response (IVR) surveys

IVR surveys were also used particularly for farmers who received alerts from the EWS. The 6-question IVR Survey was sent to 14,077 farmers 3-5 days after they received the alerts. To keep the survey quick and simple, most of the questions were answerable by a yes or no. In anticipation of farmers being new to IVR Systems, SMS instructions were sent prior to the call to enable the farmers to understand the objective and what they should do when they receive the call.

Methodology to assess partner outcomes

Activity-based Costing

To measure the efficiency gains of the project on the part of the value chain partners involved, activity-based costing (ABC) was used for, and focused on, the organic certification process of Franklin Baker.

Franklin Baker's organic certification process is divided into two major phases: the pre-selection and audit. The pre-selection phase is performed by Franklin Baker, while the audit is performed by a certifying body (e.g. Control Union). The ABC data collection only covered five stages of the pre-selection phase where digitized inspection tools developed in FarmerLink can produce efficiency gains.

Data sources. There were two sets of data used in the analysis:

1. *Baseline* – conducted in Quezon province where all data collected was from manual pen and paper procedures; the observations were also done only for certification of new farmers
2. *Endline* – conducted in Davao del Sur where data was collected from both manual and digitized procedures for re-certification activities of existing certified farmers who were due for renewal.

The focus of the ABC analysis is directed towards the endline data having both manual and digitized procedures and data were collected in similar settings, e.g. manual and digitized inspection was performed by the same inspector.

Data collection tool. The tool was developed in close collaboration with Franklin Baker's field operations teams in Davao and Quezon. The tool had undergone several iterations based on Franklin Baker's feedback and recommendations and was also pilot-tested with a third-party survey team. Similar to the digital baseline and endline surveys, this tool was on the TaroWorks mobile application.

Data collection process. An enumerator of the survey team shadowed a Franklin Baker inspector to observe and document the time and costs associated with every procedure the inspector performed. All observations within the day were submitted or synced through TaroWorks and were extracted by Grameen's Monitoring and Evaluation (M&E) Team for data analysis and validation.

Sample size. The unit of the observation was "elapsed time per procedure." Due to aforementioned project duration limitations, the survey team was given a limited window for observation. The survey team was required to gather at least 5 samples for each procedure and was given 7 days to observe during baseline and endline. The survey team was able to gather 88 valid observations in the baseline and 128 valid observations in the endline.

Scope and limitations

Franklin Baker, People's Bank of Caraga, and the Philippine Coconut Authority identified farmers from their own programs that were then assigned to the treatment groups or the control group. Given that the farmers were not randomly assigned into the groups, the changes detected among the treatment groups cannot be solely attributed to the FarmerLink program, but can only be suggestive of its impacts. Moreover, it cannot be fully guaranteed that part of the intervention did not reach the farmers in the control group and that some of the results found could have potentially been commingled given the proximity of the control group to farmers in the treatment group.

Also, as has been noted, the limited seven months of exposure to the intervention only allowed for observation of changes in variables such as smallholder farmer knowledge, access to financial services and farm inputs, and adoption of GAPs. Detecting changes in income or agricultural productivity were neither possible nor expected due to the short implementation period.

FARMER OUTCOMES

Demographics

The average coconut farmer in the FarmerLink sample in the Davao Region tills 2.3 hectares of farmland, 2.0 hectares of which are devoted to coconut trees. At the baseline, 12.6% of the total sample was found to live below the $1.25 international poverty line and $43.97% were found to live below the $2.50 international poverty line using the 2014 Progress out of Poverty Index (PPI) that used 2009 data. Comparing this to the Philippines poverty data in general, using International 2005 PPP data, 11.5% of the Philippines lived below $1.25 and 42.7% lived below the $2.50 international poverty line.[5] Given it is assumed most coconut farmers live in more rural areas, when comparing the FarmerLink outreach to poor farmers using rural data, 18.3% lived below the $1.25 international poverty line and 58.9% lived below the $2.50 international poverty line. This data suggests that the coconut farmers reached by the FarmerLink program were slightly poorer than the national average, but slightly better off compared to the average rural household. Fifty-four percent of those farmers interviewed were women, and the remaining 46 percent were men.

Owing to a variety of factors including the drought that plagued the region in the two years prior to the project (prior to 2015), the mean coconut yield was at 4,604 nuts for the last 12 months or 20 nuts per tree per year. This yield is significantly lower than the Philippine Coconut Authority estimated range of 60 to 90 nuts per tree per year.

Each nut, weighing approximately a kilo per piece, is priced at PHP 8.41 (Philippine Peso) on the average. This translates to a farmer's yearly income amounting to PHP 38,719.64 (USD 754) that is barely enough to support a typical farming family of five.

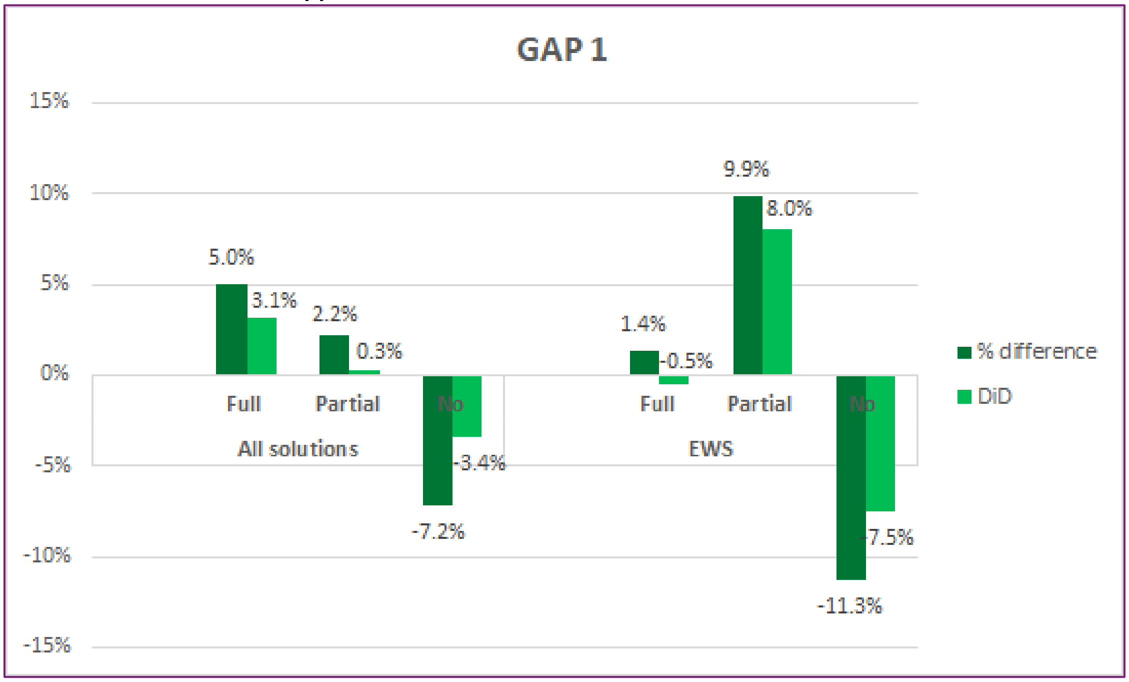
GAPs Adoption

GAP 1 Salt fertilizer application. At baseline, only 1.9% of the all-solutions group fully adopted salt fertilizer practices; at endline, 6.9% did. This represents a 5 percentage-point increase for the all-solutions cohort. 62.2% partially adopted the practice at baseline, and 64% did at endline, representing a 2 percentage-point increase. Results show that the all-solutions cohort outperformed the control group at endline both in terms of full and partial adoption by 3.1 and 0.3 percentage points, respectively.

At baseline, only 1.4% of the EWS group fully adopted salt fertilizer practices; at endline, 2.7% did. This represents a 1.4 percentage-point increase for the EWS cohort. 48.8% partially adopted the practice at baseline, and 58% did at endline, representing a 9.9 percentage-point increase. Results show that the EWS cohort outperformed the control group at endline in full and partial adoption by 0.5 and 8 percentage points, respectively (Figure 8).

[5] Schreiner, M. 2014. Simple Poverty Scorecard® Poverty-Assessment Tool Philippines. http://www.simplepovertyscorecard.com/PHL_2009_ENG.pdf

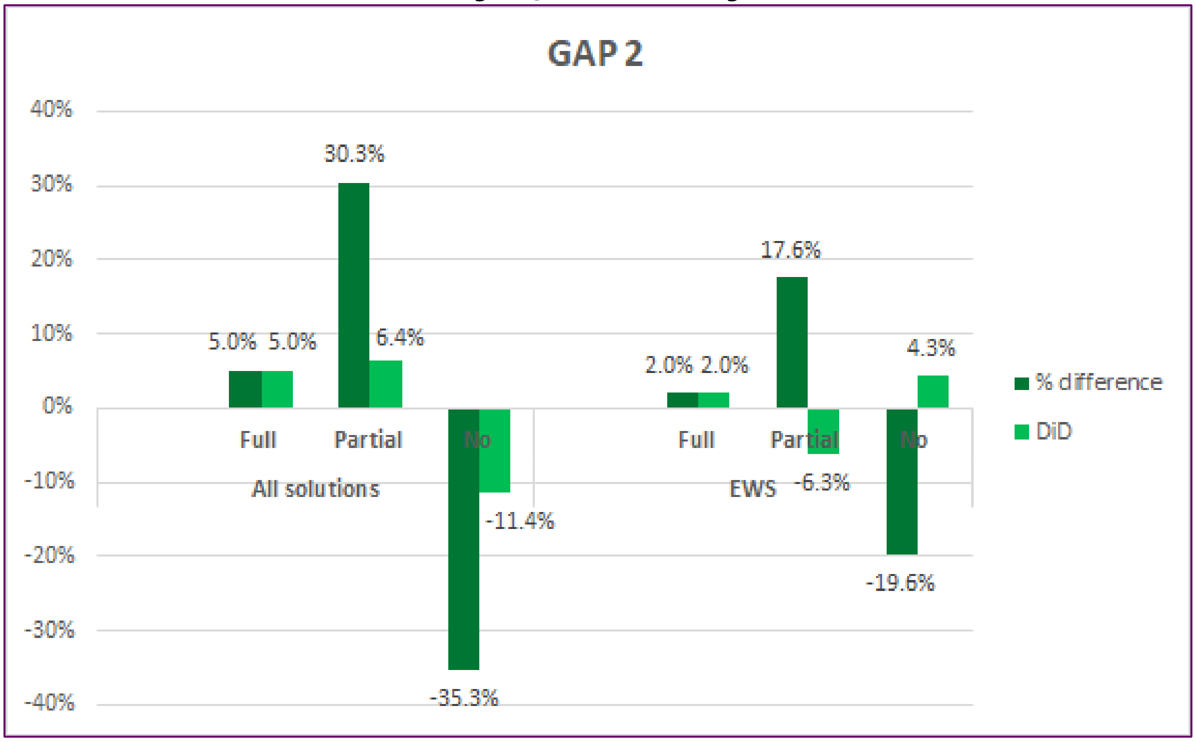
Figure 8: GAP 1 Salt Fertilizer Application



GAP 2 Mulching. At baseline, none of the farmers in the all-solutions cohort mulched (0%). At endline, 5% fully adopted the practice (5 percentage-point improvement). At baseline, 16.3% of the all-solutions cohort partially adopted mulching; at endline, 46.6% did, representing a 30 percentage-point increase. When compared to the control group (Figure 9), the all-solutions group outperformed the control group at endline by 5 percentage points for full adoption and 6.4 percentage points for partial adoption.

At baseline, only 1.7% of the EWS group fully adopted mulching practices; at endline, 3.8% did. This represents about 2 percentage-point increase for the EWS cohort. 19.6% partially adopted the practice at baseline, and 37.2% did at endline, representing a 17.6 percentage-point increase. The EWS cohort outperformed the control group at endline in full adoption by 2 percentage points; however, the control group outperformed the EWS cohort by 6.3 percentage points at endline in partial adoption of mulching.

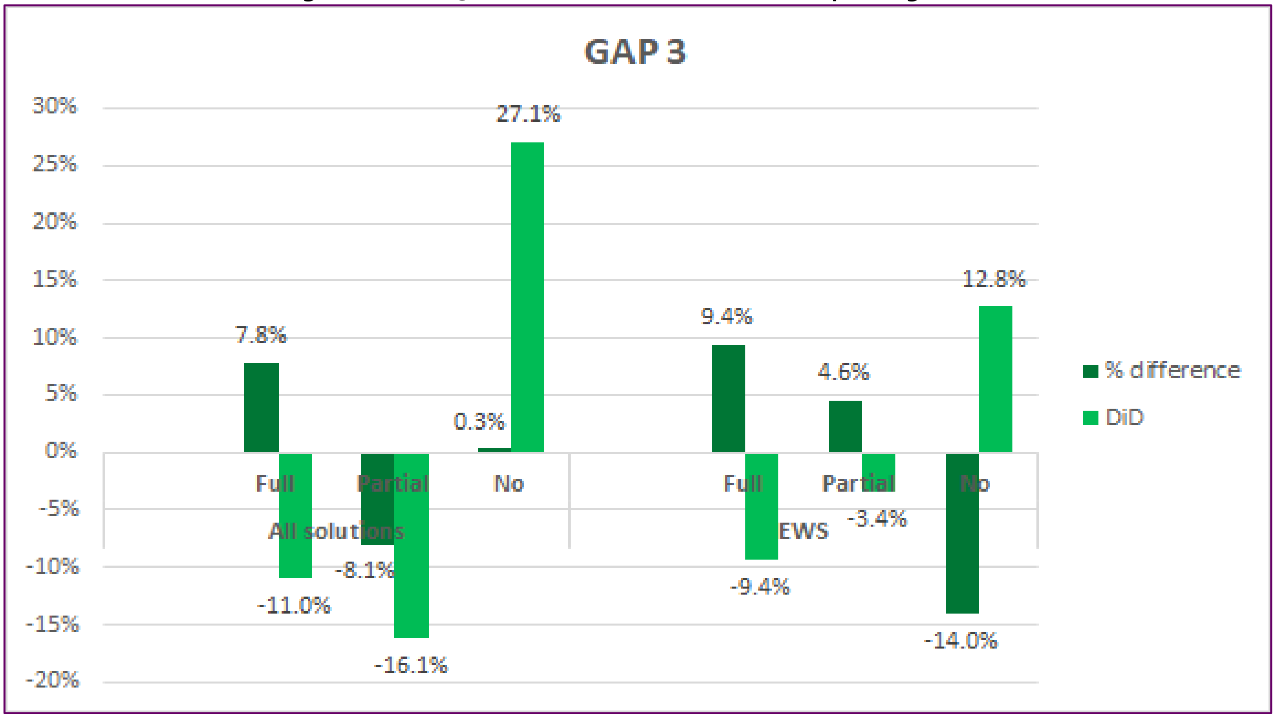
Figure 9: GAP 2 Mulching



GAP 3 Removal of old coconut leaves / Pruning. At baseline, 25% of the all-solutions cohort fully adopted the practice of pruning; at endline, about 33% did, representing a 7.8 percentage-point increase in full adoption. At baseline, almost 42% of the all-solutions cohort partially adopted the practice of pruning their coconut trees whereas at endline, only 33% did, representing an 8 percent decrease. However, when compared to the control group cohort, the control group outperformed the all-solutions cohort at endline by 11 percentage points for full adoption and by 16 percentage points in partial adoption.

Results are similar when the EWS cohort is compared to control group. At baseline, 19.6% of the EWS group fully adopted pruning practices; at endline, 29% did. This represents a 9.4 percentage-point increase for the EWS cohort. 29.9% partially adopted the practice at baseline, and 34.5% did at endline, representing a 4.6 percentage-point increase. The control group outperformed the EWS cohort by 9.4 percentage points for full adoption and 3.4 percentage points for partial adoption.

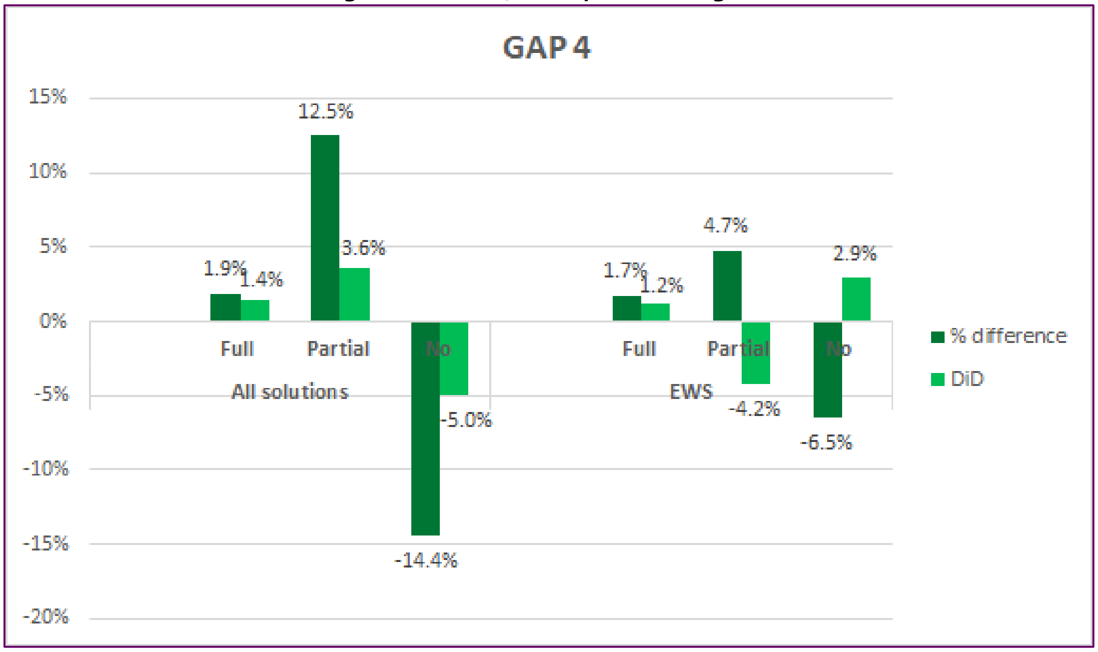
Figure 10: GAP 3 Removal of old coconut leaves/pruning



GAP 4 Timely harvesting. Timely harvesting is done within 45 to 60 days of nut maturation. Results show that at baseline, for full adoption, only 0.3% harvested in a timely manner; at endline 2.2% did, representing an almost 2 percentage-point increase. For partial adoption, 43% of the all-solutions cohort harvested their coconut in a timely manner; at endline, 56% did, representing an almost 13 percentage-point increase. Compared to the control cohort (Figure 11), the all-solutions cohort outperformed the control group at endline by 1.4 percentage points for full adoption and 3.6 percentage points for partial adoption.

At baseline, 0% of the EWS group fully adopted timely harvesting practices; at endline, 1.7% did. This represents a 1.7 percentage-point increase for the EWS cohort. 55.0% partially adopted the practice at baseline, and 59.7% did at endline, representing a 4.7 percentage-point increase. For the EWS cohort, they outperformed the control group by 1.2 percentage point for full adoption however, for partial adoption, the control group outperformed the EWS cohort by 4.2 percentage points.

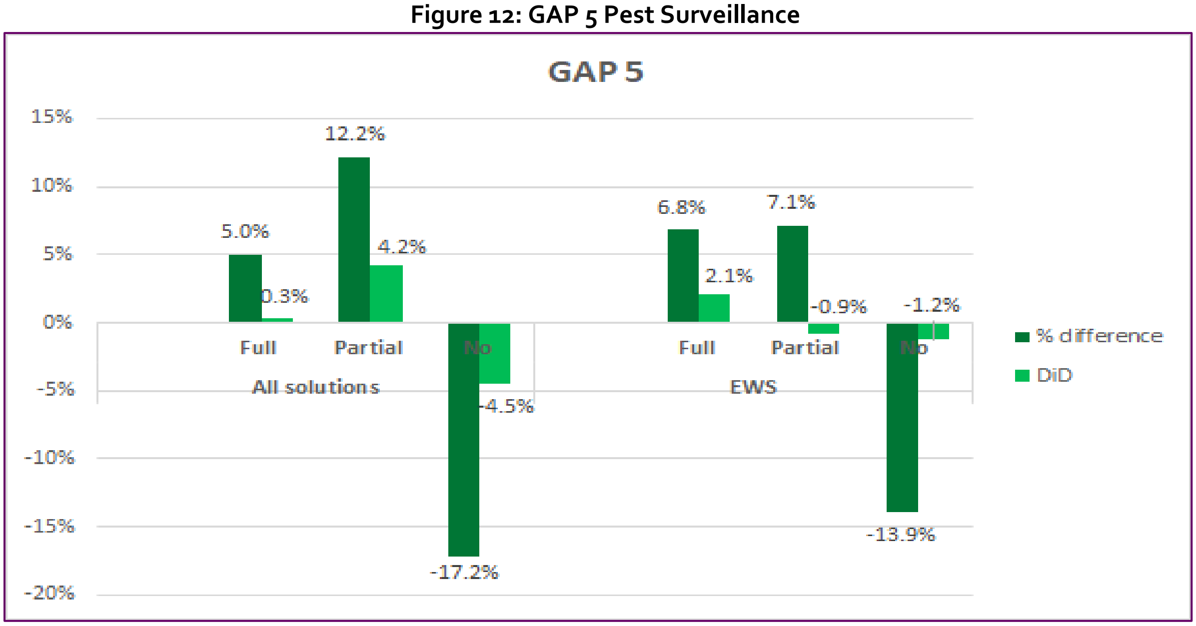
Figure 11: GAP 4 Timely Harvesting



GAP 5 Pest surveillance. At baseline, 0.3% of the all-solutions cohort were in full adoption of pest surveillance, at endline 5.3% were, representing a 5 percentage-point increase. At baseline, 4% of the all-solutions cohort were in partial adoption of pest surveillance activities; at endline 16% were, representing a 12 percentage-point increase. At endline, the all-solutions cohort outperformed the control group in full and partial adoption by 0.3 and 4 percentage points, respectively (Figure 12).

At baseline, only 2.4% of the EWS group fully adopted pest surveillance practices; at endline 9.2% did. This represents a 6.8 percentage-point increase for the EWS cohort. 8.2% partially adopted the practice at baseline, and 15.4% did at endline, representing a 7.1 percentage-point increase. For the EWS cohort, they outperformed the control group in full adoption by 2.1 percentage points; however, the control group outperformed the EWS cohort in partial adoption by 0.9 percentage points.

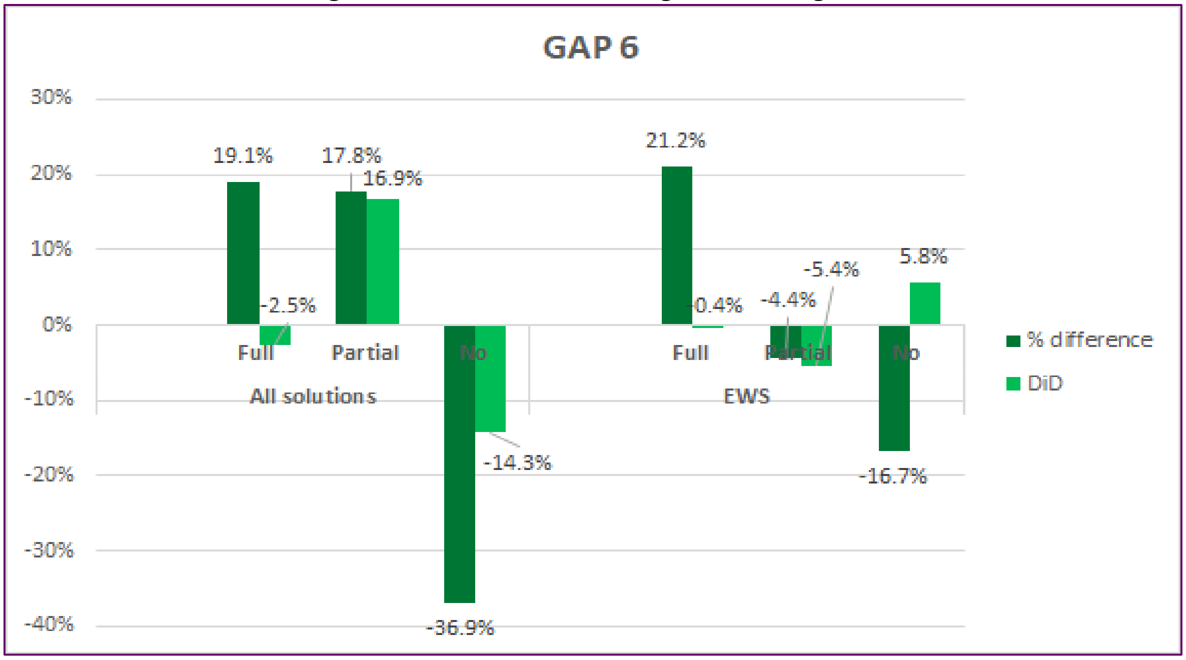
Figure 12: GAP 5 Pest Surveillance



GAP 6 Underbrushing and weeding. This was another practice not applied by any farmer in the all-solutions group. However, at the endline 19.1% of the cohort reported to full adoption of weeding. 38.8% partially adopted this practice at baseline; at endline, 56.6% did, representing an almost 18 percentage-point increase. Despite the marked improvement in full adoption of weeding, the control group outperformed the all-solutions cohort by 2.5 percentage points at endline. However, the all-solutions group outperformed the control group by 17 percentage points in partial adoption of weeding (Figure 13).

At baseline, no participant in the EWS group fully adopted weeding practices; at endline, 21.2% did. This represents a 21.2 percentage-point increase for the EWS cohort. 48.5% partially adopted the practice at baseline, and 44% did at endline, representing a 4.4 percentage-point decrease. The control group outperformed the EWS cohort in both full and partial adoption by 0.4 and 5.4 percentage points, respectively.

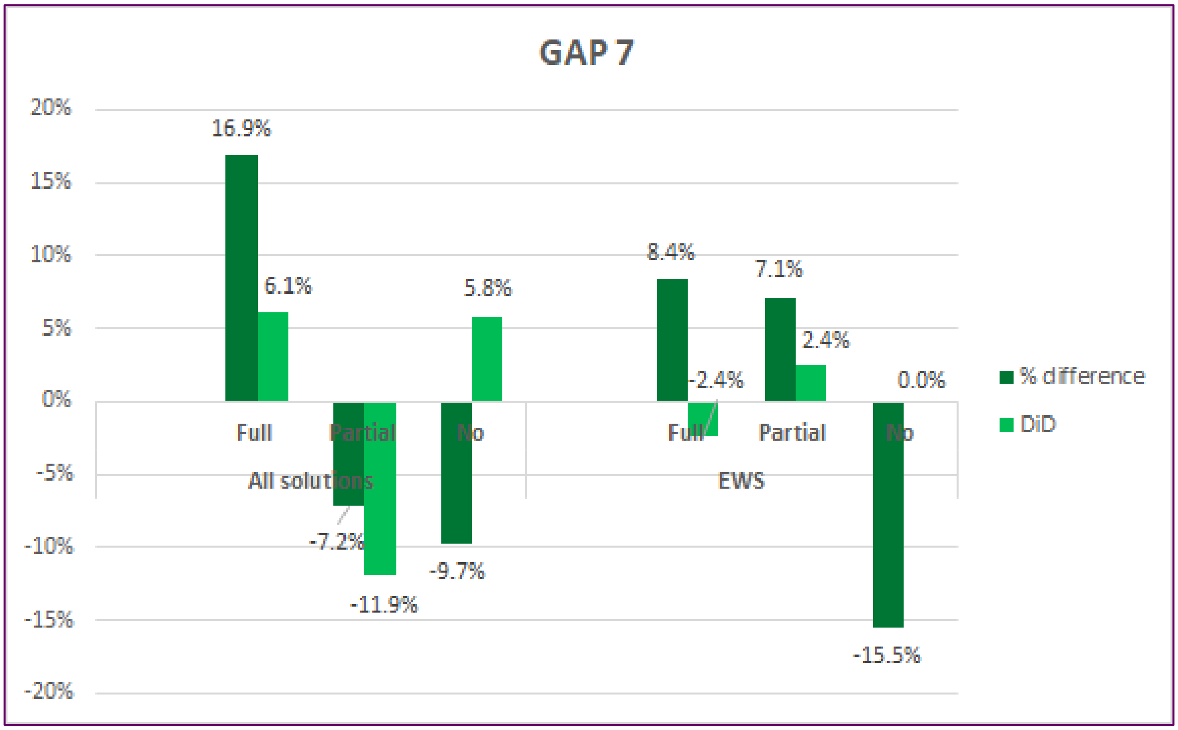
Figure 13: GAP 6 Underbrushing and weeding



GAP 7 Proper distancing. At baseline, 7.8% of the all-solutions fully adopted the practices associated with proper-distancing of coconut trees; at endline, 24.7% of the cohort did, representing an almost 17 percentage-point increase. 11.9% of the all-solutions cohort partially adopted these practices at baseline; at endline, 4.7% did, representing a 7 percentage-point decrease. Comparing the all-solutions and control cohorts at endline, the former outperformed the latter for full adoption by 6.1 percentage points. However, the control group outperforms the all-solutions group in partial adoption by almost 12 percentage points (Figure 14).

At baseline, 21.6% of the EWS group fully adopted distancing practices; at endline, 30% did. This represents an 8.4 percentage-point increase for the EWS cohort. 5.8% partially adopted the practice at baseline, and 13% did at endline, representing a 7.1 percentage-point increase. For the EWS cohort, it outperformed the control group by 2.4 percentage points in partial adoption, but the control group outperformed the EWS cohort by the same amount for full adoption.

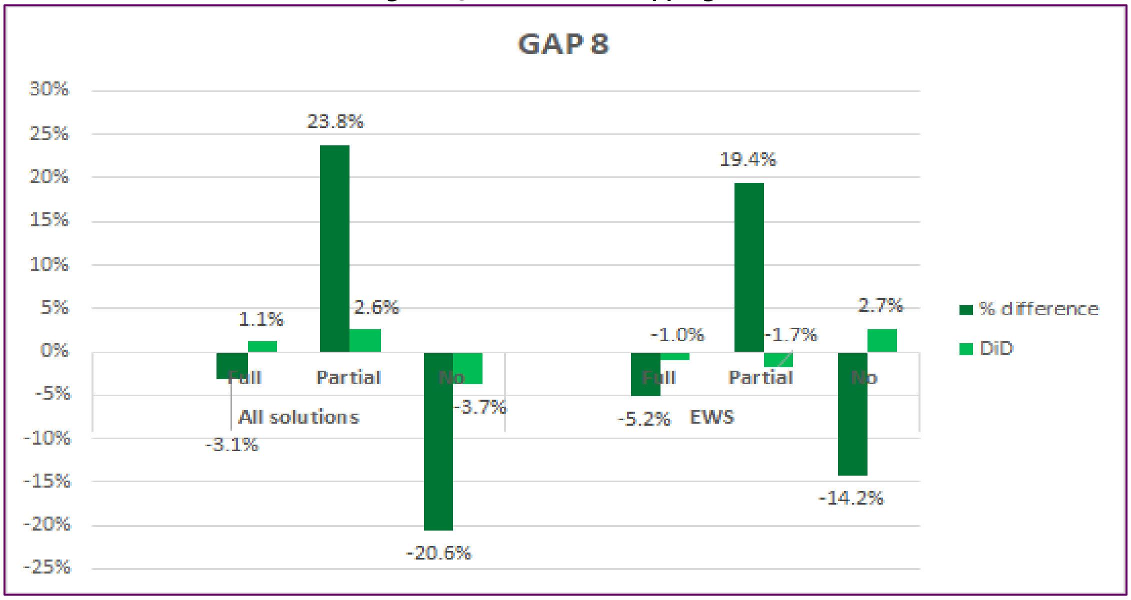
Figure 14: GAP 7 Proper distancing



GAP 8 Intercropping. At baseline, 5.9% of the all-solutions cohort reported that they are fully practicing the standard methods of intercropping; at endline, 2.8% did, representing a 3.1 percentage-point decrease. 50.9% partially-adopted the practice at baseline; at endline, 74.7% did, representing a 23.8 percentage-point increase. Comparing the all-solutions cohort to the control group at endline (Figure 15), the former outperformed the latter by 1.1 percentage points in full adoption and by 2.6 percentage points in partial adoption.

At baseline, 9.3% of the EWS group fully adopted intercropping practices; at endline, 4.1% did. This represents a 5.2 percentage-point decrease for the EWS cohort. 53.3% partially adopted the practice at baseline, and 72.7% did at endline, representing a 19.4 percentage-point increase. In the case of the EWS cohort, it was outperformed by the control group both in terms of full and partial adoption by 1 and 1.7 percentage points, respectively.

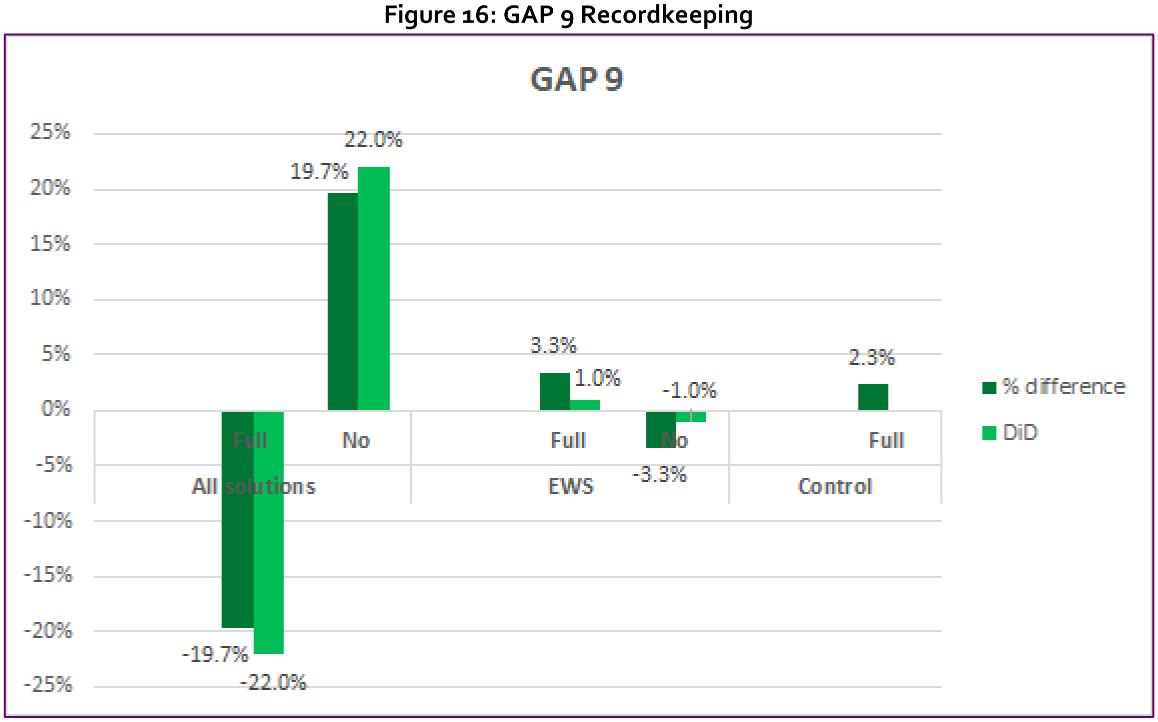
Figure 15: GAP 8 Intercropping



GAP 9 Recordkeeping. At baseline, 45.9% of the all-solutions group reported to fully adopt the practices related to recordkeeping; at endline, 26.3% did, representing a 19.7 percentage-point decrease. In terms of partial adoption, 54.1% kept records at baseline, but 73.8% did at endline, representing a 19.7 percentage-point increase. The control group outperformed the all-solutions group in full adoption by 22 percentage points at endline. However, the all-solutions cohort outperformed the control group by 22 percentage points for partial adoption.

At baseline, 9.3% of the EWS group fully adopted recordkeeping practices; at endline, 12.6% did. This represents a 3.3 percentage-point increase for the EWS cohort. The group also outperformed the control group in terms of full adoption by 1 percentage point.

Figure 16: GAP 9 Recordkeeping



A summary of the results for the full and partial adoption of each of the 9 practices for the all-solutions cohort can be found in Tables 2 and 3 below, while Tables 4 and 5 contain that of the EWS cohort results. The blue highlighted rows in the tables are practices where the all-solutions (for Table 2 and 3) or the EWS cohort (for Table 4 and 5) group outperformed the control group at endline.

Comparing the all-solutions cohort and the control group in Table 2, results show that the **all-solutions treatment group outperformed the control group in full adoption rates for 6 of 9 practices** (67% of GAPs). The GAPs where the all-solutions cohort had greater changes between the baseline and endline as compared to the control group were:

- GAP 7 Proper distancing: 6 percentage-point difference
- GAP 2 Mulching: 5 percentage-point difference
- GAP 1 Salt fertilizer application: 3 percentage-point difference

The Control group, on the other hand, outperformed the all-solutions cohort in full adoption in three practices: recordkeeping, removal of old coconut leaves and pruning and in weeding.

Table 2: Full adoption of GAPs for All-Solutions Cohort

GAP	Baseline	Endline	Difference between endline and baseline	Difference between all solutions and control in percentage points
GAP 1: Salt fertilizer application ***(Contributes 60% to overall productivity)***	1.9%	6.9%	5%	**3.1%**
GAP 2: Mulching ***(Contributes 33% to overall productivity)***	0%	5%	5%	**5%**
GAP 3: Removal of old coconut leaves / Pruning	25%	32.8%	7.8%	-11%
GAP 4: Timely harvesting	0.3%	2.2%	1.9%	**1.4%**
GAP 5: Pest surveillance	0.3%	5.3%	5%	**0.3%**
GAP 6: Weeding	0%	19.1%	19.1%	-2.5%
GAP 7: Proper distancing	7.8%	24.7%	16.9%	**6.1%**
GAP 8: Intercropping	5.9%	2.8%	-3.1%	**1.1%**
GAP 9: Recordkeeping	45.9%	26.3%	-19.7%	-22%

Results also show that the two GAPs known to contribute about 93% of overall coconut productivity (salt fertilizer application and mulching) saw two of the highest increases in full adoption. Given these promising results on adoption, there is data to show that if the intervention were to be sustained over time, it would likely lead to increases in productivity and income in the long-term. Marvin shares his experience of the SMS and one-to-one intervention here: https://youtu.be/eVBLv2j-QIA.

Between the all-solutions cohort and the control group (Table 3), results show that the **all-solutions treatment group outperformed the control group in partial adoption rates for 7 of 9 practices** (78% of GAPs). The GAPs where the all-solutions cohort had greater changes between the baseline and endline as compared to the control group were:

- GAP 9 Recordkeeping: 22 percentage-point difference
- GAP 6 Weeding: 17 percentage-point difference
- GAP 2 Mulching: 6.4 percentage-point difference

The control group outperformed the all-solutions cohort in partial adoption in two practices: removal of old coconut leaves and proper distancing of trees.

Table 3: Partial adoption of GAPs for All-Solutions Cohort

GAP	Baseline	Endline	Difference between endline and baseline	Difference between all solutions and control in percentage points
GAP 1: Salt fertilizer application *(Contributes 60% to overall productivity)*	62.2%	64.4%	2.2%	**0.3%**
GAP 2: Mulching *(Contributes 33% to overall productivity)*	16.3%	46.6%	30.3%	**6.4%**
GAP 3: Removal of old coconut leaves / Pruning	41.6%	33.4%	-8.1%	-16.1%
GAP 4: Timely harvesting	43.1%	55.6%	12.5%	**3.6%**
GAP 5: Pest surveillance	4.1%	16.3%	12.2%	**4.2%**
GAP 6: Weeding	38.8%	56.6%	17.8%	**16.9%**
GAP 7: Proper distancing	11.9%	4.7%	-7.2%	-11.9%
GAP 8: Intercropping	50.9%	74.7%	23.8%	**2.6%**

Looking at the EWS cohort, results show that the **EWS treatment group outperformed the control group in full adoption rates for 4 of 9 practices** (44% of GAPs). The GAPs where the EWS cohort had greater changes between the baseline and endline as compared to the control group, were:

- GAP 5 Pest surveillance: 2.1 percentage-point difference
- GAP 2 Mulching: 2 percentage-point difference
- GAP 4 Timely harvesting: 1.2 percentage-point difference

The control group outperformed the EWS cohort in full adoption in five practices: salt fertilized application, removal of old coconut leaves / pruning, weeding, proper distancing and intercropping.

Table 4: Full adoption of GAPs for EWS Cohort

GAP	Baseline	Endline	Difference between endline and baseline	Difference between all solutions and control in percentage points
GAP 1: Salt fertilizer application *(Contributes 60% to overall productivity)*	1.4%	2.7%	1.4%	-0.5
GAP 2: Mulching *(Contributes 33% to overall productivity)*	1.7%	3.8%	2.0%	**2.0%**
GAP 3: Removal of old coconut leaves / Pruning	19.6%	29.0%	9.4%	-9.4%
GAP 4: Timely harvesting	0.0%	1.7%	1.7%	**1.2%**
GAP 5: Pest surveillance	2.4%	9.2%	6.8%	**2.1%**
GAP 6: Weeding	0.0%	21.2%	21.2%	-0.4%
GAP 7: Proper distancing	21.6%	30.0%	8.4%	-2.4%
GAP 8: Intercropping	9.3%	4.1%	-5.2%	-1.0%
GAP 9: Recordkeeping	9.3%	12.6%	3.3%	**1.0%**

Based on Table 5, results show that the **EWS treatment group outperformed the control group in partial adoption rates for 2 of 8 practices** (25% of GAPs):

- GAP 1 Salt fertilization application: 8 percentage-point difference

- GAP 7 Proper distancing: 2.4 percentage-point difference

The control group outperformed the all-solutions cohort in partial adoption in the rest of the practices: mulching, removal of old coconut leaves / pruning, timely harvesting, pest surveillance, weeding and intercropping.

Table 5: Partial adoption of GAPs for EWS Cohort

GAP	Baseline	Endline	Difference between endline and baseline	Difference between all solutions and control in percentage points
GAP 1: Salt fertilizer application ***(Contributes 60% to overall productivity)***	48.8%	58.7%	9.9%	**8.0%**
GAP 2: Mulching ***(Contributes 33% to overall productivity)***	19.6%	37.2%	17.6%	-6.3%
GAP 3: Removal of old coconut leaves / Pruning	29.9%	34.5%	4.6%	-3.4%
GAP 4: Timely harvesting	55.0%	59.7%	4.7%	-4.2%
GAP 5: Pest surveillance	8.2%	15.4%	7.1%	-0.9%
GAP 6: Weeding	48.5%	44.0%	-4.4%	-5.4%
GAP 7: Proper distancing	5.8%	13.0%	7.1%	**2.4%**
GAP 8: Intercropping	53.3%	72.7%	19.4%	-1.7%

In conclusion, there was an overall increase in the adoption of GAPs across all three cohorts. While the all-solutions group outperformed the control group in most of the practices, the control group, on the other hand, outperformed the EWS group in most cases. There are a couple of probable causes for the change in agricultural practices (mostly improvements) exhibited by farmers in the control group despite the lack of any intervention applied to their cohort:

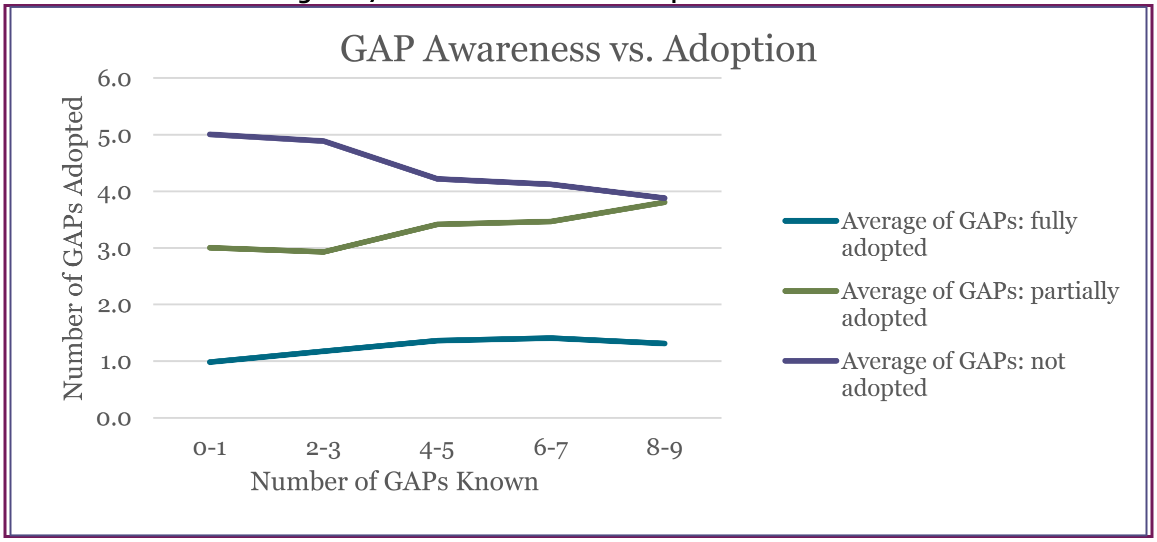
- *Spillover effects*: The close proximity between treated and control farmers may have helped spread the awareness and knowledge of implementing GAPs to the control group.
- *Survey effects*: The fact that the control group was asked about these practices may have created awareness which may have led to increased adoption.
- *External factors*: There may have been a change in factors external to the project that affected adoption of GAPs, and these changes happened in farmers across all three cohorts. It is not immediately clear what these factors might have been.

Drivers of GAP Adoption

In addition to assessing GAPs in terms of their individual and cumulative adoption, additional analysis was completed to help provide insights on the possible drivers of adoption. The first appraisal compared GAP adoption and the awareness or knowledge of the processes involved in the practices. The second compared GAP adoption and access to financial products and services, while the third compared GAP adoption and the farmer's gender.

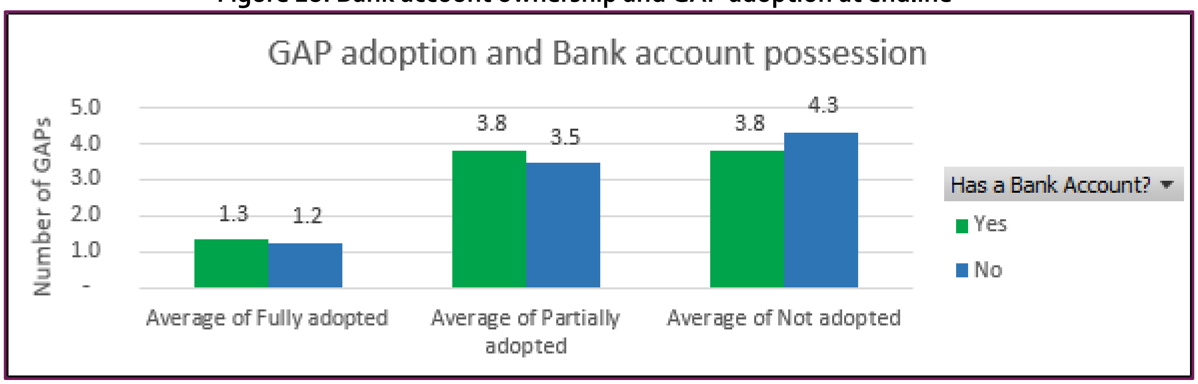
Awareness and GAP adoption. Figure 17 compares the adoption levels with the farmers' awareness of good agricultural practices at endline. The y-axis contains the average number of GAPs adopted (fully or partially) and the x-axis contains the number of practices that the farmers are aware of. The results suggest that awareness of the GAP is somewhat associated with whether or not a farmer adopts the practice. This seems particularly true for those that partially adopt GAPs, but less so for full or no adoption, suggesting other constraints to adoption of GAPs.

Figure 17: GAP awareness and adoption at endline



Access to financial services and GAP adoption. Figure 18 looks at farmer data on possession of a bank account and GAPs application. Data shows that farmers who have a bank account had a slightly higher number of GAPs fully and partially adopted than farmers who did not have a bank account. However, the analysis did not see a clear relationship between access to loans and adoption.

Figure 18: Bank account ownership and GAP adoption at endline



The analysis used four variables to represent access to financial services and whether they were related to GAP adoption among the all-solutions cohort. These variables were (1) bank account ownership, (2) debt status (had a loan), (3) debt repayment status, and (4) source of credit.

Analyzing bank account ownership data and individual GAP adoption, the results showed that:

- Farmers who had bank accounts didn't seem to have higher levels of full adoption in all GAPs:
  - GAP 6 (proper distancing): with bank account → 23% full adoption; without bank account → 18% full adoption
  - GAP 8 (intercropping): with bank account → 5% full adoption; without bank account → 2% full adoption
  - GAP 9 (recordkeeping): with bank account → 33% full adoption; without bank account → 25% full adoption

- Farmers who had bank accounts had higher levels of partial adoption in 4 out of 9 GAPs:
  - GAP 1 (salt fertilizer application): with bank account → 77% partial adoption; without bank account → 62% partial adoption
  - GAP 2 (mulching): with bank account → 63% partial adoption; without bank account → 43% partial adoption

- GAP 3 (pruning): with bank account → 42% partial adoption; without bank account → 32% partial adoption
- GAP 8 (intercropping): with bank account → 77% partial adoption; without bank account → 74% partial adoption

- For intercropping, full and partial adoption were still observed to be higher among those who had bank accounts as compared to those who didn't but the difference is smaller than in the previously mentioned GAPs.

There does not seem to be a relationship between GAP adoption and whether their repayment was up-to-date, with the exception of mulching and weeding. Farmers who were up-to-date with their loan payments were the ones who were adopting salt fertilizer application and pruning. Salt fertilizer application is the most expensive practice to adopt among all GAPs promoted since farmers need to invest $63 per 100 trees annually. But it is one of the most important as it contributes to 60% of overall coconut productivity.

Finally, farmers who borrowed from cooperatives and banks were more likely to adopt 6 out of 9 GAPs or 67% as compared to farmers who borrowed from traders, informal lenders, and family members. These included salt fertilizer application, mulching, pruning, weeding, proper distancing and recordkeeping. This uptake can possibly be attributed to the combination and variety of services (extension and support services) offered by these institutions in addition to the loans.

Gender of farmer interviewed and GAP adoption. More than half of the sampled farmers were women. For many of the participants, it was the first time they had been exposed to actionable SMS-based agronomic information which they could easily access and apply in their farm. Results show a lack of significant relationship between GAP adoption and farmer gender. This can be interpreted in two ways: (1) either coconut farmers were influenced by the FarmerLink interventions regardless of their gender or (2) the farmers gave a response on behalf of the actual farm operator (more than half of the sampled farmers were women and their answers could have been given on behalf of her husband or other members, which do not directly reflect her personal capability to put GAPs into practice). The relationship between gender of the farmer (particularly for female-headed households) and GAP adoption needs further exploration.

Impact of the EWS. As of June 30, 2017, 3,291 farmers received an SMS alert on "too dry" weather conditions via the EWS. Farmers received SMS stating the unfavorable weather condition and the appropriate action they could take to mitigate risks. There were 128 farmers in the sample who responded to the monitoring system that was set up to capture feedback. Results show that (1) 85% of farmers confirmed that the alerts reflected the reality around them, (2) 86% indicated they learned how they could take appropriate actions to mitigate the risk of drought and pests, and (3) 58% reported putting into practice the recommended actions promoted by the alert.

Cristita shares her experience of FarmerLink's EWS here: https://youtu.be/xjK1Sas2jIc

PROGRAM SUSTAINABILITY

For the program to continue post-grant, there should be a clear value proposition for farmers and the partners who are the potential implementers after the grant funding. During the endline data collection, farmer perceptions and satisfaction level were gathered. For partners, an activity-based costing methodology was used to measure efficiency gains when using the FarmerLink mobile tools in their operations. These gains were translated to dollar values to inform the decision making of partners. The key findings are summarized in the sections below.

Farmer Satisfaction

- Farmers were very satisfied with the program and agreed that they would likely gain new skills if FarmerLink was sustained. 93% of farmers in All-Solutions and EWS/SMS cohort agreed or strongly agreed that they would gain skills from the project if it is continued (Figure 19).
- 90% of farmers responded they are likely to recommend participation in the program to others in their community (Figure 20).
- 80% reported to be either extremely or very satisfied with the FarmerLink program (Figure 21).
- Perception on overall SMS content and its impact on farm management was also high (Figure 22). 70% of farmers who received messages on farm management practices confirmed that the information was very or extremely influential in the way they managed their farms.
- Perception on overall SMS content and its influence on household financial management was also relatively high (Figure 23). 65% percent of farmers who received messages on financial literacy and household financial management practices confirmed that the messages were very or extremely influential in the way they handled their household finances.
- Farmers reported high satisfaction with one-to-one agricultural extension agent visits and coaching sessions (Figure 24). 96% of farmers who received the visits responded that they had established a positive relationship with the agents. Majority of the farmers (about 93%) were satisfied with the quality of agent's agronomic knowledge. (Figure 25).

Figure 19: Perception of Skills Acquisition and FarmerLink Continuation

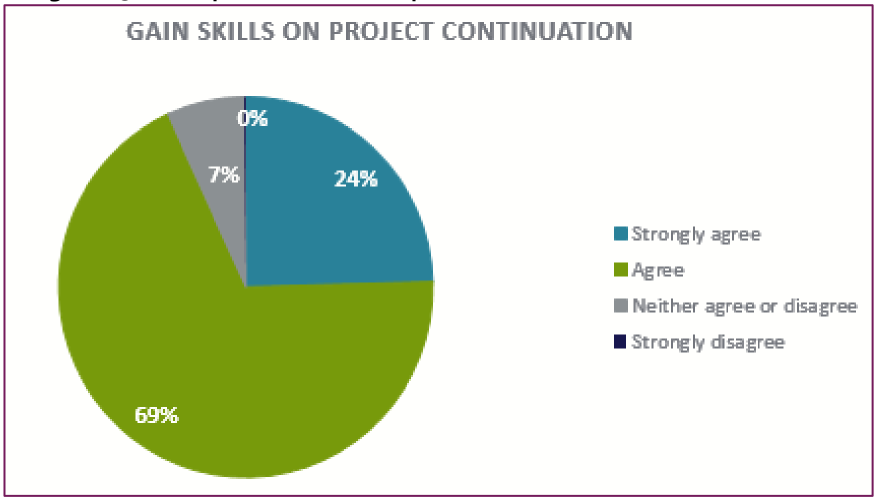


Figure 20: Recommendations of FarmerLink to Community

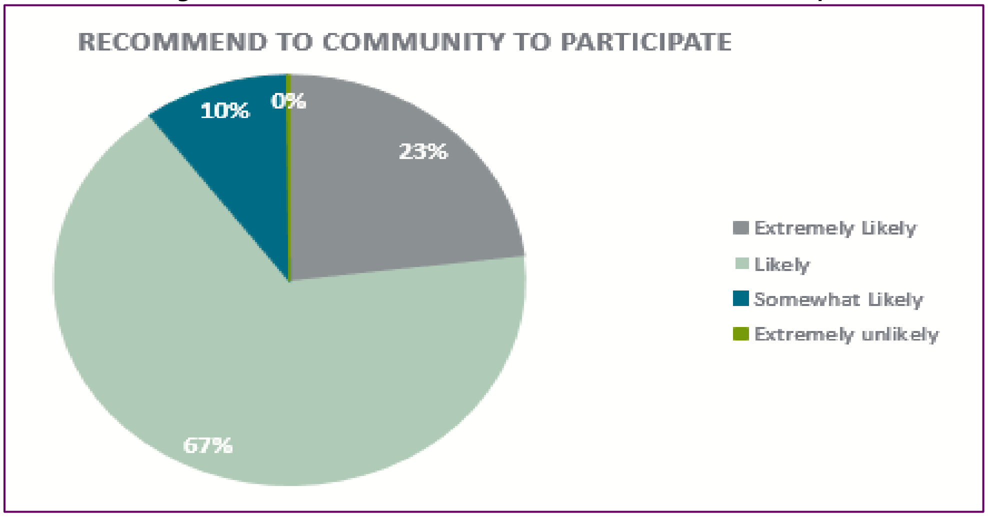


Figure 21: Satisfaction with FarmerLink

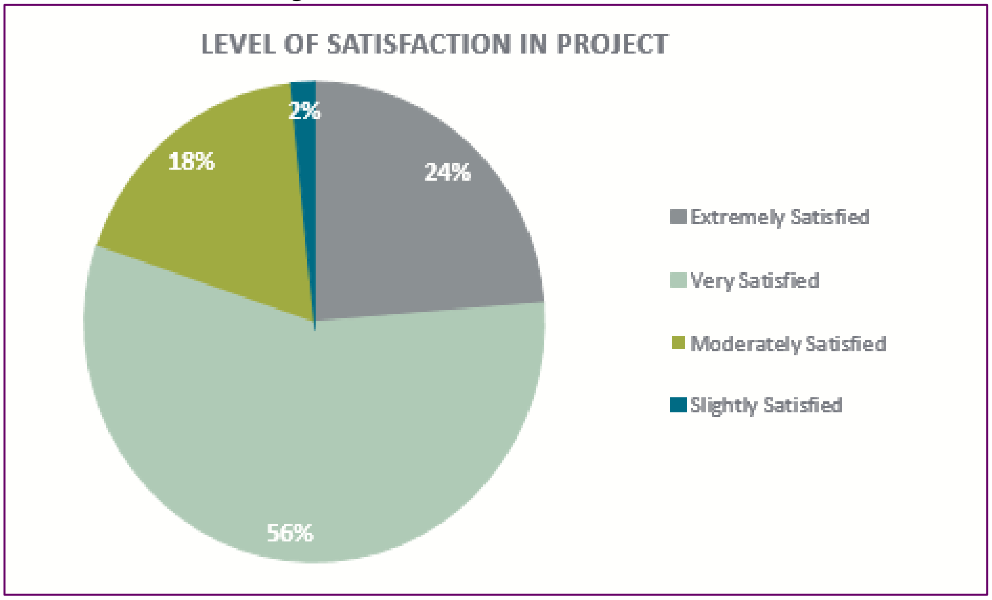


Figure 22: Influence of SMS content on Household (HH) Farm Management

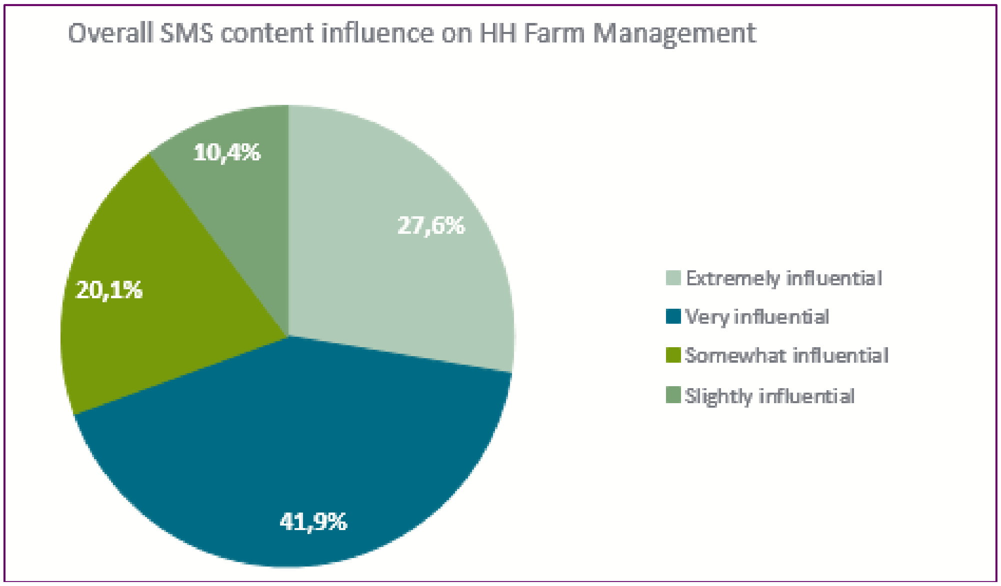


Figure 23: Influence of SMS content on Household (HH) Financial Management

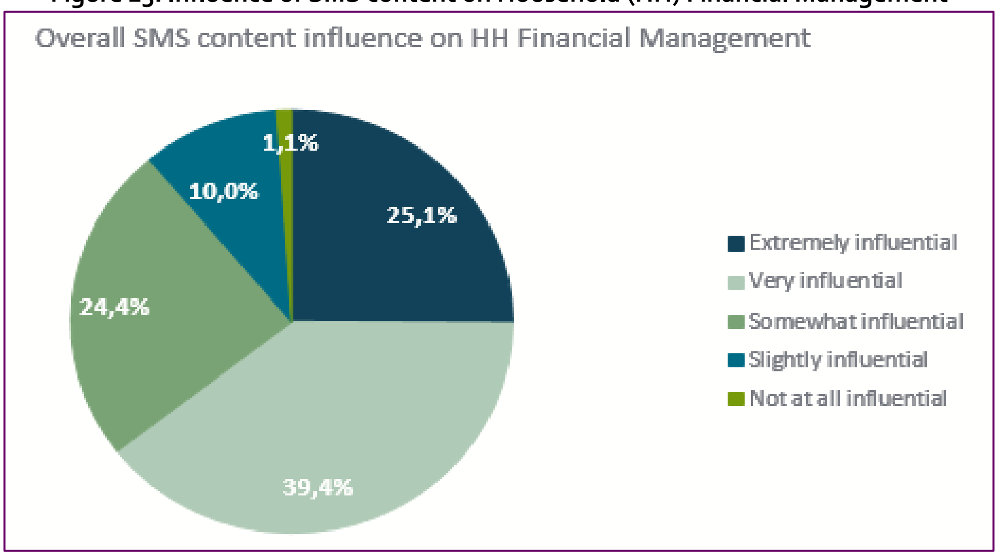


Figure 24: Relationship between Farmer and Extension Agent

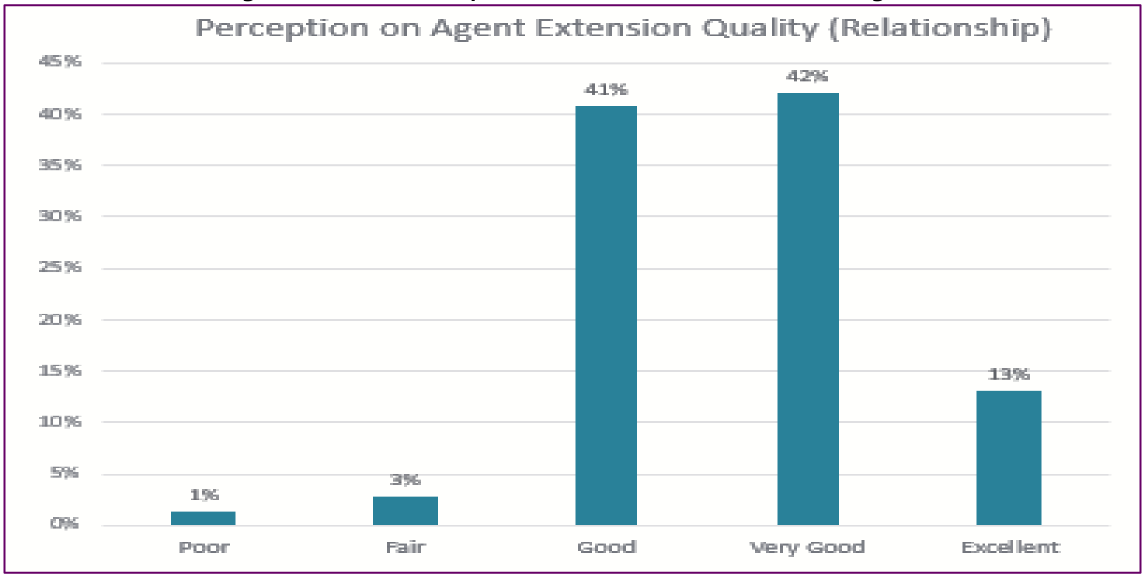
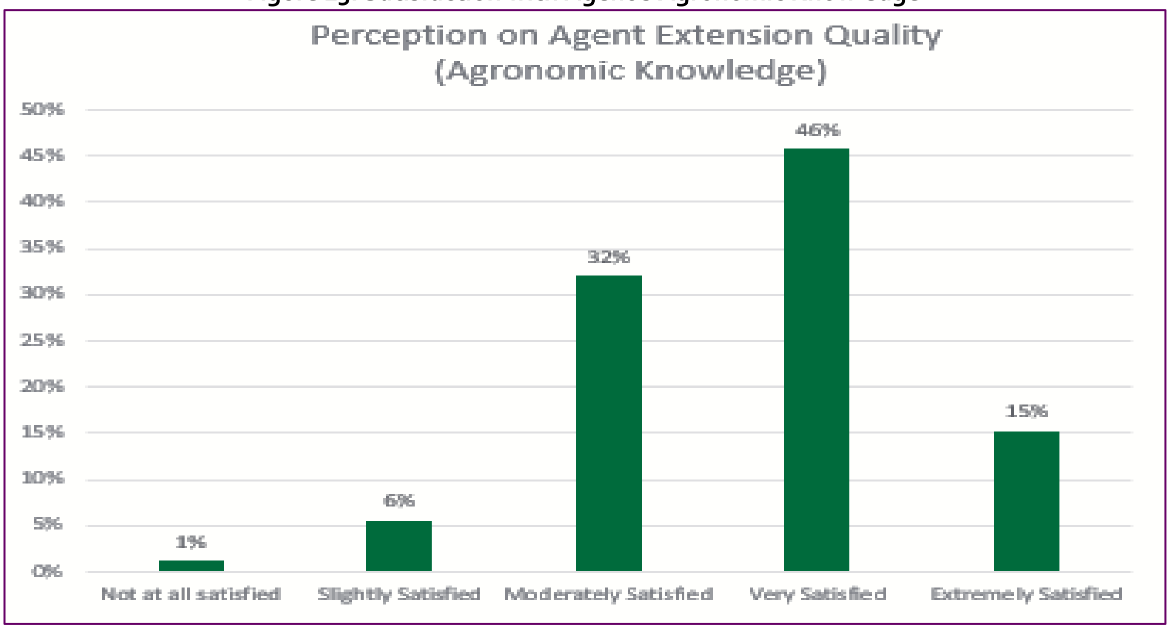


Figure 25: Satisfaction with Agent's Agronomic Knowledge



Partner Satisfaction and Efficiency Gains

There are two areas in Franklin Baker's operations that are potential sources of efficiency gains. The first one is the farm organic inspection process where agents visit farmers one by one and inspect each farmer's plot for organic certification. The second area is the reporting process where data is consolidated, analyzed and used to inform field operations. Compared to the manual process, the farm inspection process is 62% faster when using the mobile tools developed in the program.

Results showed (1) a 62% efficiency gain in the digital farm organic inspection process compared to the manual processes of Franklin Baker (Table6); (2) that field officers can double their farmer outreach for farm inspection using the mobile tools (Table 7); and (3) that the value of the efficiency gain is $3,676 per field officer per year or $47,788 per year if used by all 13 of the current field officers of Franklin Baker (Table 8).

Table 6: First area of efficiency gain: Farm organic inspection process

ACTIVITY	MANUAL	DIGITIZED	TIME SAVED	% SAVINGS
Farm organic inspection Process	37 minutes	14 minutes	23 minutes	62%

Table 7: Second area of efficiency gain: Report generation and analysis

ACTIVITY	MANUAL	DIGITIZED	TIME SAVED	% SAVINGS
Encoding of inspection reports	7 minutes	Automated	7 minutes	100%
Risk assessment	9 minutes	Automated	9 minutes	100%
Create list of farms for re-inspection	8 minutes	Automated	8 minutes	100%
Re-inspection	17 minutes	14 minutes	3 minutes	18%
Consolidate list of compliant farms	6 minutes	Automated	6 minutes	100%

Compared to the manual process, report generation, consolidation and analysis is 70% faster when using the digital reports and dashboards containing data pulled from the mobile tools developed in the program.

To measure the value of savings in farm inspection alone, ABC analysis was applied to the operational costs of Franklin Baker, particularly the salary of each field agent, travel and meal allowances related to field activities, as well as the target number of farmers in 2017.

Table 8: Third area of efficiently gain: Cost savings of efficiency gain

UNIT	ESTIMATES OF COST SAVINGS	DETAILED CALCULATIONS AND ASSUMPTIONS
Inspector	PHP 183,800 or $3,676	With a 62% time reduction in digitized inspection, Franklin Baker agents can increase their average outreach per day from 1 farmer to 2 farmers. Given this, the field agents' individual target of 191 farmers per year can be accomplished in just 6 months. Below is a calculation of the potential monetary gains from the 100 days saved per agent with the use of the FarmerLink tools. Daily operations cost per agent: Agent's daily rate PHP 496 Field work incentive PHP 342 Daily food allowance PHP 500 Transportation PHP 500 Expense per agent PHP 1,838 Franklin Baker savings per agent with FarmerLink: Daily expense per agent PHP 1,838 100 days saved x PHP 100 **Potential savings PHP 183,800** Note that the above computation is a conservative estimate that took into account farm distances.
Inspector	PHP 2,389,400 or $ 47,788	Multiplying the savings per field agent to 13 agents, which is the total number of field agents in Franklin Baker's operations, they can potentially save PHP 2,389,400 or $47,788 if the mobile tools is scaled to cover all operations in Davao.

DISCUSSION

Learning 1: A consortium approach is powerful in building resilient systems.

Traditionally, private and public sector players independently implement programs that are targeted to address needs of specific groups. However, the problems within the agriculture value chain are complex and often the long-term solutions need to go beyond specific areas of the value chain. The Philippine Coconut Authority implements projects that are geared towards increased productivity of farmers but it does not connect the farmers to market players and buyers to ensure that improved productivity translates to better income. Market players such as Franklin Baker create a demand for high quality produce and promote its production but do not provide the financing and inputs that farmers require to adopt the practices it entails. People's Bank of Caraga offers financial products and services to farmers but is unable to ensure that those utilizing its financing are able to access low-cost inputs and viable markets which, if realized as income, would enhance farmers' repayment capabilities.

In order to make connections within the agriculture value chain, the FarmerLink program built a consortium of partners that included the government, private sector buyers, financial service providers and technology players. Working in a consortium with identified and concrete areas for integration translates collaborative thinking into integrated and holistic action points that help tackle the intricate challenges that farmers face on a daily basis. To make the consortium work, a lot of partner handholding was important—especially in the first six months of implementation. The activities included weekly, monthly and quarterly performance reviews where the data from the FarmerLink platform was examined, analyzed and discussed. This process ensured that partners were given the opportunity to make practical use of the data in their operations which promoted ownership and buy-in at various levels of their organization. Establishing a good working relationship with the partners required collaboration, trust and support. Diligent relationship management and change management involving all stakeholders, from top management to field officers, were keys to a unified and robust operation of the program.

Learning 2: Inclusive decision-making processes should be a consistent part of program execution in order to meet farmers where they are.

The farmer's journey toward resilience is not a linear one where they steadily progress from one stage to the next. Due to increasing vulnerability to external stresses, often they remain in cycles of low productivity, high indebtedness and diminishing returns in a value chain with complex dynamics. Because of this, it becomes increasingly important to include the farmers early on in any type of program intervention and provide them an opportunity to shape the program's design and execution plan. Involving farmers, especially those who already have leadership positions, provides rich insights that can be constantly integrated into program implementation. This allows projects to capture nuances and execute relevant and appropriate programs. A specific example in the FarmerLink pilot was the development of the Farm Management Plan mobile tool. This mobile tool takes into consideration what the farmer wants for his or her farm (i.e. is the goal to maintain, grow or diversify the farm?). The succeeding steps in the plan are then based on the farmer's decision, encouraging buy-in and ownership but also capturing his or her limitations.

Through the technology platform developed in the pilot, the FarmerLink team was able to collect data used to shape the contents of SMS and voice messages, and focus the topic on areas that needed an improvement. One example was when the data showed very low adoption rates on salt fertilizer application. In response, an agricultural extension SMS was created that focused on the specific details of salt fertilizer application including the dosage and appropriate frequency.

Learning 3: Different channels have varying degrees of impact on behavior change and GAP adoption.

FarmerLink experimented with different channels like SMS, voice messages, videos and mobile alerts to complement the field agent's interactions with the farmers. The EWS IVR assessment showed that SMS alone can be powerful for situations that have a sense of urgency. A subset of farmers in the program received early warning alerts for coconut scale insect and brontispa, the main pests that affect coconut production. Coupled with the alert is a recommendation to prune affected leaves and file a report with the Philippine Coconut Authority. 65% of farmers took action for the pest alerts, a higher number than the average of 57% farmers who took action for weather alerts like 'too dry' weather conditions. However, SMS also has its limitations. If the goal is to drive adoption for GAPs, SMS should be combined with one-to-one visits of field agents. Not only do farmers prefer this (data shows that 94% of farmers are moderately to extremely satisfied with the agents visits), but the results show higher increases in adoption of GAPs when SMS is combined with coaching sessions using the mobile tools during visits. This is consistent with other research that has found that depending on the SMS or information communication technology (ICT) approach, SMS and mobile agriculture extension services can improve farmer GAP adoption and productivity.[6] In the end, these channels should be designed to reinforce each other. For example, SMS coupled with a visit or a follow thru by an agent or a farmer leader increases trust in the system.

Learning 4: The Philippine Coconut Authority is the likely long-term owner to scale FarmerLink.

Moving from pilot to scale requires identifying a long-term owner of the program. The FarmerLink pilot was a good platform to experiment with different set-ups because of the diverse set of partners involved. Among the implementing partners, the Philippine Coconut Authority is the likely long-term owner of the program and leader of the consortium because:

(1) Their mandate is to address specifically the needs of coconut smallholder farmers and to oversee the whole coconut industry.
(2) They have nationwide coverage and existing organizational set-up to support scale and replication of the program.
(3) The increased visibility and efficiency of M&E activities resulting from the adoption of FarmerLink tools directly addresses their most pressing operational challenges and can pave the way to strategic decisions of their board of trustees.
(4) There is buy-in of the program across different levels of the organization.

There are ongoing discussions with the board members, senior management and field teams of the Philippine Coconut Authority about costing scenarios to scale the program to two other regions in the near term, apart from the pilot region in Davao. For their 2019 budget, nationwide scale is also being considered.

The Philippine Coconut Authority saw the value of having real-time field data early on in the project - not only in measuring their performance in the field but also in determining the most appropriate program and services for farmers. This early buy-in of embedded M&E systems in their operations promoted ownership. Since there is potential to collect data from more than 2 million coconut smallholder farmers nationwide, it will be important to identify and design the appropriate technology and solutions that (1) can be sustained and absorbed by existing human resources budget and capacity; (2) will meet immediate and medium term needs; and (3) set the infrastructure to meet long-term goals.

A testimonial on how FarmerLink is helping the Philippine Coconut Authority's operations can be found here: https://youtu.be/QGSgooUOpo.

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[6] Belakeri P, Prasad CK, Bajantri S , Mahantesh MT , Maruthi ST , Rudresh GN. 2017. Trends of Mobile Applications in Farming. Int.J.Curr.Microbiol.App.Sci (2017) 6(7): 2499-2512https://doi.org/10.20546/ijcmas.2017.607.295

Learning 5: FarmerLink's program design requires at least three years, ideally five years of implementation to detect changes in outcomes.

Given the short implementation period of FarmerLink and the immediate collection of an endline survey upon project closure, it was only possible to track changes in short-term output variables such as the adoption of GAPs. Long-term outcomes such as productivity, changes in crop quality and price realization require years to manifest any real change. In future phases of the project, additional evaluations should be conducted to appropriately measure medium-term outcomes and long-term impact, if possible. For example, a medium-term outcome might be measuring the benefits of the application of salt fertilizer being applied on new seedlings or mature trees, the benefit of which can generally be measured on an annual basis.[7]

Ideally, future evaluations would involve a randomized control trial where farmers are randomly assigned to the treatment or control groups to provide a more accurate analysis of the effects of the intervention. This will ensure unbiased results and the possibility to infer conclusions about a larger population than the one that participated in the pilot. In addition, future evaluations could use a propensity score matching methodology when randomization is not possible due to project design or implementation challenges.

Learning 6: There is considerable opportunity for deeper integration of financial services.

The pilot program was not designed to evaluate People's Bank of Caraga's operational footprint and support provided to farmers. Financial information such as investment amount required to adopt GAPs, trade-offs faced to finance adoption, as well as household cash-flow, were not captured in the assessment. The relationship found between GAP adoption and account ownership suggests that deeper integration between financial service providers and agricultural extension could strengthen the ability of a farmer to plan for the investment and utilize existing or new financial services for GAP adoption.

Parallel to FarmerLink, Grameen has worked with its agricultural extension partners in Ghana and Colombia to develop Farm Development Plans (FDP; similar to the Farm Management Plan used to assist farmers in adopting GAPs but FDPs assess household income and expenditures, costs to adopt GAPs, and predict future investments). This component was not part of FarmerLink and while data on how Farm Development Plans influence GAP adoption is still forthcoming, research has shown that financing and financial planning influence smallholder farmer productivity.[8]

[7] Salt. Philippine Coconut Authority. Technology Guide Sheet No. 5 Series of 2000 http://pca.da.gov.ph/pdf/techno/salt.pdf

[8] Access to Finance for Smallholder Farmers: Learning from the Experiences of Microfinance Institutions in Latin America. 2014. International Finance Corporation: Washington, D.C. http://www.ifc.org/wps/wcm/connect/071dd78045eadb5cb067b99916182e35/A2F+for+Smallholder+Farmers-Final+English+Publication.pdf?MOD=AJPERES;
Serving Smallholder Farmers: Recent Developments in Digital Finance. 2014. CGAP: Washington, D.C. https://www.cgap.org/sites/default/files/Focus-Note-Serving-Smallholder-Farmers-Jun-2014.pdf

CONCLUSION

The FarmerLink project was an ambitious, 18-month pilot program that set out to demonstrate that by leveraging the strengths of different organizations representing the private sector (Franklin Baker and People's Bank of Caraga), the public sector (Philippine Coconut Authority), and civil society (Grameen Foundation), coconut smallholder households could benefit from an integrated agricultural extension support ecosystem backed by technology.

Despite being constrained by the relatively short duration of the pilot stage, the outcomes that emerged suggest that the farmer participants made positive changes in GAP adoption with the personal assistance received from the agricultural field officers as well as with the introduction of various technology-based channels (SMS, EWS) that enhance the farmer-agent interaction. These early markers of change could result in the longer-term gain in farmer coconut productivity and income. Franklin Baker also saw efficiencies gained through the digital transformation of its agricultural extension processes, setting the stage for demonstrating a business-case for the adoption of the FarmerLink technology suite and mobile-enabled extension services to other private sector players in the coconut industry. Raising awareness and appreciation of the impact of ICT interventions on the value chain was achieved by FarmerLink both for its partners and for the smallholder farmers who were part of the program.

ANNEX: GAPs ADOPTION CRITERIA

GAP	CRITERIA
1. Salt application	• NO Adoption – Those farmers who DON'T apply salt • PARTIAL Adoption – Those farmers who apply salt + to 1-89% of their trees + those who don't know or apply 1 time/year + those who don't measure or apply >1 kg. or between 1-1.5 kg + those who don't follow particular application method or follow sprinkle method or other • FULL Adoption - Those farmers who apply salt + to 91-100% of their trees + those who apply 2 or 3 or >3 times/year + those who apply 2 kg. + those who follow spot or uniform broadcasting application method
2. Mulching	• NO Adoption – Those farmers who DON'T mulch • PARTIAL Adoption – Those farmers who mulch + to 1-89% of their trees + those who do mulching with less than 50 husks or don't count husks (estimates) • FULL Adoption - Those farmers who mulch + to 90-100% of their trees + those who do mulching with 50-80 or 51-80 husks or >100 husks
3. Removal of old/skirted coconut leaves	• NO Adoption – Those farmers who DON'T remove old fronds • PARTIAL Adoption – Those farmers who remove old fronds + to 1-89% of their trees + those who do not remove during every harvest • FULL Adoption - Those farmers who remove old fronds + to 90-100% of their trees + those who do remove during every harvest
4. Timely harvesting	• NO Adoption – Those farmers who DON'T practice right harvest at maturity + those who practice but fruits are dropped to the ground during harvest + any other method used + no maturity indices considered or buyer decides • PARTIAL Adoption – Those farmers who practice right harvest at maturity + those who use implements such as "karet" (scythe) + those who ONLY consider maturity indices of nut size or nut color or nut age or nut size with color • FULL Adoption - Those farmers who practice right harvest at maturity + those who bring harvested nuts to ground using ropes + those who consider ALL maturity indices of nut size + color + age
5. Pest surveillance	• NO Adoption – Those farmers who DON'T practice pest surveillance + those who don't follow any specific duration for pest monitoring + those who leave their trees as is or do some other action during pest/disease outbreak • PARTIAL Adoption – Those farmers who practice pest surveillance + those who follow pest monitoring once a year or every 6 months + those who monitor 1-89% of their tree's crown + those who conduct research or consult other farmers during pest/disease outbreak • FULL Adoption - Those farmers who practice pest surveillance + those who follow pest monitoring every 3 months or every month + those who monitor 90-100% of their tree's crown + those who decide control measures based on experience & knowledge or those who consult local experts (last two apply in conjunction with full adoption criteria of 5.3 & 5.4)

GAP	CRITERIA
6. Weeding	• NO Adoption – Those farmers who DON'T practice weeding + those who don't follow any specific duration for weeding + those with no control mechanism for weeding • PARTIAL Adoption – Those farmers who practice weeding + those who follow weeding once a year or every 6 months + those who do weeding to 1-89% of their farm + those who do manual weeding • FULL Adoption - Those farmers who practice weeding + those who follow weeding every 3 months or every month + those who do weeding to 90-100% of their farm + those who use herbicide or manual weeding or mechanical weeding (all three apply in conjunction with full adoption criteria of 6.2 & 6.3)
7. Proper distancing	• NO Adoption – Those farmers who DON'T practice proper distancing during replanting/expansion + those who don't cut down old trees once replanted trees are grown up • PARTIAL Adoption – Those farmers who practice proper distancing during replanting/expansion + those who follow practice less than 8 Sq. mtrs or more than 15 Sq. mtrs spacing • FULL Adoption– Those farmers who practice proper distancing during replanting/expansion + those who follow practice of spacing between 8-15 Sq. mtrs + those who cut down old trees once replanted trees are grown up
8. Intercropping	• NO Adoption – Those farmers who DON'T practice intercropping • PARTIAL Adoption – Those farmers who practice intercropping + those who follow practice less than 8 Sq. mtrs or more than 15 Sq. mtrs spacing for intercropping • FULL Adoption– Those farmers who practice intercropping + those who follow practice of spacing between 8-15 Sq. mtrs
9. Recordkeeping	• NO Adoption – Those farmers who DON'T practice documenting coconut production and marketing records • FULL Adoption– Those farmers who practice documenting coconut production and marketing records