
# Impact Evaluation (IE) Concept Note
# DIME Global Agriculture and Food Security Program Liberia Impact Evaluation

Liberia

P147170

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**Keywords: O12, O13, Q12, Q16, Q18, J43**

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# IE Profile Indicators

| No. | Indicator | Description |
|---|---|---|
| **1** | IE code | P147170 (hyperlink to the IE portal) |
| **2** | IE Title | Liberia Global Agriculture and Food Security Program Impact Evaluation |
| **3** | IE TTL | Paul Christian (DECIE) |
| **4** | IE Contact Person | Paul Christian (DECIE) |
| **5** | Region | AFR |
| **6** | Sector Board/Global Practice | Agriculture |
| **7** | WBG PID | N/A |
| **8** | WBG Project Name | N/A |
| **9** | Project TTL | N/A |
| **10** | Intervention | Input delivery and targeted messaging to recruit youth to agriculture programs |
| **11** | Main Outcomes | Youth participation, proportion of farmers using improved farming methods, dietary diversity |
| **12** | IE Unit of Intervention/Randomization | Village, Individual (Farmer) |
| **13** | Number of IE Units of Intervention | 100 villages, 1,000 farmers (50% assigned to treatment) |
| **14** | IE Unit of Analysis | Household, farmer |
| **15** | Number of IE Units of Analysis | 1,000 |
| **16** | Number of Treatment Arms | 2 |
| **17** | IE Question 1 (Treatment Arm 1) | Does the provision of 91%-subsidized improved seeds, tools, and fertilizer promote the take-up of modern farming inputs and improve diets? |
| **18** | Method IE Question 1 | Random assignment of communities to receive next wave of improved seeds and agricultural tools and random selection of beneficiaries within intervention communities. |
| **19** | Mechanism tested in IE Question 1 | Subsidized delivery of agricultural inputs |
| **20** | IE Question 2 (Treatment Arm 2) | Do short text messages to target population of beneficiaries (young farmers) help recruit these beneficiaries for agricultural programs and are different messages in these invitations more or less effective at reaching these target populations? |
| **21** | Method IE Question 2 | Random assignment of text message invitations to phones of farmers assigned. |
| **22** | Mechanism tested in IE Question 2 | Targeted text messages delivered by SMS |
| **25** | Gender-specific treatment (Yes, No) | No |
| **27** | Gender analysis (Yes, No) | Yes |
| **28** | IE Team & Affiliations | Florence Kondylis (Senior Economist, DECIE)<br>Paul Christian (Economist, DECIE)<br>Katherine Abrikian (Impact Evaluation Researcher, DECIE) |
| **29** | Estimated Budget (including research time) | USD 686,000 |
| **30** | CN Review Date | Sept - 2016 |
| **31** | Estimated Timeframe for IE | January 2017 – February 2018 |
| **32** | Main Local Counterpart Institution(s) | Ministry of Agriculture |

# 1. Executive Summary

The continued development of Liberia's agricultural sector is crucial to Liberia's economic growth and food security. A focus on smallholder farmers helps to ensure pro-poor growth; over 70% of Liberia's population is involved in farming and the vast majority of this population practice cultivation at the subsistence level, utilizing traditional techniques. The Smallholder Agricultural Productivity Enhancement and Commercialization project (SAPEC) aims to improve the productivity, income and nutritional outcomes of beneficiary farmers in 12 of Liberia's 15 counties. SAPEC provides farmers with agricultural technologies, constructs and rehabilitates infrastructure to support value-chains and market linkages, as well is working to improve the institutional capacity of the Ministry of Agriculture and associated research institutions. The impact evaluation focuses most directly through the most rigorous methods on the input delivery component. SAPEC's design incorporates a focus on women, youth and the disabled to better integrate these groups into the agricultural sector and improve their capacity. Given Liberia's relatively low life expectancy and high youth population (42% below age 15; LISGIS 2011), it is particularly important to encourage youth participation in agriculture. Declining youth participation in the agriculture sector across Africa prompts concerns that if youth are the most open to new technologies, programs promoting new agricultural methods and varieties may struggle to convince farmers to try these new methods unless they can recruit young farmers.

We propose to study the impact of seed and tool distribution on the take-up of modern farming inputs and the use of productivity enhancing tools, thereby resulting in higher agricultural yields and improved nutritional outcomes, as measured by dietary diversity scores. The wide geographic scope of SAPEC and its focus on smallholder farmers offer a unique opportunity to generate data that can be more robustly extrapolated to the wider Liberian population. We will use data from a 2016 registration of Liberian farmers to randomly select 1,000 Liberian farmers from 100 randomly selected communities in Liberian districts serviced by SAPEC.

Using a randomization at multiple levels, we seek to determine whether the provision of 91%-subsidized improved seeds, tools, and fertilizer promote the take-up of modern farming inputs and improve diets. We will also study whether particular beneficiary sub-groups (by age and gender) are more likely to respond to SMS messaging with an agricultural focus and whether small adjustments to the content of these messages can result in relatively greater improvements in take-up by youth.

# 2. Background and Key Institutional Features

After a long stretch of stagnation and backsliding, Liberia's economy has shown some recent promise. Between 2009 and 2013, Liberia experienced strong economic growth 5.3% to 8.7% p.a., well above the average for developing countries in Sub-Saharan Africa (WB). However, the Ebola crisis that began in 2014 has had a large impact on Liberia's economic prospects: GDP growth in 2014 fell to 0.7% and deteriorated

further to 0% in 2015. Per capita GNI grew from USD 150 to USD 380 between 2000 and 2015, remaining stagnant between 2014 and 2015 (World Bank, 2016b; World Bank, 2016c). Despite Liberia's generally strong economic performance, the headline poverty rate is estimated to be 54.1% (LISGIS 2016), down from 63.8% in 2007 (World Bank 2016c). Further reduction of the poverty rate may be driven by improvements in agricultural productivity, since approximately 70% of Liberians participate in the agricultural sector (Republic of Liberia Ministry of Agriculture 2007). Driven by a population boom, growth in Liberia's labor market will result in an employment gap of 600,000 people by 2030 (Zinnah 2016); improvements to agriculture productivity will help to create jobs along the various crop value chains to help absorb some of these persons.

Production of paddy rice in 2009 was still approximately 6,000 metric tonnes below 1988 levels, despite growth of 3.1% p.a. between 2001 and 2009 and the reported area harvested for 2009 being 12,000 ha larger than that harvested in 1988 (with 5.1% p.a. increase between 2001 and 2009) (Larbi 2012). This comparative productivity lag indicates wide scope for productivity improvements. Such low productivity in a context where yield potential is known from historical experience to be substantially higher presents a good test case for a rigorous RCT on the constraints to technology adoption, because the adoption of improved methods in this context are known be profitable on average. In contrast, production of cassava grew in tandem with area harvested (3.6% p.a. growth in production between 2001 and 2009, for an associated 3.5% p.a. increase in harvest area) and productivity levels per hectare harvested were very close to 1988 levels.

The Smallholder Agricultural Productivity Enhancement and Commercialization project (SAPEC) was established as a pillar of the Liberia Agriculture Sector Investment Program (LASIP), which was a policy strategy framework tied to the African Union/New Partnership for African Development's Comprehensive African Agricultural Development Program (CAADP) initiative. LASIP's pro-poor approach to economic development through agricultural transformation focused under four programmatic thrusts for 2010 to 2015, the period during which SAPEC was conceptualized and reached effectiveness: (1) Land and Water Resources Development; (2) Food and Nutrition Security; (3) Competitive Value Chains and Market Linkages; (4) Institutional Development. As it was designed, SAPEC aimed to address all four LASIP programmatic thrusts.

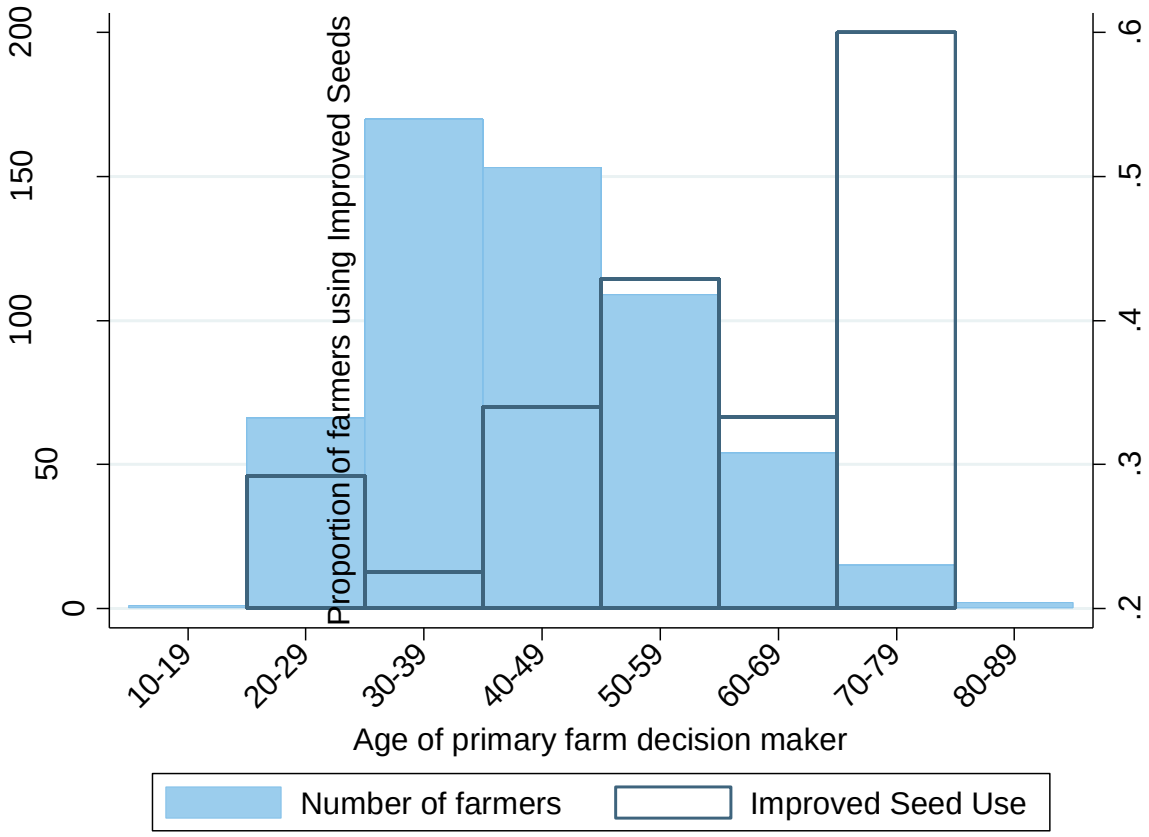
SAPEC has four components: (1) Sustainable Crop Production Intensification; (2) Value Addition and Marketing; (3) Capacity Building and Institutional Strengthening; and (4) Project Management. The first component, Sustainable Crop Production Intensification, includes the development of lowland for rice production and the dissemination of improved agricultural technologies to farmers, who would also be encouraged by SAPEC's staff to adopt these. SAPEC expected that the increased yields resulting from this strategy would improve nutritional outcomes in beneficiary populations. The second and third components of SAPEC corresponded to the third and fourth prongs of the LASIP strategy and included activities related to the creation/encouragement of value chains and improvements in Liberia's agricultural research and instructional capacity. SAPEC is funded by the Global Agriculture and Food

Security Program (GAFSP), African Development Fund (ADF) and Government of Liberia (GoL) and reached effectiveness in October 2012. SAPEC is administered by the African Development Bank and is run by a project management unit appointed by Liberia's Ministry of Agriculture. DIME was asked to carry out an impact evaluation of the SAPEC project, with funding provided by GAFSP. SAPEC's first beneficiaries were reached in May 2015, through a quick distribution of seed rice to assist in alleviating the damage done by Liberia's Ebola crisis.

Development of the inputs to be provided includes identification of improved varieties of rice and cassava and dissemination activities through partnerships with the International Institute of Tropical Agriculture (IITA), Africa Rice Center. Together these institutions have established 25 demonstration farms (22 cassava and 3 rice) to promote improved varieties of these crops. So far, these efforts have followed a loose system of informally recruiting and tracking participants. The IE will improve learning about the efficacy of these models in two ways. First, the IE will improve the tracking of both participants and non-participants in extension activities in order to assess impacts. Second, the invitation system for offering benefits will be piloted through invitations to visit demonstration farms, allowing us to assess during the pilot stage what draws particular types of farmers to attend the demonstration visits.

One feature of SAPEC's model is a target that at least 30% of beneficiary farmers should be age 35 or below. This model presupposes that youth are especially effective users of technology and so specific quotas should prioritize their involvement. But as we will see below, the basis for such a prediction are surprisingly not well founded either in theory or previous evidence from analogous contexts. The only way to be certain whether younger farmers should be the priority for outreach is through a rigorous experiment of recruitment strategies.

The plot below shows data from a survey of households which conducted a non-randomized comparison of SAPEC and non-SAPEC communities. It depicts the distribution of households by the age of the person who the survey respondent identified most responsible for farming and the proportion of these farmers in each age category who report that they have adopted improved seeds on their own farms. This plot seems to pose a puzzle for the justification of the project's targeting strategy because the households with older farmers appear to be the most likely to adopt the new technology, which challenges the view that youth are the most inclined toward trying new things. But it is important to note that the relationships observed in cross-sectional data such as this do not have a causal interpretation. Households who choose to have relatively elderly members make most decisions for the farm may be those who have elderly people who are especially effective at being productive through agriculture. It may still then be the case that a young person who is offered the opportunity to use a technology would be more likely than the elderly person to try something new, but it is impossible to know this without observing the offers for people to try new methods.




## 3. Literature Review

*Low agricultural productivity in Liberia*

Traditional rice and cassava varieties in Liberia generate low yields. Sub-Saharan Africa (SSA) has long lagged behind other developing regions in terms of the adoption of new varieties of agricultural crops (Aker 2011, 24). Even among its SSA peers, Liberia's use of improved crop varieties is particularly low: in 2005, Liberia and Niger were the only two West African countries with no NERICA production – Guinea, Côte d'Ivoire, and Ghana were already producing over 10,000 ha./year at that time (Akintayo et al. 2009, as cited in Diagne et al., 2011, p. 260). The GoL's 2007 Comprehensive Assessment of the Agriculture Sector proposed that the use of improved technologies, including NERICA rice, was the best path forward for Liberian rice and other food crop production in the medium term, since "large-scale mechanization of food crop production has failed" (Republic of Liberia Ministry of Agriculture 2007, xvi). Early attempts to encourage NERICA use have succeeded in increasing yields. Under the World Bank's Agriculture and Infrastructure Development Programme (AIDP; 2007-2015), farmers were provided with NERICA rice foundation seed, training in improved farming techniques and, in some cases, newly-constructed irrigation schemes. In AIDP project areas, low land rice yield per hectare increased from 1.2 MT to 2.33-3

MT, with results varying by county. Results exceeded the target figure by 69% (World Bank 2016). AIDP did not benefit from a RCT, so it is unclear as to whether the results are replicable.

Despite clear evidence of improved yield, individuals in Sub-Saharan Africa may rationally decide not to invest in agricultural technology, due to social pressures that consume savings in favor of unproductive, community-based activities (Dessy et al 2006). As such, it is important to properly evaluate means of providing farmers with increased access to inputs, since evidence alone is unlikely to stimulate change in the short- to medium-term. Moreover, since the approach being practiced by SAPEC is typical of the approaches used by the Liberian government over the past 12 years, it merits particular scrutiny as a policy prescription.

*Constraints to adoption of improved varieties and modern farming methods*

In a review of determinants of technology adoption, Foster and Rosenzweig (2010) identify three key factors that influence the propensity that a person or group adopts a new technology. First, the person must learn about the technology, which requires both exposure to new methods and the capacity to understand differences in costs and outcomes from new methods. Second, if actors see and understand the gains from a new technology they must have the financial means to access it, which includes both the upfront cost through loans or direct purchases as well as the ability to smooth risk associated with adopting an uncertain technology either through insurance or savings. Finally, they highlight that institutions, markets, and environments can often interact with behavioral inclinations to encourage or discourage adoption. For example, if fertilizer or seeds are only available in shops during harvest season, people who are myopic will not purchase it since the returns are long delayed while the costs must be born immediately. SAPEC's process of subsidized input delivery addresses the first two of these constraints simultaneously. Endorsement by the project of improved rice and cassava varieties encourages farmers to try them, subsequently allowing farmers to learn about their effectiveness. The subsidized delivery alleviates the upfront cost, and therefore the financial constraint. The hope is that after a season of experiencing the heavily-subsidized inputs, the farmers will both have higher income from improved yields and greater demand for these varieties in the future, which will stimulate access in the future. There are many open questions in whether the subsidized input system will be effective in Liberia however. In the context of a resource poor and low education setting such as Liberia, is endorsement and self-experimentation enough to demonstrate the effectiveness of a technology to users? Is the fixed cost of inputs and delivery the primary financial barrier to access? After farmers experience the new varieties are local shops likely to stock them and are farmers likely to report willingness to use them again? By exploring whether education is associated with take-up and outcomes among those offered the opportunity to participate in SAPEC, we can answer the first question. By exploring whether credit constrained households saw the biggest participating and returns, we can answer the second question. And finally, by assessing availability of new varieties in shops at endline, and willingness to pay for new varieties, we can get indications of whether the subsidies can create sustainable markets for the improved products.

There is a deep literature on the determinants of adoption of specific agricultural technologies. Suri (2011) finds that there is heterogeneity in the returns to technologies that is ex ante not observable to policymakers, so that some farmers who do not adopt technologies that appear profitable among adopters are rationally forgoing the adoption because they expect to experience negative gains. To our knowledge, previous studies have not rigorously explored age of farmers as a predictor of heterogeneity in returns to adopting new technologies despite the fact that age has been identified in other context as a potential constraint to adoption. Another common finding is that lack of access to savings, credit, and insurance, and the resulting inability to smooth finances between harvest and planting periods inhibit the adoption of risky technologies (Karlan, et al, 2014; Duflo, Kremer, and Robinson, 2009). To the extent that youth have different attitudes toward risk or access to savings and credit, age and experience may be associated with take-up.

*Role of youth in technology adoption*

Like many similar projects, SAPEC specifically targets youth for participation. The stated motivation for this is that youth are exiting agriculture in countries across Sub-Saharan Africa (Maïga, Christiaensen and Palacios-Lopez 2015; Bezu, Sosina, and Stein Holden 2014). One prevalent theory behind the departure of youth from the sector is the relatively low prestige of agriculture for youth, particularly in comparison to other economic sectors perceived as more productive (Njenga, Mugo and Opiyo 2012; White 2012; Bezu, Sosina & Stein Holden 2014). But it is not known whether inviting youth to participate in a subsidized input scheme will actually make employment in agriculture more appealing for them. In Uganda and Nigeria, evidence suggests that youth participate more in agriculture as agricultural productivity and income increase (Ahaibwe, Mbowa, and Lwanga 2013; Agwu et al. 2014). As such, informing youth about the possibility for increased income under the SAPEC project (due to improved use of technologies) may be sufficient to attract youth who already practice some farming to the project, as a means to deepen their engagement with the agricultural sector.

Beyond the income motivation for occupational choice, labor economists and psychologists have identified an ambiguity in whether age should be predictive of openness to new technology. On the one hand, farmers may gain experience and human capital over time, which might lead older farmers to be better at understanding the benefits of new varieties and maximizing their return (Weinberg, 2004). This experience effect might lead older farmers to be the most interested in new technologies. Conversely, older farmers may have the fewest seasons left of their career. If adopting a new variety imposes an up-front cost whose benefits are only recognized over time, younger workers might be the most likely to adopt new technologies (Friedberg, 2003). This effect would argue for younger workers being the most likely to adopt.

Empirical literature on adoption decisions by age is mixed. From the context of African agriculture, Seyoum, E.T., G.E. Battese, and E.M. Fleming (1998) find that it was the youngest farmers participating in an agricultural productivity project in Ethiopia who seemed to experience the highest yields of maize

during the program. Conversely, Adesina and Baidu-Forson, (1995) found that in observational data from Burkina Faso and Guinea that age was positively predictive of adoption of improved varieties of rice and sorghum. Looking beyond examples from African agriculturalists, the evidence on openness to innovation by age is also mixed in other settings and sectors. To pick two examples, younger farmers in the United States are more likely than older ones to expand the size of their farms relative to past levels (Katchova and Ahearn, 2015), but relative earnings of older workers compared to younger workers in Germany has increased as tasks have become more cognitively demanding. Recent psychology literature on technology adoption sheds light on this ambiguity by highlighting that perceptions of technology change by age. Younger worker's decisions about whether to adopt a new technology may be more influenced by their own attitudes toward using the technology, while older workers may be more influenced by subjective norms.

The ambiguous theoretical and empirical evidence on whether age is associated with technology adoption leads to two hypotheses. First, if SAPEC seeks to use age as a proxy for which users will be most receptive to the technology and the best users of the technology, it is not clear ex ante whether it is older or younger users who will most benefit, because this relationship depends on the context of both the technology and the environment, so a rigorous answer can only be provided by experimentation. Second, the type of messaging may have differential impact the likelihood of a given farmer being responsive according to their age. Younger farmers may be more responsive to messages about profitability, while older farmers may be more influenced by the view that other farmers like them are taking up.

*Agriculture, poverty, and improved nutrition*

One of the core goals of SAPEC and the GAFSP is that the improvement of agricultural productivity and income brought about by the project will improve nutritional outcomes. This connection between improved agricultural productivity and better nutrition is a surprisingly unsettled question. Using cross sectional data and spatial instrumental variables strategy, Minten and Barrett (2008) find that locations with higher rice yields have lower food prices and higher wages, suggesting that higher agricultural productivity can help tackle poverty from both angles, by increasing income and reducing the cost a sufficient diet. Using cross-country evidence, Christiaensen, Demery, and Kuhl (2011) show that growth in agriculture has a bigger impact on poverty rates among the poorest populations than other sectors. Studies like these underlie the increasingly well-established observation that poverty reduction and improvements in diets and nutrition tend to occur together. But the causal direction of this relationship is not well established (Headey, 2011). It is possible that that improved diets cause people to be more effective at farming, or that the co-movement of agricultural production and nutrition is caused by improvements in a third factor such as education. To our knowledge, no RCT has established the connection between an intervention that improves productivity of staple foods and a causal improvement in nutrition.

# 4. Policy Relevance

Efforts to improve Liberia's agriculture sector have been a core component of Liberia's peace-building and reconstruction efforts since the transitional government took power, following the end of the civil war. Strategies for restoring the country's agricultural productive capacity have featured in the Government of Liberia (GoL)'s first Results-Focused Transitional Framework (2004), its revision (2005), the subsequent interim Poverty-Reduction Strategy (2006), Poverty-Reduction Strategy (2008), and the current Agenda for Transformation (2012), which covers the period from 2012-2017. A focus on pro-poor growth in Liberia demands that the smallholder farmers that dominate the Liberian agricultural sector incorporate improved technologies as a means to increase production beyond a subsistence level (Republic of Liberia Ministry of Agriculture 2007). Access to assets (including knowledge assets) and infrastructure have been identified as key constraints. Increased production of crops meant for the domestic market will also reduce the real cost of food (as well as Liberia's import burden), thereby improving food security for the average Liberian. The lack of available and robust data on the Liberian agricultural sector is a major obstacle to the assessment of present policies and the creation of improved, evidence-based policy frameworks. The study is also timely, as the data produced can be used by the new government, following the elections that will take place in October 2017.

Since SAPEC was established as a key part of LASIP, the impact evaluation of the project will be relevant to the policy initiatives as an evaluation of this transformation strategy. It will also provide some feedback on one aspect of the Liberian Agriculture Transformation Agenda (LATA), a complementary program currently being rolled out by the Ministry of Agriculture, with support from its international development partners, focuses on value chain support for cash crops. In doing so, the LATA will also improve access of all smallholder farmers to technology: under LATA, SAPEC financed the registration of over 184,000 farmers in a mobile wallet program that will allow these farmers access to subsidized fertilizer and other inputs. Eventually, the government plans to use the service to improve access to extension services through the use of SMS messaging. This messaging platform will be used as the frame from which the messaging intervention will be implemented and the beneficiaries for the RCT of the delivery of inputs will be chosen.

# 5. Description of Intervention

The Smallholder Agriculture Productivity Enhancement and Commercialization (SAPEC) project conducts three core activities:

A. Sustainable Crop Production Intensification, which includes the dissemination of improved technologies for rice, cassava and vegetable farming;
B. Value Addition and Marketing, which includes the construction and rehabilitation of roads linking farms to rehabilitated markets;

C. Capacity Building and Institutional Strengthening, which includes the training of farmers in contemporary, evidence-based farming practices.

These three activities will feed into two impact evaluations which use activity C to evaluate two aspects of activity A.

*Core evaluation of the distribution of seeds and tools:*

In SAPEC's 2016 survey of farmers in SAPEC communities, the most common reason that farmers reported not using modern inputs and methods such as improved seeds, chemical fertilizers, and intercropping methods was a lack of access to materials, followed by a lack of interest. This suggests that important constraints to agricultural productivity in Liberia are ability to purchase the materials necessary to practice high value agriculture and lack of evidence available at the local level to farmers that these farming methods are effective. To address both of these constraints at once, SAPEC distributes a package of materials that are necessary inputs to practice modernized farming. This package includes either 50kg of seeds of improved rice varieties or cuttings of cuttings of improved cassava varieties, poultry manure, a cutlass, a file, an axe, trap wire, flash tape[1], and a hoe. In the first stages, of SAPEC, farmers initially received these inputs for free, but going forward will now receive them at a highly-subsidized rate.[2] Farmers are also provided with follow-up support from agricultural extension workers on how to cultivate the new varieties and use more efficient methods of farming.

To assess whether access to materials and evidence of the effectiveness of methods really is the key constraint, we will compare farming households who receive SAPEC benefits with households that do not. This comparison will be achieved in two ways.

First, 100 communities in SAPEC treatment and control districts will be randomly selected to take part in the study, using the list of SAPEC-eligible communities in the LATA database as a sampling frame. Each community will have a minimum of 25 farmers. 50 of the selected communities will be treatment communities and 50 will be control communities. Since SAPEC can deliver inputs and technical assistance to a maximum of 5,000 farmers in a given year and the potential number of beneficiaries in all SAPEC-eligible communities is much larger than this 5,000, the random assignment of potential treatment communities to the set of controls only changes the order of who receives the benefits next, rather than withholding benefits from anyone in particular.

The second dimension to create a counterfactual for beneficiaries will be the random selection of specific beneficiaries within SAPEC treatment communities. From the list of all farmers registered in the e-

[1] Flash tape is a reflective plastic ribbon that when strategically placed around a plot scares birds away from the plot, preventing crop loss from birds eating grains.
[2] Fertilizer (NPK and Urea) will be substituted for the poultry manure in future distributions.

platform system, we will randomly select an average of 10 per community to be SAPEC beneficiaries in the next round. This will allow us to sample farmers within treatment communities as well as farmers who were randomly selected to not receive them this year, allowing us to see the causal impact of this input provision on the delivery of tools.

*Youth Messaging*

In order to help SAPEC achieve its target of 30% of its participants being less than 35 years old, we propose to use the Ministry of Agriculture's LATA e-platform system to recruit SAPEC beneficiaries through targeted messaging delivered via SMS. As of August 2016, there were over 183,000 farmers registered in the e-platform, including over 15,000 farmers under the age of 35 located in SAPEC districts. This database creates a pool of potential recruits for SAPEC's program. Each of these farmers has registered a mobile number where the farmer can be reached with information about extension.

To test whether messaging can help recruit youth to farming, we will send SMS invitations to farmers informing them that if they report to a SAPEC office to request that the local focal person registers them, they will receive subsidized inputs. We will randomly assign the messages on two dimensions, whether the farmer receives the text message invitation (SMS invitation treatment) and conditional on being in the SMS invitation treatment, the specific content of the message. SAPEC expects to enroll 5,000 beneficiaries in its next wave of distributing subsidized inputs: the impact evaluation hopes to focus on at least 1,500 of these. To recruit these beneficiaries, we will send text messages to a randomly selected set of farmers in the e-registry, with at least 20 farmers being recruited in each treatment community: at least 10 farmers below age 35 and 10 farmers above age 35.

The core content of the message will be a brief description of the inputs that SAPEC provides including quantity and variety of rice seeds or cassava cuttings and description of tools —and an invitation to come and be registered to receive these inputs. The base message will be something along the lines of the following:

"*Hello! SAPEC has selected you to receive farming inputs. If you register, you will be eligible to receive 50 kg of rice seeds, one hoe, an axe, and a cutlass. All you need to do to claim these benefits is to bring your e-registration card to your local SAPEC office and speak with [NAME OF DISTRICT FOCAL PERSON OR EXTENSION WORKER] by [DATE] to be registered.*"

This message and randomization of invitations will allow us to test whether inclusion of youth in agriculture programs can be increased by simply identifying them in advance and inviting them in particular to be included.

After an agreed length of time to be registered until the deadline (expected to be 1-3 weeks pending field staff advice), additional invitations will be sent to next the farmers on the randomly sorted list until the targeted number of beneficiaries have been selected and registered.

In order to test mechanisms through which messaging can help recruit young farmers in particular, we will test an additional follow-up message to highlight various benefits of registering for the SAPEC input distribution. Each of these messages will be delivered to 20% of the farmers in the sample who receive a message. Prospectively, these follow-up messages will stress the following aspects:

- Potential for improved inputs to improve yields (eg "*Improved varieties that SAPEC provides have shown yields up to X% per hectare!")*
- Potential for labor savings (eg "*Using a weeder can make cultivation easier, saving you time and effort.")*
- Potential for higher earnings (eg "*Did you know that 20 kg of improved rice is selling for $X at Market Y?"*
- Social linkages to farmers with a similar profile (eg "*Invitations have been sent to many other young/experienced farmers like you in your community."*)
- Appeals to pride in farming (eg "*Help us to grow the food that feeds Liberia!")*

The exact content of these messages will be tested for effectiveness during pilots planned for December 2016 wherein messages will be sent to groups of youth inviting them to come to view demonstration plots in their communities which showcase new varieties and improved methods.

We will track impacts from the messaging in two ways. First, to track the impact of invitations on increasing youth participation, SAPEC will record the beneficiaries who are registered for input delivery after receiving a message. This will allow us to immediately assess whether this strategy can promote participation from youth. By matching the participation records with household data from the baseline and endline, we will also be able to assess in detail which types of households are most likely to respond to the invitations, including with regard to literacy, education, farming practices, distance from SAPEC households, etc.

SAPEC also conducts additional interventions including the construction of roads, irrigation and market structures. Because these interventions are geographically determined we cannot alter the location or the timing of these interventions in order to cleanly evaluate them. All infrastructure construction has yet to begin, and so is unlikely to be a relevant confounder of the technology dissemination and adoption impacts during the next 18 months in which we plan the evaluation. By stratifying randomized assignment of the technology interventions at the county level, we expect to be able to identify the effect of the improved rice, improved cassava, and tool delivery even if lowland rice extension programs occur in our study sites. Assuming that lowland rice extension programs continue, we expect that some of our study sites will be involved in both the input delivery component and the lowland rice extension treatment,

which may also allow us to identify whether lowland rice extension leads to distribution of improved varieties being more effective, but power may be limited for this kind of heterogeneity analysis.

# 6. Theory of Change

We hypothesize that there are four primary constraints which could affect farmers adopting modern, improved varieties of seeds, tools, and farming methods that could be influenced by the intervention:

- Supply: Lack of materials available for purchase in accessible markets
- Finance: Farmers do not have capital or access to finance to allow them to make investments such as purchasing seeds or tools for the first time even if these investments would be profitable
- Information: Farmers may not understand or may underestimate the benefits of tools or new technologies, leading them to not purchase technologies when they are available
- Targeting: The benefits of the tools or technologies may depend on who receives them so that for example the degree to which higher agricultural productivity translates to improved diets may depend on whether the beneficiary is a man or a woman, or the willingness of a beneficiary to take up technology that takes a long time to return may depend on the age of the beneficiary

Providing seeds and tools at no cost may alleviate the first two constraints, while the farmer e-registration and messaging are hoped to address the information and targeting constraints.

The agricultural input supply chain can be a major constraint to adoption of productive farming practices if firms do not find it either possible or profitable to market and sell key agricultural inputs in locations where farmers can easily access them. This constraint arises because of supply constraints including the high cost of transporting and marketing inputs such as seeds in rural areas with a low density of potential customers combined with financial constraints faced by farmers. The input prices at which farmers are willing and able to purchase inputs may be too low to induce private sellers to offer these inputs. Even when investments are profitable for the farmers at market rates in the sense that the yield gains would be enough to pay for the cost of the up-front investment, farmers may not be able to purchase these inputs without access to loans or savings facilities, given that the cost of purchasing improved seeds must be borne up front while the benefits only come with harvest. The current approach under LATA of identifying agro-dealers upfront, tasking them with delivery to centralized warehouses, having the GoL and SAPEC subsidize input delivery, and pre-identifying (through the database) a set of farmers who are interested in input purchase can solve supply and demand constraints by eliminating marketing costs, reducing transportation costs, and bridging the gap between farmer willingness to pay and the price signal required to induce sellers to offer inputs for sale.

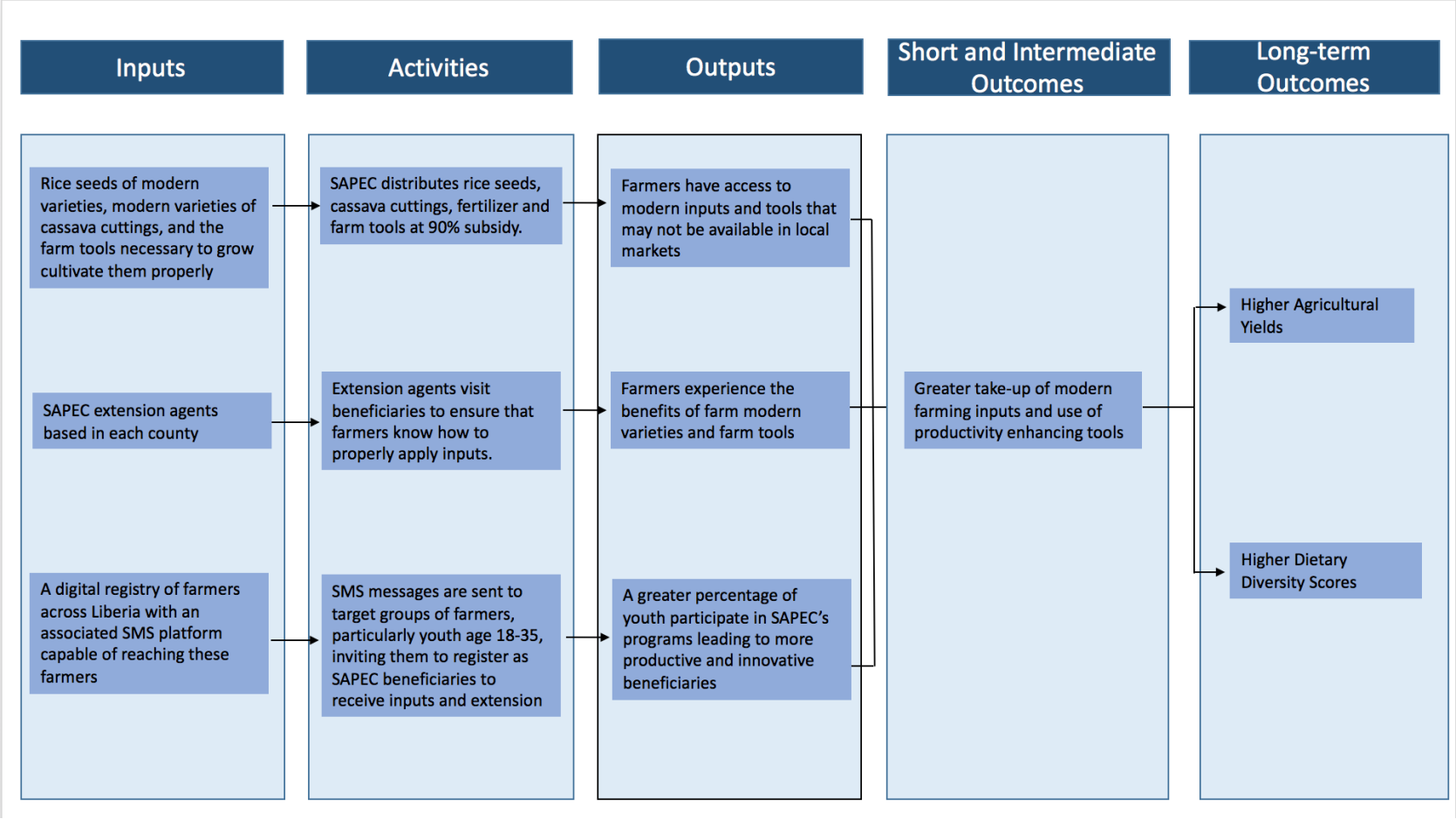
If supply constraints and financial access are primary constraints, then the question of sustainability arises. Even if input use is profitable, will delivery of benefits create long-term private markets for these goods? Subsidies can stimulate sustainable investment if they create market opportunities either by demonstrating to suppliers that there are potential users of technology or by improving incomes to the point that farmers are able to purchase inputs in the subsequent season without resorting to loans.

Using the text messages invitations to recruit specific types of beneficiaries and assess the messages that attract them may alleviate the last two constraints. Having a short text message about an improved variety come through Ministry of Agriculture's mobile messaging platform may signal to farmers that this technology is worth paying attention to and that they should sign up to get the improved seeds or cuttings. Having the opportunity to try the seeds or cuttings for a year gives the farmer the opportunity to try the new technologies and learn about their effectiveness before they have to decide whether to purchase them on their own.

Finally, as described in section 3 on the literature around youth and technology adoption, one barrier to the sustainable and effective use of new varieties may be that projects get the wrong set of beneficiaries. If youth are leaving agriculture and youth are the most open to new technologies, the farmers left who end up benefiting from a new program in the absence of conscious recruiting strategies may be those least willing or able to use the inputs to full potential.

The processes and assumptions underlying this theory of change are outlined in the following diagram, *Figure 1*.

**FIGURE 1 – THEORY OF CHANGE**



# 7. Hypotheses/Evaluation Questions

1. Does providing subsidized seeds and agricultural tools stimulate higher agricultural productivity through higher adoption of improved varieties?
2. Does higher agricultural productivity for staple foods help farmers improve their diets as measured by dietary diversity?
3. Are text message invitations an effective method for recruiting youth to agriculture projects like SAPEC?
4. Does the content of an invitation influence whether younger or older farmers are more or less likely to participate SAPEC programs?

# 8. Main Outcomes of Interest

**TABLE 1 – MAIN OUTCOMES OF INTEREST**

| Outcome Type | Outcome Name | Definition | Measurement Level |
|---|---|---|---|
| **Primary** | | | |
| | Adoption of Modern Seed Varieties | Proportion of households who have planted modern varieties of rice seeds and cassava cuttings promoted by SAPEC in the previous season | Household |
| | Willingness to participate in SAPEC programs | Responds to a text message invite in order to be registered as a SAPEC beneficiary | Individual |
| **Secondary** | | | |
| | Dietary Diversity Score | Sum of 19 indicator variables for whether a person consumed a food from 19 recognized food groups | Individual |
| | Attendance at SAPEC training and demonstration events | Indicator for attended a SAPEC an organized demonstration at a demonstration plot or distribution of benefits | Individual |
| | Yields of rice and cassava | Kg of rice or cassava per kg harvested in the last cropping season | household |
| | Income from agriculture | Revenue from sales of all crops minus production costs | Household |

# 9. Evaluation Design and Sampling Strategy

The core strategy for the evaluation is a cluster-randomized phase in of subsidy offers with individual assignment of input deliveries within treatment communities. What this means is that, because SAPEC can only provide a fixed quantity of inputs in a particular season due to capacity constraints, we will randomly assign which communities are first in line to receive the inputs and which farmers in these communities are first in line to receive the inputs. Random selection of farmers and communities is a fair way to decide who receives inputs first that allows us to compare farmers who have been offered inputs with those who have not been offered yet without ultimately affecting which farmers receive benefits at

the project closing date. Including some communities and not others in the first round allows us to rule out spillovers of farmers who get inputs to other farmers in the same community by comparing to communities where no one has received any inputs. Randomly selecting farmers within communities in contrast also allows us to make comparisons between farmers who are very similar to each other. Finally, we will strategically make offers of inputs to youth vs older farmers in order to also make careful comparisons of impacts on these groups of particular interest. This strategy is further described below.

## 9.1 Treatment and Control Groups

There are two dimensions on which the offer of improved seeds, cuttings, and tools will be made in order to assess the impact of this offer on agricultural practices and outcomes, both in general and differentially by the age of the farmer.

First, we propose to compare households in communities where SAPEC will offer subsidized inputs against communities where subsidized inputs will not be offered during the evaluation year.[3] Assignment to SAPEC input provision (treatment communities) or no provision (non-treatment) occurs at two levels. First, 100 communities in SAPEC treatment and control districts will be randomly selected to take part in the study, using the list of SAPEC-eligible communities in the LATA database as a sampling frame. Each community will have a minimum of 25 farmers. 50 of the selected communities will be treatment communities and 50 will be control communities. Since SAPEC can deliver inputs and technical assistance to a maximum of 5,000 farmers in a given year and the potential number of beneficiaries in all SAPEC-eligible communities is much larger than this 5,000, the random assignment of potential treatment communities to the set of controls only changes the order of who receives the benefits next, rather than withholding benefits from anyone in particular.

The second dimension to create a counterfactual for beneficiaries will be the random selection of specific beneficiaries within SAPEC treatment communities. From the list of all farmers from the randomly-selected treatment and control communities that have been registered in the e-platform system, we will randomly select an average of 10 per community to be SAPEC beneficiaries (or survey respondents, for control communities) in the upcoming round. This will allow us to sample farmers within treatment

[3] All of the SAPEC eligible communities have received some distribution of inputs in the past. However, distribution is far from covering the entire community so that current rates of uptake of these methods is still low. The impact evaluation will cover those who would next have received the benefits in absence of the IE but did not receive them this year with those who are randomly selected to receive them this year. Given the high proliferation of NGOs and development projects in Liberia, many SAPEC-eligible communities have already received development assistance from other sources, so as is usually the case with cluster level RCTs, we are studying the additional impact of adding SAPEC's intervention to other activities which may be occurring but are not systematically varying by treatment and control.

communities as well as farmers who were randomly selected to not receive them this year, allowing us to see the causal impact of this input provision on the delivery of tools.

Within the communities to be treated this year, we will start from the list of all households listed in the mobile phone registries who are eligible to receive SAPEC benefits in this year's wave of benefit delivery. In advance of distribution, we will stratify these eligible farmers by age and gender, and randomly assign 1,500 of them to be invited to report to a SAPEC office in order to be registered as beneficiaries, with equal proportions of male and female and under- and over-35-year-old farmers receiving invitations. All of the farmers who appear to be registered will receive the package of benefits from SAPEC. If less than 1,500 farmers reply, a corresponding number of additional invitations will be sent to randomly selected households who were not selected in the first round until 1,500 beneficiaries have been registered.

When invitations are sent, the invitee will be randomly assigned to receive one of 5 different types of messages which emphasis different features such as the potential to earn higher income or to meet other farmers the invitee as described in section 5. This will allow us to test whether different types of farmers (young vs. older) respond to different aspects of program benefits or design.

## 9.2 Sample Size Calculations

SAPEC has data from a rapid assessment survey of 570 households in project areas we can use to estimate parameters needed for power calculations for the adoption of improved seed variety outcome and the dietary diversity score. Assuming that we have 50 communities who receive benefits this wave and 50 that do not, and assuming that we can survey 10 beneficiaries (+ 2 non-beneficiaries) in each treatment community along with 10 households who would have been treated in control communities, power for these two outcomes is shown in the two tables below.

*Adoption of Improved Seed Varieties*

| Baseline Mean | Baseline St. Dev. | Intracluster Correlation (ρ) | Number of Clusters | Units per cluster | Power | Size (α) | Minimum detectable effect |
|---|---|---|---|---|---|---|---|
| 33% | 47% | .176 | 100 | 10 | 80% | .1 | 12% |

*Dietary Diversity Score*

| Baseline Mean | Baseline St. Dev. | Intracluster Correlation (ρ) | Number of Clusters | Units per cluster | Power | Size (α) | Minimum detectable effect |
|---|---|---|---|---|---|---|---|
| 5.18 | 1.00 | .02 | 100 | 10 | 80% | .1 | .18 |

*Youth more likely to responds to a text message invitation to register for SAPEC*

Because responses to the text messages can be measured in administrative data, we can measure outcomes for all the farmers who respond to the text messages, not just those who we include in the household survey. We will send out 1,500 text messages to registered farmers in the mobile phone system beneficiaries. The outcome of interest is a binary variable for responding to a text message to be registered to receive inputs from SAPEC, and we are interested in testing whether youth have a higher response rate than older farmers. Since we don't know the baseline level of responsiveness of farmers, to be conservative, we assume it is 50% would give the lowest power for our test. Because assignment is at the individual level within communities, we no longer need to assume intracluster correlation or correct for the number of clusters.

| Baseline Mean | Baseline St. Dev. | Total number of individuals (50% receive SMS messages) | Power | Size (α) | Minimum detectable effect |
|---|---|---|---|---|---|
| 50% | 50% | 1,500 | 80% | .1 | 6% |

The power calculations above show power for tests relying on community-level treatment for identification, which is a comparison of the first 10 households invited in treatment communities to the first 10 households who would have been invited in control communities. We will also survey 2 households in each treatment community who would have been the next invited but were not selected. This allows us to identify the effects of treatment assignment at an individual level within treatment communities.

# 10. Data Collection

## 10.1 Quantitative Instruments

*Participation in programs*

Administrative data on selection, invitation and registration of beneficiaries in the communities participating in the IE will be standardized by DIME for the households selected for the IE. The collection and management of this data will be overseen by the DIME field coordinator to ensure that the invitations, registration, and distribution rates are accurately tracked by the survey.

*Agriculture Surveys*

Multi-module agriculture household surveys are planned for a sample of 10 farmers in 50 randomly selected communities that receive the SAPEC benefits this year and 10 farmers in 50 communities which do not. In the treatment communities, an additional two households who would have been the next 2 on the randomly sorted list to receive benefits but were left out will also be surveyed. Surveying these two farmers will allow for comparisons against the control community to assess whether there are spillovers

in the form of non-treated farmers learning from their neighbors who are treated.[4] The surveys will capture relevant information to compute yield and profit such as self-reported landholdings, crop choice, harvest, sales and input use (labor, fertilizer, pesticides and self-reported water use) as well as general household characteristics and indicators of satisfaction with the project processes. Two large scale surveys are planned: the baseline survey is expected to go to the field in January 2017, following the harvest of the rice season and more than half-way through the harvest of the cassava season in Liberia. This survey will allow us to understand farming practices prior to introduction to SAPEC programs. The second survey is planned for January 2018. This survey will allow us to identify the impact on yield from using upgraded inputs. The second round of the survey will involve revisiting as many of the baseline farmers as possible in order to create a two-round panel, allowing us to control for differences in initial adoption and productivity of farmers. Tracking information on these farmers will be collected in order to allow for the possibility of revisiting some or all of the baseline farmers following the second round of the survey.

## 10.2 Management of Data Quality

All data collection activities will be supervised by the Monrovia-based IE field coordinator in partnership with the SAPEC team. The DIME field coordinator will oversee the process for selecting beneficiaries from the e-registration and the systems for tracking the administrative data on invitations, registration and receipt of inputs from SAPEC.

The agriculture data collection instruments will be piloted extensively in the field prior to going starting the data collection to ensure they are appropriate for the local context. They will be closely based on a rapid response survey that was commissioned by SAPEC, designed by DIME, and implemented with 570 households in 2016. Enumerators will participate in extensive training of the questionnaire and functioning of the tablets. Training will include classroom and field training. Enumerators will be selected based on their performance during the training. The data will be collected electronically, which allows us to program consistency checks and perform quality checks on a daily basis. Audits will be performed by recording parts of the interview and performing back-check interviews by a different team of interviewers. Cross-checking of the data will allow us to provide immediate feedback to the field teams in case of divergences or other problems.

## 10.3 Ethical Issues

Because of oversubscription relative to the planned timeline for delivery of inputs, the randomized allocation of which farmers in the e-registration system are invited first to receive benefits does not

[4] The exact number of non-beneficiaries within treatment communities that will be surveyed may be adjusted pending the actual survey cost. If survey bids come under the budget, we will expand the number of non-beneficiaries surveyed to increase power.

withhold the benefit of the SAPEC inputs from any farmers who otherwise would have received them. Arguably, random assignment from among all possible beneficiaries may be the fairest method to determine which registered farmers will receive the benefits first.

All survey participants will be carefully informed about the data that will be collected throughout the study, the purpose of the surveys and the fact that their participation is voluntary. Only after participants provide consent will their data be collected. Strict protocols will be put in place to ensure data remains confidential. Any information that can link data to specific households will be removed for data analysis after assignment of a unique identifier.

### 10.4 IE Implementation Monitoring System

The SAPEC inputs (improved seeds and cassava cuttings, agricultural tools, etc) are assigned to the communities, and we expect excess demand. The same inputs were delivered in the first round of distribution which occurred in 2015. Therefore, we expect that organization, planning and take-up are not likely to be significant issues.

However, administrative data collection is a challenge in Liberia, where connectivity is not always consistent and the level of experience among field staff with data entry and tracking systems is relatively low. Nevertheless, the project team in collaboration with the field coordinator will carefully monitor all the different implementation phases from selection of program participants for the current round, through invitations and registration of participants to surveys to ensure tracking of beneficiaries and alignment of objectives.

## 11. Data Processing and Analysis

*Data processing*

Two types of data will be collected, administrative data collected during program implementation and large scale household surveys.

The administrative data will track which potential beneficiaries are invited to receive SAPEC benefits and out of these which sign up. This data collection will be coordinated by the field coordinator based in Monrovia and carried out largely by the SAPEC focal persons in each county. The data collection will be based on a system of data entry sheets established by DIME during the preparation phase and currently in use by the project.

Survey data collected electronically to ensure up to daily monitoring and consistency checks. The primary agriculture surveys will be collected using a survey format based a household agriculture survey

designed by the current DIME field coordinator in the project areas to assess agricultural practices in income in SAPEC project areas. Consequently, the primary data collection methods have been tested and have an established track record.

All data will be collected by a survey firm competitively selected within Liberia for this purpose who will be responsible for recruiting, training, and supervising the data collection under the guidance of the DIME field coordinator. Data will be synced from the field to servers protected by passwords so that individual enumerators do not have access to the data. The data will be de-identified for analysis.

*Data Analysis*

The relative treatment effects of receiving an invitation by text message on registration for benefits for different groups can be identified by the random assignment of text message invitations to individuals who are included in the ministry of agriculture's registry of farmers in cell phones in the SAPEC communities. Since SAPEC can work with 5,000 beneficiaries in the next round of input delivery, SAPEC can send up to 5,000 text messages to members on the registry and then track responses through the admin data. This impact evaluation has assumed that a minimum of 1,500 text messages will be sent. The mobile phone registry of farmers includes indicators for age and gender, so we can identify whether younger farmers are more likely to respond to text messages through the following simple regression:

$$Y = f(\alpha + \beta Young) + \epsilon$$

where *Young* is a dummy variable for indicator for whether the person's age in the mobile registry is less than 35, *Y* is an indicator for whether a person responded to the message in order to be registered as a beneficiary and *f* is a functional form for identifying linear dependent variable effects such as logit or probit. Since messages are randomly assigned to both older and younger members, this regression tells us whether younger farmers are more likely to respond to text message invitations.

We can further explore the effect of messages by testing whether different types of messages are more or less effective in encouraging different kinds of members to sign up. For example, we can run the regression:

$$Y = logit(\beta_0 + \beta_1 Young + \beta_2 SocialEncouragement + \beta_3 SocialEncouragement * Youth) + \epsilon$$

where S*ocialEncouragement* indicates whether the invitation included a message indicating that SAPEC's programs provide an opportunity for the respondent to interact with other farmers like them. Then $\beta_0$ identifies the effect of a standard invitation on sign-up rates for older farmers, $\beta_1$ identifies the differential response of the young to standard invitations, $\beta_2$ identifies the effect of the social encouragement messaging on take-up among older farmers and $\beta_3$ identifies the additional effect of social messaging on youth.

The average effect of the SAPEC treatment (receiving subsidized seeds/cuttings and tools) on take-up of improved varieties, higher dietary diversity, and higher income can be identified through two methods. First, we can compare households in communities who will be receiving this round of benefit deliveries (treatment) with households in communities who are not receiving benefits in this upcoming round (control). Both treatment and control communities will likely have received SAPEC benefits in the past, but at far from total coverage. Since beneficiaries will be chosen from lists of farmers who appear in the mobile registries and these registries exist in both treatment and control, we can identify the households who would have been treated next in treatment and control communities. This allows us to sample from only households who were randomly assigned to be invited for treatment within the treatment communities and households who would have been invited in the control communities if their community was treatment and conduct surveys both before and after the actual treatment is provided. The random assignment of communities to treatment allows us to identify the treatment effect of providing subsidized improved varieties and agricultural tools on an outcome Y such as adoption of improved varieties, better dietary diversity, or improved income through the simple differences-in-differences regression as follows:

$$Y = \beta_0 + \beta_1 post + \beta_2 treatment + \beta_3 treatment * post + \epsilon$$

In this standard differences-in-differences regression the parameter of interest is $\beta_3$ the improvement in adoption, dietary diversity, or income in the treatment areas following the intervention compared to households in control communities who did not receive the intervention.

The second method available to identify the effect of treatment on adoption, dietary diversity, and income is to compare households who were randomly selected from the mobile registries to receive the treatment in treatment communities with those in the same communities who were not selected to be invited. The same difference in difference specification can be used with the one difference that treatment assignment will vary within communities. The advantage of this approach is that random assignment is at the individual level, so the power of statistical tests to identify treatment effects is not affected by intra-cluster correlation. The disadvantage is that within communities, knowledge of improved varieties could spill-over between the treated individuals and the non-treated individuals. If the improved varieties are available for private purchase, this may cause some of the non-treated households to adopt improved varieties, causing the difference in outcomes we would expect to see to be attenuated, causing the estimated impact of the SAPEC intervention to be smaller than the full causal effect of the treatment.

Because we will select and equal number of young and older farmers to receive treatment in order to maximize power, the sample in our survey is not guaranteed to have the same proportion of young and older farmers that we would expect to find in the population. This is important for interpreting the average effect of the treatment on the population as a whole. In order to recover population based estimates that are unbiased by sample selection, we will apply population based probability sample

weights to all regressions that estimate sample weights. Using weights allows us to recover an unbiased estimate of the effect of the population on the overall treatment.[5]

## 12. Study Limitations and Risks

The primary risks on this impact evaluation come from the risk of project's implementation being delayed. Liberia is a difficult context for implementation with security risks, poor infrastructure, and a low level of field level human resources that have caused the project roll-out to be delayed significantly. Because of these factors, and particularly because of the Ebola crisis, the disbursement rate for SAPEC is behind schedule. A mid-term review for the project is on-going and the outcome of this MTR in the context of low disbursement could change the expected project activities, timeline, and targets.

In order to minimize the risks of delays to effective learning from the study, we are focusing on the narrow activities most likely to occur in the current calendar year and least likely to be affected by project restructuring, the delivery of benefits to the next set of beneficiaries. Plans prior to the MTR indicate that 5,000 beneficiaries should be reached by input delivery this year. We have kept our expectations at a minimum level, given the uncertainty; the project management unit has indicated that the project should reach at least 1,500 beneficiaries as a reasonable and very conservative estimate of likely reach.

In order to follow the influence of Ebola on program effects, the household survey instrument will include questions designed to measure the incidence of the Ebola crisis on the community. Collecting this data will allow the research team to evaluate whether Ebola incidence mediates program impact and allow for potential corrections to the effect of Ebola on project outcomes.

## 13. Plan for Using Data and Evidence from the Study

We will be actively involved in the dissemination of evidence acquired during the course of this process to policy makers, practitioners and academics. First, we have been actively involved with policy makers at

[5] Since we will stratify our sample by age and gender, the relevant population weight for a person of age s and gender g is $weight_{sg} = \frac{N}{n_{sg}} * \frac{p_{sg}}{P}$ where N is the total number of households in our sample, $n_{sg}$ is the number of households selected because they have a farmer with age s and gender g, P is the total population for the relevant estimate and $p_{sg}$ is the number of farmers in this proportion. These weights can be used to report relevant estimates for different parameters of interest. For example, if we are interested in the farmers registered in the e-database as the set of farmers most targetable by SAPEC, P can be determined by the farmers in the e-database. Alternatively if one is interested in parameters relevant for rural Liberia, the relevant population proportions can be calculated through any survey representative survey of rural Liberia such as the census.

different levels during the design phase. A rapid response survey commissioned by SAPEC was designed and overseen by DIME to ensure high quality data was obtained to plan deliveries and to design the impact evaluation. Baseline and monitoring data will help the provincial administration during the program implementation of the project as well as inform the broader agriculture investments made in the country at the national level. Upon completion of the evaluation we will work closely together with all stakeholders to elaborate relevant policy briefs and dissemination events. A report will be produced by the research team to be shared with project staff, the TTL's and policy makers from relevant departments to summarize learning, solicit suggestions and improvements, and generate new uses for the resulting data.

Second, through the global DECIE network we are working closely with different stakeholders in the development arena. The network brings together governments, TTLs from different MDBs, multiple donors and academics. The IE was proposed and designed with participation from TTL's, project staff and the core research team and a subset of that group met in Kigali in June 2014 as part of DECIE's broader initiatives in the areas of agriculture and food security. The results will be disseminated widely across the community of practice through the annual workshops as well across the irrigation projects specifically through close collaboration between the research teams.

In addition, we plan to make our finding broadly available to other WB and independent agriculture and irrigation related projects to emphasize the role of community targeting of public goods. Finally, we plan to develop a series of research papers from the experiment and the results and engage the broader academic community to both contribute to and shape the knowledge from this IE. We hope that such academic work is widely regarded in seminars and conferences and eventually published in an academic economics or general interest journal of the top caliber.

All data will be made available online through the IE database, following the Bank's open data policy.

Results will be shared as they are produced with the GAFSP CU to ensure that learning from this IE can be incorporated into the design and implementation of other projects in the GAFSP portfolio.

# 14. IE MANAGEMENT

## 14.1 EVALUATION TEAM AND MAIN COUNTERPARTS

**TABLE 2 – IE TEAM AND MAIN COUNTERPARTS**

| Name | Role | Organization/Unit |
|---|---|---|
| Paul Christian | Principal investigator, IE TTL | WBG/DECIE |
| Katherine Abrikian | Field Coordinator | WBG/DECIE |
| Patrick Agboma | Project TTL | AfDB |
| William Kalawalu | Project Coordinator | SAPEC |
| Harry Wonyene | M&E Officer | SAPEC |

## 14.2 WORK PLAN AND DELIVERABLES

**TABLE 3 – MILESTONES AND TIMELINE**

| Milestones | Completion Date |
|---|---|
| Scoping Survey Completed | June, 2016 |
| Randomization of Beneficiaries and Messaging | October, 2016 |
| Baseline Survey | February, 2017 |
| Endline Survey | February, 2018 |
| Endline Report | June 2018 |

## 14.3 BUDGET

| | FY16 | FY17 | FY18 | Total | % of total |
|---|---|---|---|---|---|
| STC | | | | | |
| -Field Coordination | $ 40,000 | $ 60,000 | $ 60,000 | $ 160,000 | 23% |
| Total STC | $ 40,000 | $ 60,000 | $ 60,000 | $ 160,000 | |
| Data Collection | | | | | |
| -Ag survey 1 | $ | $ 247,635 | $ | $ 247,635 | 36% |
| -Ag survey 2 | $ | $ | $ 217,635 | $ 217,635 | 32% |
| Total data collection | $ 0 | $ 247,635 | $ 217,635 | $ 465,270 | |
| Travel | | | | | |
| Total Travel | $ 20,000 | $ 20,000 | $ 20,000 | $ 60,000 | 9% |
| Grand Total | $ 60,000 | $ 327,635 | $ 297,635 | $ 685,270 | 100% |

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