Tailoring Contract Farming to Smallholders:

Experimental Evidence on Enrollment Impact, Insurance Provision, and Communication Technologies

Proposal to BASIS AMA CRSP via the Stanford Institute for Economic Policy Research (SIEPR)

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Abstract

The research proposes three field experiments in Kenya to evaluate the potential of contract farming schemes to increase smallholder welfare. In the first intervention, a large contract farming company will randomly enroll new farmers among its outgrowers. In the second, we will pilot tailored insurance products for outgrowers that reduce basis risk and provide innovative premium payment options. In the third, we examine the role of mobile phones to reduce communication frictions across agents in the contract farming supply chain.

These interventions are developed in partnership with one of the largest agribusiness companies in East Africa, running a contract farming scheme with about one-hundred thousand outgrowers. The evaluation will rely on the rich farmer-level administrative data provided by the company, as well as on agricultural household survey data, with accurate information on agricultural and non-agricultural income, input choices and technology adoption.

Collaboration between U.S. and Kenyan researchers and capacity building are a crucial component of the project. Capacity building activities --- including training, research funding, curriculum development, and degree scholarships --- will target academics, policymakers, and the private sector.

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1. Introduction

The shift from subsistence to cash crops and from sales on spot markets to more complex contractual arrangements is often considered an important driver of structural transformation and growth. In the developing world, including Sub-Saharan Africa, contract farming is one of the most common contractual forms through which this transition occurs. The diffusion of such schemes has been steadily increasing over the last decades (Armah et al, 2010; Barret et al, 2012; Reardon et al, 2003, 2009). The proposed research --- resulting from a long-term partnership between the research team and Mumias Sugar Company, one of the largest private sector contract farming schemes in East Africa (100,000 smallholders) --- includes randomized controlled trials of a suite of interventions to assess potential impact of such schemes along several dimensions, including farmer income, technology adoption and take-up of insurance products.

First, we will have the rare opportunity to randomly vary participation in a contract-farming scheme. The partner company, which enrolls several thousands of new farmers on a yearly basis and is planning expansion into new locations, has agreed to randomly select a share of their new contracting farmers from among those expressing interest. In addition, we are also exploring variations in the details of the contract offered to the farmers in order to shed light on which features of the contract farming model drive the impact. As an example, we will attempt to disentangle the relative role of the company provision of inputs on credit and of the company purchase commitment.

Second, we will explore innovative insurance products targeting contracting farmers. Contract farming arrangements have the potential to address two crucial issues that limit the demand for insurance: credit constraints and basis risk. At the beginning of the agricultural season, credit constraints and myopia may reduce farmer willingness to pay for insurance premiums. However, in the

case of contract farming, the company may be able to provide insurance, deducting premiums for repayment at harvest time. Farmers will pay premiums in the form of a deduction at the time of harvest delivery. This may substantially affect insurance take-up. Typically, it would be hard to have the farmer to commit to harvest-time premium payment. However, nesting insurance in a contract farming arrangement makes this option viable.[1] Basis risk is another well-known deterrent to take-up of weather insurances and reduces its effectiveness in consumption smoothing. An alternative option is to tie insurance compensation to actual average crop outcomes in the target location. Contract farming companies typically collect precise data on farmer output. Our partner also collects information on plot sizes, thus allowing computation of yields. This makes it possible to offer an insurance product based on average yield in a properly defined geographical location, as well as weather. In collaboration with the partner company, we are exploring the development and piloting of the above tailored insurance products.[2]

Third, we plan to examine the potential of mobile technology to improve efficiency of communication and interaction along the supply chain. In a large outgrowing scheme like the one under consideration, traveling distances between farmer dwellings and company field offices are often very large and the company extension staff is limited. Information technology --- specifically the diffusion of cell phones among rural populations in the target areas--- presents an opportunity to substantially reduce these communication costs. In the last component of the project, we thus plan to evaluate several interventions that allow farmers to report issues in company performance in terms of input provision (seedcane, fertilizer) or that enable the company to ask farmers for feedback about tasks they are required to perform (e.g., fertilizer application, weeding).

1 Obviously, strategic default considerations affect insurance provision to the same extent that they affect provision of other inputs on credit. Success of such a contract will rely on sufficient enforcement on the contract-faming enforcement.

2 We are also exploring cooperation with other organizations involved in the design and provision of insurance products for small producers, such as *Financial Sector Deepening – Kenya.*

All the interventions rely on a long-term partnership between the research team and the company, one of the most successful agribusinesses in the region. As a result of the cooperation, members of the research team are already: i) conducting a panel data analysis of agricultural dynamics and its relation to rainfall shocks using farmer-level administrative records, and ii) managing a randomized control trial to evaluate the impact of pre-harvest conditional cash advances to outgrowers on plot management and yields. Company management and field staff provide a valuable resource in designing the interventions and defining their operative details. In addition, the partner company provides numerous resources to the project (e.g., staff, transport, office space). Finally, the researchers and the company have reached an agreement concerning the access and analysis of the rich farmer-level administrative data collected by the company, which contain information on plot size, input charges and output. The research analysis will heavily rely on these unique administrative data, as well as on field surveys.

As we describe later in the proposal, the project contributes to each of the three AMA CRSP research themes: risk management, inclusive economic growth, and technology adoption. The project is aligned with several other USAID initiatives. First, USAID *Feed the Future (FTF)* identified Western Kenya as one of the two focus regions of the program, as they present the best opportunities for linking growth and poverty reduction. Second, the FTF program multi-year strategy document for Kenya identifies contract farming as one of the potential targets for program direct investments (USAID, 2011a).

A central part of the proposed project concerns curriculum development and capacity building with Kenyan institutions. This will include: i) project management and co-writing of academic and policy papers by U.S. based and Kenyan researchers; ii) faculty training, involving faculty from the three major universities in Western Kenya; iii) graduate student training, in the form of workshops, graduate student funding, and research assistant/data analyst positions; iv) capacity building at the partner company, in the form of both workshop and doctoral studies funding.

In order to ensure successful development impact, *before the implementation of the interventions,* the researchers will seek inputs from the partner company management, local policy makers, and other stakeholders in the agricultural sector on the relevant quantitative indicators along which to measure the impact of the interventions. In addition, the proposal outlines the outreach strategy at various levels (local, national, global). Innovations for Poverty Action, the partner NGO that will coordinate field work, and academics involved with the project have a history of success in the dissemination of research results to policy audiences and in the scale-up of proven interventions nationwide.

Support from AMA CRSP will play a critical role for the funding of the intervention. In addition to the funds requested in this proposal, we have already obtained funding from other donors for several components of the research program. We also note that the partner company is devoting a substantial amount of resources to this collaborative research effort.

The remainder of the proposal is organized as it follows. Section 2 presents the proposed interventions and research questions. Section 3 provides details on the research analytic strategy, including identification, data collection, and timeline. Section 4 describes policy relevance, scalability, and an overview of the outreach plan. Section 5 presents the capacity building component of the project. Section 6 details how the project relates to BASIS, Feed the Future objectives and regional USAID goals. Section 7 concludes.

2. Proposed Interventions and Research Questions

A. Contract Farming Enrollment, Technology Adoption and Agricultural Income

The partner company runs one of the largest outgrowing schemes in East Africa, involving approximately 100,000 farmers. In the region under study, smallholders play a crucial role in providing raw materials to the processing company, while less than 10% of the total production comes from

plantation estates (*nucleus estates)*. The company offers a standardized contract to outgrowers. This includes two primary features. First, the company commits to purchase at harvest time all the cane produced by the farmer on the plot targeted by the contract. On the other hand the farmers commit to sell their cane only to the company they contract with. Second, the company provides smallholders with several inputs on credit, including land preparation, seedcane, fertilizer, harvesting, and transport of cane to the mill. Input charges (plus interest) are subtracted from the farmer payments at the completion of the cycle.

Every year, the partner company targets new farmers for enrollment in the outgrower scheme. In addition, the company is currently exploring expansion of the scheme into new areas. This recruitment process consists of a listing of interested farmers in a given location and then in a selection of a subset for inclusion in the scheme. As part of the collaborative research effort, the company has agreed to select the subset of contracting farmers following a randomization protocol. This will provide exogenous variation in farmer-level contract farming status.[3] In addition, as part of its strategy to recruit new farmers, the company is also considering a "private cane" model for a subset of its existing farmers. In this contract, the company will still commit to purchase the cane at harvest time, but it will reduce its role in input provision.

The research design will allow us to shed light on several channels through which participation in contract farming arrangements could affect participating farmers. First, we will study the impact on overall household agricultural and non-agricultural income. In order to measure profits we will collect detailed agricultural labor and wage data.[4]

Second, we will assess the overall extent to which enrollment in the contract farming scheme affects farmer technology adoption. In particular we will measure input usage (e.g. fertilizer) in all the crops

3 For this component of the research, we will focus on locations where the company does not face competition. In these locations, control-farmers will not be able to enter another outgrowing scheme. This will ensure a strong first stage.

4 Research team members have experience in collecting this type of data in the target region. For instance, one of the academics is involved in the collection of a panel assessing the long-term impact of child health gains.

cultivated by the farmer. This will allow us to test whether input intensity in crops not targeted by the contract farming, as well as in sugar cane.

Third, we will study whether joining the sugar cane contract farming scheme has an impact on food security. There is debate over the impact of a shift to cash crops, not directly consumed in the household. We will collect data on food security in order to assess whether the impact in the data.[5]

Fourth, the choice to honor the contract plays a crucial role in ensuring sustainability of the contracting farming arrangement (Minot, 2011). In most contract farming schemes in Sub-Saharan Africa high legal transactions costs, court inefficiency and the relative small scale of most farmers imply that the companies primarily rely on the threat to interrupt the relationship to induce farmers to honor the contract. Understanding to which extent the choice to default by side selling varies with the details of the contract is thus an important question, for which evidence is scant. We will contribute by testing to which extent the likelihood that the farmer defaults on the contract (i.e., she fails to deliver cane to the company) depends on the amount of inputs a given farmer is receiving from the company and thus the amount owed at harvest. Understanding this elasticity may provide key insights on the optimal trade-off the company faces when deciding the volume of inputs to provide to its outgrowers (i.e., higher productivity vs. higher moral hazard concerns). We will provide additional evidence on the nature of moral hazard by exploiting geographical variation in the presence of outside options that farmers face. Specifically, in a subset of locations, the partner company faces substantial competition from other processors. Basic models of ex-post moral hazard would predict that defaults are more likely in these areas. Our study will test this basic hypothesis. In addition, we will be able to assess the heterogeneous impact of input provision on default by the level of competition with other companies. This may have implications for optimal regulation. If competition makes input provision impossible,

5 One of the members of the research is collaborating with another project collecting detailed food security data. Food security modules for that project are designed by public health/nutrition experts familiar with the target region. We will use similar modules for our surveys.

then there may be a case for restricting competition as a second best.

Finally, we will measure heterogeneity of the impact of contract farming along at least three dimensions: i) farmer wealth; ii) gender of the contracting farmer; iii) plot ownership/tenancy status.

B. Interlinking insurance and contract farming

Over the last decade, microinsurance products for agricultural producers, particularly rainfall insurance, have received a growing amount of attention from scholars and policymakers (Karlan and Morduch, 2009; IFAD 2010). These products may help contribute to resilience in the face of weather risk, which may grow over time with climate change. However, many studies have found low take-up of weather insurance, even at actuarially fair prices (Cole et al, 2013).[6] Incomplete understanding of the insurance terms, distrust, liquidity constraints, and basis risk (Mobarak and Rosenzweig, 2012; Clarke 2011) are often mentioned as contributing to low uptake. Interlinking contract-farming with insurance products provides an important opportunity to assess these limitations. We propose the design and pilot of two interventions that exploit these opportunities.

First, we will compare take-up of insurance when this is either unbundled or bundled with the contract farming arrangement. In the unbundled case, the farmer pays for the product at the beginning of the planting cycle. In the bundled case, at harvest time, the company deducts the insurance premium (plus interest) from the payment to the farmers, similar to other input arrangements. Several theoretical models would predict higher take-up for the second product. For instance, credit constraints may prevent purchase before harvesting. In addition, impatient farmers may also prefer paying the premium later. Loss aversion theory provides another insight: premium deductions at harvest time could be perceived as ``less gain" while ex-ante payment could be perceived as a loss. Contract farming

6 An important exception is Karlan et al. (2012)

arrangements provide farmers with the ability to commit to delayed payments (i.e., deductions from harvest time payments), which is likely to be difficult in other settings.

Second, interlinked insurance products can exploit the fact that our partner company, similarly to many other contact-farming schemes, collects accurate data on yields across plots. These can be used to develop an insurance product featuring both a rainfall insurance component and an *area yield insurance* component. In the latter component, indemnities are honored when the average yield in the location of the plot (for instance a set of villages) is below a certain threshold, relative to its historical mean. One such product would provide a modest compensation when average yields in the target area are low, even if rainfall was not below the payment threshold. By reducing basis risk, this product would provide an incremental benefit for farmers relative to standard weather insurance. In partnership with the company, we plan to use rich long-term historical yield data to design and pilot such a product and test how its take-up compares with rainfall insurance policies. Preliminary data analysis conducted by the researchers on a subsample of locations for a twenty-year time span reveals that a model including both rainfall measures and average yields in neighboring fields displays a predictive power 50% to 100% higher than a model which includes only rainfall measures.

To summarize, the provision of input on credit is one of the defining features of contract farming arrangements. We highlight that integrating farmers into contract farming may also enhance their ability to access tailored and effective agricultural insurance products. The proposed interventions provide a contribution in this direction.

C. Farmer hotlines and SMS-based interactive scheme

Efficient communication both within a company and between the company and its stakeholders (including its suppliers) is an important determinant of firm performance (Aral et. al. 2010; Bloom et al., 2010). This is certainly the case for contract farming schemes. On the one hand, it is important for

the company to provide some degree of monitoring of the smallholder plots, for instance by checking whether the farmers have completed crucial tasks such as weeding, and to be able to diffuse information to farmers cheaply. On the other hand, farmers must be empowered to provide timely feedback to the company about input delivery performance (e.g., whether land preparation was completed properly or whether fertilizer has been delivered at the right time in the growing cycle). This is particularly relevant for our case. Third-party contractors are in charge of delivering inputs to the fields and delays relative to the recommended schedule are quite common. In addition, farmers often require a second delivery of seedcane.

The large penetration of mobile phones in Kenya, including among rural populations, provides an important opportunity with respect to the above challenges. In East Africa, mobile phones have proven to be effective for a wide range of services such as mobile money transfers, health service delivery, and education (Aker and Mbiti, 2010). Our research will shed light on how ICT affects interactions across agents in the contract farming supply chain (company, farmers, input providers).

In the first component of this intervention, the company will select a random sample of farmers to access a hotline service, where they can record queries about company services, agricultural practices, and other contractual details. The research team and the company's Information Technology Department are collaborating to develop a query logging software platform to direct the queries to the relevant department and to monitor the responses. The logging platform will channel the request to those departments of the partner company in charge of dealing with input provision. Using company administrative data, we will test whether access to the hotline affects indicators such as delays in seedcane and fertilizer delivery. Potential extensions will target variations in hotline features, such as the cost of the service for the contracting farmers. The treatment has the potential to reduce frictions among the company, the cane suppliers, and the third-party contractors that provide inputs. For instance, access to hotline records may allow the company to better monitor the performance of the

contractors, thus raising their effort. Increased efficiency in input provision would benefit both the contracting farmers and the company. For instance, timely delivery of fertilizer could increase yields. This would affect both farmer revenues and company profits. Our evaluation design will enable us to quantify these changes.

The second component of the intervention consists of a SMS-based interactive scheme where farmers will be asked to provide feedback on tasks they need to perform, such as trashlining, fertilizer application, and weeding. Product design testing concerning prices and message content will identify the most effective way to engage farmers in these mobile-based interactions. The evaluation of this intervention will assess the role of service fees and training in determining adoption of the proposed services. In one treatment, we will assess whether SMS prices affect take-up. The findings will complement the existing literature documenting high price sensitivity for education and health treatments (Kremer and Holla, 2009). In another treatment, we will test whether trust in messages sent by the phones might be a barrier to take-up. Rural phone users are often subjected to spam phone messages that are designed to scam people. We developed some ideas to formally measure whether trust is indeed a barrier. In one of these, we will test whether providing business cards from the sugar company with information about the program might be complementary to use of the mobile phone system.

We are also exploring the option to assess how mobile-based interventions can increase adoption of new farming technologies among outgrowers. As an example, the company is currently piloting the usage of herbicides (as opposed to manual weeding) in the cane plots. We will test the cost-effectiveness of mobile-based marketing campaigns relative to a standard agricultural extension approach.

3. Analytic Strategy

A. Identification Strategy

We will use randomized controlled trials to measure the impact of each of the three interventions.

Identification concerns that arise from endogenous selection into the scheme are particularly relevant for estimating the impact of contract farming enrollment on farmer technology adoption and welfare (Barrett et al., 2012).[7] Farmers enrolled may be systematically different along several unobservable characteristics. In the proposed design, the company will first identify farmers who report interest in joining this scheme, and will then randomly select half of these. Therefore we will be identifying the local average treatment effect of joining contract farming for those farmers that express interest for participation. We note that this is a policy-relevant treatment effect as the recruiting process of contract farming companies typically follows an initial expression of interest from the farmer side.

The unit of intervention will be the *field*, a group of plots (average 5) that are treated homogeneously by the company for harvest cycle and input provision. As mentioned above, in partnership with the company, we are also exploring the option to vary specific details of the farmer contract, such as the nature of the input provision. Depending of the outcomes of this exploratory work, we will expand the sample to retain power while including further experimental variation.[8] We conducted preliminary sample size estimation using summary statistics from survey data in the target region collected by the Tegemeo Research Institute[9]. We focus on agricultural income, revenue per acre and fertilizer costs per acre. Based on these figures, the proposed sample size for the experiment is 2,000 plots.[10]

7 An important study is Ashraf, Giné and Karlan (2008) who evaluate the impact of Pride Africa's DrumNet export horticulture crop promotion service bundling program on farmer practices and household income.

8 As we detail below, in this proposal, we request funding for i) full evaluation of the impact of joining the scheme with the standard contract; ii) piloting of variations in the contract specifics. If needed, we will require further funding to scale-up the evaluation of point (ii)

9 We thank Tavneet Suri for providing the summary statistics used for this analysis.

10 Further details on these sample size calculations are available on request.

For the insurance interventions, we will randomize farmers along one or both of the following dimensions: i) payment vs. deduction; ii) weather insurance vs. an insurance product featuring both a weather insurance and an area yield insurance component. The preliminary target sample size is four hundred farmers per treatment group.

For the mobile phone interventions, access to baseline administrative data and pre-pilot results allowed us to perform rigorous power calculations. For each hotline intervention and SMS treatment group we will target a sample of 350 fields to estimate the impact of the different treatments on farmer participation, and performance of the company in providing input to the outgrowers.

Economic theory will complement rigorous evaluation methodologies and help in developing generalizable lessons from the randomized controlled trials. As an example, we will combine measures of credit constraints and discounting from survey data with the experimental impact of bundling insurance with the outgrower contract. Using this information for calibration, we will estimate the relative explanatory power of standard expected utility models vs. models featuring loss aversion in predicting the insurance take-up decision. This exercise will generate insights that go well beyond the specific context of our intervention and that will be relevant for other contexts where farmer microinsurance products are being examined.

Finally, where possible, we will attempt to relate our findings to existing evidence from other studies. For example with regard to the proposed insurance interventions, we will compare the impact of bundling insurance with contract farming and of adding an area-yield component to the standard weather insurance with the impact of other interventions aimed at increasing take-up, such as financial literacy training and social network incentives (Cole, Gaurav, and Tobacman, 2011; Gine', Karlan, and Ngatia, 2012).

B. Data Collection Strategy

Data analysis for the proposed research will also rely on two primary sources. For the analysis of the impact of joining the contract farming scheme, we will collect two rounds of household data, before planting and after harvesting. While the surveys will include an extensive agricultural module, they will also comprise other modules, such as food security, consumption, migration, and wealth. This will allow the researchers to fully characterize the impact of joining the contract farming scheme. In addition, baseline variables on wealth and land rental status will allow us to perform the heterogeneity analysis described above. Our field staff will also collect basic data across the company catchment area on key large farmers who are buying/renting land in the target areas. We will combine these data with the historical farmer-level records described in Section 1 to shed light on the relation among contract farming, weather shocks and land concentration.

For all the interventions, will extensively use the company's rich outgrower-level administrative data. First, the company maintains a census of producers, plot sizes, harvest cycle, geographical information and other baseline information. Second, the query logging platform will produce live reports on usage, type of query, status (i.e. open or solved) and resolution methods. Third, the SMS platform will record date and content of each message sent either by the company or by the cane suppliers. Fourth, different departments in the company produce reports on their daily activities. This will allow us to compile data on the timing of input provision, such as seedcane and fertilizer deliveries, which are important outcomes variable for the hotline intervention. Fifth, we will use archival data that go back to the mid-Eighties to compute location-specific means and trends in yields.[11]

Finally, we notice that, besides detailed information on active outgrowers, the company administrative data will also allow us to monitor whether a certain plot exits the scheme. By relying on

11 With funding from the National Bureau of Economic Research, we digitized a subset of these records. As we describe in the budget narrative request, requested funding from BASIS will allow us to digitize more records. The data also allow us to look at other features of agricultural dynamics in the region over the same time horizon, such as plot size and contract transferring.

this information, we will therefore be able to assess the long-run impact of different contractual forms on the duration of the farmer-buyer relation at a very low cost.

4. Policy Relevance

How to improve smallholder producer livelihoods is of central importance in Kenya, where 75% of the working population is employed in agriculture and smallholdings contribute to the vast majority of agricultural production. The challenges of increasing farmer profitability are even more relevant in the presence of stagnating agricultural productivity in the region. The role of contract farming, the potential for agricultural microinsurance products and of information communication technologies have each received considerable attention in the current agricultural policy debate. For instance, some regional organizations, such as The New Partnership for Africa's Development (NEPAD), explicitly endorse contract farming as tool to promote inclusive agricultural growth (NEPAD, 2008). On the other hand, in a recent joint report, Technoserve and the United Nations International Fund for Agriculture and Development (IFAD) pointed at the challenges of these schemes to reach more marginalized farmers (Technoserve, 2011). Similarly, over the last few years, key players in the agricultural sector, such as the Syngenta Foundation and Financial Sector Deepening Kenya, have devoted increasing resources to agricultural microinsurance products. Finally, there are high hopes for the development of applications that use communication technologies in agriculture to improve farming practices and increase production and welfare, including at USAID (Payne 2012). Mobile phones have proved effective in a wide range of sectors, such as money transfer, health, and early warnings.

The proposed project will contribute to these policy discussions in several ways. First, we expect our experimental analysis to be an important innovation in the understanding of the impact of contract farming on smallholder welfare and thus to attract considerable attention. Second, both the proposed insurance products and the ICT interventions display high scalability potential. Should the pilot prove

these ideas successful, the partner company has the potential to scale these up to the entire contract farming scheme (more than one hundred thousand contracting suppliers) over a relatively short time horizon. As the prevalence of these schemes is growing in the developing world, the results will be relevant for a large set of players. For instance, we will present our results to the *Kenya Sugar Board* and to other contract-farming companies in Kenya. Even more broadly, other organizational forms ---for instance, large farmer cooperatives --- could relatively easily adopt the interventions for their members. For instance, the provision of insurance products through deduction at payment time will be easily adaptable to different settings. While the focus of our research is on sugarcane --- a sector that is expected to expand due to the increased demand for biofuels and bioelectricity --- the potential of these interventions goes well beyond this crop. For instance we expect the findings to be applicable to other value chains for which cooperative and contract farming are important organizational forms, such as horticulture and dairy farming.

We note that one member of the research team and Innovations for Poverty Action, the partner NGO, have a successful history for scaling-up interventions, such as deworming and chlorine dispensers, to nationwide and global levels. The scaling-up leverages on the rigorous evidence generated by the evaluation of the pilot stages. We estimate that the two efforts have reached forty-five million people and one million people, respectively.

In order to maximize the impact of the research we have identified target partners at various levels (local, national, regional, global, academic) and devised an outreach plan for each of these levels. Target of the outreach activitis include local and central government, private sector, industry organizations, regional initiatives, international institutions, and the global academic community, among others. The outreach activities will take place at the design stage, the project implementation stage, and the dissemination stage. Appendix E provides the details of this plan. Both the academic researchers and representatives from Innovations for Poverty will contribute to this effort.

5. Capacity Building

Capacity building is a key component of the proposed project. This will take the form of: i) peer research collaboration; ii) academic capacity building; iii) policy capacity building; iv) partner capacity building.

A. Peer Research Collaboration

Juma Alphonce Odondo, a lecturer at the Department of Economics at Maseno University, will contribute to the project throughout its duration. In the past few years, as a member of other research projects in the region, Kremer has developed successful collaboration with academics from the same institution. Odondo will play a key role during project implementation (spending a total of thirty days per year in the field), paper writing, and result dissemination. Casaburi and Kremer will travel to Kenya to interact with Odondo. In the final stages of the project, Odondo will visit the United States (Harvard or Stanford) to work with the US researchers on the data analysis and academic paper writing. In partnership with Innovations for Poverty Action, Odondo will also play an important role in result dissemination.

B. Academic Capacity Building

a) Faculty and Ph.D. Training: Academic Course on Evaluation In 2014, the researchers will hold a course on development program evaluation methodology at Maseno University. The course will target around ten faculty members and twenty doctoral students. We expect one third of the participants to be women

b) Ph.D. Training and Research Funding Over the project time span, we will hire at least three Kenyan students (at least one woman) who are either in their final stages of Masters and looking to pursue a PhD program or in the early stages of their PhD studies.[12] These students will collaborate on both field activities and data analysis. The project researchers will provide mentoring and will

12 Currently, we estimate that women represent about 15% of the doctoral students in Economics in the target region.

encourage the students to develop their own research projects, exploiting complementarity with the main project activities (for instance by adding modules to the project survey instruments). In addition, we will provide each doctoral student with research seed grants.

c) Master Student Training: Academic Course on Research Methods In 2015, the research team will teach a short course on household survey methodologies, targeted at master students at Maseno. Topics will include survey design, field team management and quality controls. A particular emphasis will be placed on agriculture survey modules. We expect around thirty students from at least three universities in Western Kenya.

d) ***Degree Scholarships.*** The project will provide two of the IPA Kenyan project staff members (e.g., research manager, research assistants, field staff) with a scholarship that will partially cover the costs for a graduate degree in social science, preferably abroad. The scholarship will target local staff who have proved particularly promising during the project activities.

C. Policy Capacity Building

a) Course on Randomized Evaluations In 2015, the research team will offer a course on randomized evaluations, targeted at practitioners from Kenyan NGOs focusing on agriculture. The content will focus on practical issues, such as sample size calculations and non-compliance. Innovations for Poverty Action will take the lead in identifying suitable candidates for participation. We expect around twenty participants.

b) Workshop on Contract Farming Evaluation Toward the end of the project, the research team will hold a workshop on the impact of contract farming schemes. The workshop will target both NGOs and local government departments working on agricultural value chains and smallholder market linkages.

D. Partner Capacity Building

a) Course on Data Management and Analysis Research staff from Innovations for Poverty Action will provide a course in data management and analysis to the company staff. We expect the course to consist at least of five sessions and to have about five members from the company participating, primarily from the outgrower service department. The goal will be to identify effective ways to manage and analyze outgrower recruitment, input provision and harvesting services.

b) Research funding The project will provide funding for two research projects undertaken by staff of the company. The focus will be on projects researching challenges and innovations in sugarcane farming and outgrower welfare, from either an agronomic or a social science perspective.

c) Maseno student internships at Mumias Sugar Company and Innovations for Poverty Action

Both MSC and IPA are currently exploring opportunities to open internship positions for current Maseno students or recent graduates.

6. Contribution to USAID objectives and initiatives

The project contributes to each of the BASIS-AMA research themes. First, the interventions attempt to connect smallholder households to agricultural growth opportunities (theme 2) and to promote the shift toward integrated value chains and a more market-oriented agricultural sector. Second, the proposed research aims to develop and test scalable mechanisms to promote take-up of insurance products among smallholders in a cost-effective away. This directly relates to research theme 1, both by interlinking agricultural and product value chains, allowing farmers to pay premiums as a deduction at harvest time, and by reducing basis risk through the development of combined area yield and rainfall insurance for outgrowers. The research will also unveil the extent to which contract farming linkages drive agricultural technology adoption (theme 3) and on whether this affects investment choices in

sugarcane and in crops other than the ones targeted by the contract. In addition, we will study the take-up of interventions based on information technologies, and their potential to improve efficiency and communication across agents in agricultural value chains. We will also assess to which extent cheaper communication via mobile phones can increase the diffusion of agricultural technologies (i.e. herbicides) among contracting farmers.

Kenya is one of the countries targeted by the *Feed The Future* strategy. Contract farming plays a prominent role in the objectives of the program. The 2011-2015 Multi-Year Strategy Document (USAID, 2011a) includes contract farming among the targeted activities for the *Kenya Feed the Future Innovation Engine,* an initiative akin to a venture capital fund for agricultural innovations. In addition, the research project region (Western Province) is one of the two high priority regions identified by Feed the Future (FTF) Kenya, as it offers highly promising opportunities for linking growth and poverty reduction. We are confident that the evidence generated by the proposed research will be informative for the broader FTF effort to "mak[e] agriculture innovative, commercially oriented, and modern" (USAID, 2010).

USAID Kenya has a wealth of interventions that aim to, "link farmers to markets, financing, and other business services" as part of the *Economic Growth and Agriculture* goals (USAID, 2011b). The proposed research will provide valuable lessons for these efforts along several domains, such as the impact of contract farming and its heterogeneity by farmer characteristics, the opportunities for interlinking of product and insurance markets, and the role of ICT in enhancing value chain efficiency. As such we will actively seek inputs from agricultural specialists in the USAID mission on program design, survey measurements, and development indicators, as well as providing regular feedback on program implementation and results. In particular we will discuss project design and present our results at the Tegemeo Institute of Agricultural Policy and Development, a USAID funded research center which provides an excellent venue for interaction with local policy oriented researchers.

We also expect cooperation with USAID at a broader level, through regional initiatives such as the Comprehensive Africa Agriculture Development Program (CAADP) (a partnership with the Common Market for Eastern and Southern Africa (COMESA), the African Union, and The New Partnership for Africa's Development (NEPAD)).

Finally, we emphasize that the IPA Kenya is already collaborating with USAID in the scale-up of cost-effective interventions in the health domain in the target region.

7. Conclusion

The importance of contract farming schemes in the developing world has been increasing over the last few decades. Improving our understanding of how these schemes can achieve their full potential to improve small producers livelihood is thus a particularly timely question. The proposed study --- a collaboration among Kenyan and United States based researchers, one of the largest agribusinesses in East Africa, and an international non-governmental organization with a strong track-record in result dissemination and intervention scale-up --- contributes to this debate.

The interventions will assess: i) the impact of farmer participation in these schemes on farmer well-being, including income, investment, and agricultural technology adoption; ii) the potential of tailored insurance products to raise uptake among smallholders, and iii) the role of modern communication technologies in improving coordination across different links in the agricultural supply chain. By providing rigorous evidence on the above questions, we expect that the evaluation results will achieve widespread diffusion among academics, policymakers, and private sector operators in the agricultural sector.

Appendix A. Project Partners

Maseno University

Maseno University is the leading academic institution in Western Kenya, offering both undergraduate and graduate training (Master, Ph.D.). Members of the research team have already collaborated with academics from Maseno for projects in the public health domain[13]. We see the BASIS grant as an opportunity to expand the collaboration to agricultural research, by involving new researchers with a focus in this area. Alphonce Odondo will play a central role in all the steps of the project, including evaluation design, academic paper writing, and dissemination activities, at both the national and international level. In addition, Innovations for Poverty Action and Maseno University have been collaborating in the organization of policy workshops, the institution of scholarships for graduate students and internships for recent university graduates. The BASIS grant will broaden this cooperation, for instance by providing seed research funds and by having members of the research team advise doctoral students.

Mumias Sugar Company

Mumias Sugar Company is one of the largest agribusiness companies in East Africa. Its contract farming scheme involves around 100,000 smallholders. Over the last five years, members of the research team have been actively collaborating with the company on several projects, such as the analysis of administrative data on land and yield dynamics and the piloting of tailored loan products for the outgrowers designed to reduce the long interval between the time farmers are required to exert effort on their plot and the time they harvest. The company management and field staff are actively involved in the project design and provide inputs in each step of its development. In addition, the company is devoting substantial resources to the proposed interventions. Finally, the large pool of outgrowers contracting with the company provides an important source of scalability for any pilot that

13 Maseno researchers are currently involved in the evaluation of a large scale water-sanitation project in Western Kenya run in partnerhsip with a team of U.S. researchers and with Innovations for Poverty Action Kenya.

will be proved cost-effective by the initial evaluation. We attach to the proposal a letter of cooperation that clearly shows the company support and interest for the proposed outcomes.

Innovations for Poverty Action- Kenya

Innovations for Poverty Action is an international non-governmental organization dedicated to discovering what works to help the world's poor. IPA works in over forty countries around the world. The organization partners with researchers from leading academic institutions for the design and evaluation of development programs. In addition, the organization is committed to replicate and scale-up successful initiatives. In Kenya, IPA has managed several agricultural interventions, focused on fertilizer and index insurance and is supervising the national scale-up of school-deworming and chlorine dispensers. Innovations for Poverty action will coordinate the outreach and dissemination at the national level, targeting local and central government agencies, NGOs and other stakeholders in the agricultural sector, as well as contributing to international outreach efforts.

Stanford Institute for Economic Policy Research (SIEPR)

SIEPR will provide support to the grant administration and the dissemination components of the project. The institute hosts a *policy briefs* series (http://siepr.stanford.edu/pubsarchiveorg/1/br) which has high visibility among academics and practitioners. Among other outputs, we aim to produce at least one such brief, presenting the output of the research in a non-technical language accessible to a broader audience. We expect SIEPR support will substantially benefit the dissemination of the results generated by the project.

Appendix B. Research Project Timeline

We provide an overview of the preliminary timeline for the project. Activities in year 0 (2013) are supported by funding already secured from other donors.

YEAR 0 (2013)	
August	Drafting of new contracts with company agriculture and legal departments
August	Discussions with MSC to revise existing recruitment protocol
September - November	Scouting and identification of potential (new) farmers
September – October	Piloting of the hotline and SMS scheme (with support from Maseno University Student)
October – December	Recruitment of farmers for the hotline and SMS scheme
October – December	Analysis of historical plot level data on yields
YEAR 1 (2014)	
January – February	Course on data management and analysis for partner company
January	Research funding provided to MSC staff research projects on challenges and innovations for sugarcane small holders
January-June	Hiring and research grant for two more Maseno doctoral students
January – March	Development and piloting of survey instrument
April – November	Baseline round of household survey and Listing of farmers
June – December	Randomized enrollment of farmers into the contract farming scheme
October - December	Evaluation of enrollment into the contract farming scheme with support from Maseno University Student
October	Short course on program evaluation at Maseno University for Doctoral Students and Faculty members
October - November	Designing insurance product (with support from Maseno University Student)
November	Provision of master scholarship for one student

November	Beginning small-scale piloting of designed insurance product
December	Conclude Mobile phone interventions
YEAR 2 (2015)	
January – April	Data entry for baseline household survey
January – March	Conclude randomized enrollment into the contract farming scheme
January to March	Conduct Telephone based Mid-line survey
March	IPA course on randomized control trials for policy practitioners and Agriculture Sector
April – May	Short course on field research methodology for masters students from western Kenya
August	Complete first academic paper and policy brief about mobile based interventions
October	Provision of master scholarship for one student
YEAR 3 (2016)	
January	Collect administrative data on insurance take-up
January – February	Development and piloting of survey instrument
March – August	Run comprehensive endline survey
April	Second research grant for partner company staff.
October – December	Data entry for endline survey
December	Complete second academic paper and policy brief about insurance interventions
YEAR 4 (2017)	
January	Collect administrative data tracking all activities in the cycle including yield data
February – May	Kenyan PI to visit US for data analysis and paper writing
February – May	Data analysis and paper writing
August	Complete third academic paper and policy brief on the project
August	Publication of research report for local partners (MSC/KSB/KESREF).

October	Academic workshop presentations at US and local institutions.
November	IPA Policy Conference for 30 attendees from local, national, international organizations.

Appendix C. Benchmarks and Development Impact

The proposed project aims to achieve several goals, going well beyond purely academic outcomes. For each of these goals we discuss quantifiable benchmark that will allow us to assess the project impact.

Program Implementation

- Contract farming enrollment offered to approximately 1,000 farmers (Yr 1 and 2)
- Hotline based query logging system and SMS interactive scheme offered to 8,000 farmers (Yr 1 and 2)
- Development of insurance products tailored for outgrowers (Yr 2)
- Insurance products offered to at least 800 farmers in the pilot stage (Yr 2 and 3)

Evaluation Tools

- Integration of the query-logging system and SMS interactive scheme with the company farmer-level administrative data (Yr 1)
- Administration of comprehensive baseline survey to 2,000 farmers (Yr 1 and 2)
- Data collection on insurance take-up (Yr 2 and 3)
- Administration of comprehensive endline survey to 2,000 farmers (Yr 3)

Collaboration and Capacity Building

- Peer Research Collaboration
    - U.S.-Kenyan research teams actively collaborates to project design and implementations (Yr 1-3)
    - Odondo to visit United States to collaborate to data analysis and paper writing (Yr 3 or 4)
- Academic Capacity Building
    - Short course on program evaluation at Maseno university for doctoral students and faculty members from Western Kenyan universities (Yr 1)
    - Short course on field research methodology for master students from Western Kenyan University (Yr 2)
    - Mentoring and research funding for three graduate students (at least one woman) from Maseno University (Yr 1-3)

    - Provision of two degree scholarships for master students (Yr 2-3)
- Policy Capacity Building
    - IPA course on randomized evaluation for policy practitioners in the agricultural sector (Yr 2)
    - Workshop on contract farming evaluation (Yr 4)
- Partner Capacity Building
    - Course on Data Management and Analysis for partner-company staff (Yr 1)
    - Research funding provided to company staff research projects on challenges and innovations for sugarcane smallholders (Yr 1-3)

Outreach

- Yearly updates delivered to USAID Kenya, USAID Feed the Future and BASIS
- National dissemination conference, co-organized by Maseno and IPA
- Dissemination of project reports and policy briefs to target partners (see appendix E for details)

Academic Deliverables

- At least three academic papers to be submitted to leading economic journals
- Three policy briefs for publication on IPA/JPAL/SIEPR policy brief series

Appendix D. Research Project Outputs

Academic Publications

At least three papers to be submitted to leading economic journals:

a) The impact of contract-farming participation on smallholder welfare, including technology adoption, income, and investment decisions

b) Bundling agricultural insurance and contract farming: impact on farmer take-up and welfare

c) The impact on information communication technologies on agricultural value chain coordination

Policy Publications

We will produce yearly progress reports on the project to disseminate to the USAID mission and other local stakeholders. We will actively seek feedback on the implementation development.

As part of the outreach strategy we will also produce one policy paper summarizing the results of each of the above academic papers. In order to reach a broad policy audience, the presentation will primarily rely on graphical tools and cross-tabulations.

SIEPR and IPA policy briefs series will provides natural venues for the policy papers. Publication in the series will increase their diffusion both domestically and internationally.

Training and Doctoral Theses

As part of the project, five doctoral students at the partner university and the partner company will receive funding for their own research project and mentoring from research team members.

The research projects will form chapters of the granted students' theses and will be submitted to academic journals.

Conference Presentations

We expect to present the results of the research at several venues:

- Workshops at Stanford University, Harvard University, and Maseno University
- Conferences American Economic Association (AEA); American Agricultural Economics Association (AAEA); North East Universities Development Consortium (NEUDC); Pacific Conference for Development Economics; Centre for the Study of African Economies (CSAE); African Association of Agricultural Economists
- Workshops at the World Bank; the International Food Research Institute (IFPRI); the International Fund for Agriculture and Development.
- East Africa agricultural sector stakeholders: Mumias Sugar Company, Financial Sector Deepening, Kenya Agricultural Research Institute, Ministry of Agriculture Kenya, Comprehensive Africa Agricultural Development Programme (CAADP)

Appendix E. Outreach Plan

	Target Partners	**Design Stage**	**Implementation Stage**	**Results Dissemination Stage**
Local	-District Agricultural Commissioners, Division Agricultural Commissioners - Mumias Sugar Company (MSC) - Kenya Sugar Board (KSB) - Kenya Sugar Research Foundation (KESREF)	Meetings with existing local partners and policymakers to discuss pilot findings and new research design. Meetings held at Mumias or regional headquarters in Nyanza Province (KSB/KESREF)	Working group meetings with joint-committee of local partners from MSC/KSB/KESREF to raise industry awareness of the implementation and to share interim results (2 per year) Research bulletins in Maseno University news publications to raise awareness among local academics and policy makers(1 per year)	Publication of research report for local partners (MSC/KSB/KESREF). Results summary to be posted on Maseno University site.
National	-Ministry of Agriculture - Kenya Agricultural Research Institute (KARI) - Agricultural Finance Corporation (AFC) -USAID Kenya -Financial Sector Deepening Kenya -Tegemeo Institute for Agricultural Policy and Development	IPA Kenya to lead national-level discussions with government institutions. Local PI to meet with USAID Kenya mission and develop a joint national dissemination strategy Project design presentations	Annual progress reports distributed to national partners (USAID mission and Kenya partners) to promote interest and raise awareness among national policymakers (1 per year)	National IPA Policy Conference for 30 attendees from local, national and Kenya-based international organizations. Diffusion of digital copy of the official program report to national level stakeholders. Online project summary and findings on USAID mission website.
Regional (East Africa)	Local and international PIs to reach out to existing regional initiatives - mFarmer - Fostering Agricultural Competitiveness Employing Information Communication Technologies (FACET) - Comprehensive Africa Agriculture Development Program (CAADP) - Africa Lead -AGRA	N/A	Progress reports delivered to target partners	-Circulation of official program report and policy briefs
Global	-UN IFAD -Syngenta Foundation	IPA national office and global policy	Progress reports delivered to target partners	-Policy briefs circulated to target partners

	-Rockfeller foundation	group (Washington DC) to develop policy and dissemination plan in collaboration with PIs		-Presentations at selected global target partners
Academic	PI universities: Harvard, Maseno, Stanford	Academic presentations on project design at internal seminars at PI universities	Academic presentations on project preliminary results at internal seminars at PI universities	-Academic conferences -Briefs for SIEPR/IPA/JPAL website -Submission to peer-reviewed journals

Appendix F. Research Qualifications

Lorenzo Casaburi

Lorenzo Casaburi is a doctoral candidate in the Department of Economics at Harvard University and he is expected to begin his appointment as Postdoctoral Fellow at the Stanford Institute for Economic Policy Research (SIEPR) in September 2013. His research focuses on political economy and development economics, with a particular emphasis on agricultural value chains, rural credit markets, and infrastructure in Sub-Saharan Africa. He has run several randomized controlled trials in Kenya and Sierra Leone. He has extensive experience in designing agricultural household surveys. He was Technical Consultant for the Government of Sierra Leone for the implementation the nationwide Agricultural Tracking Survey. His research has been funded by the International Initiative for Impact Evaluation (3ie), the Private Enterprise Development in Low Income Countries (PEDL) initiative, and USAID.

Michael Kremer

Michael Kremer is the Gates Professor of Developing Societies in the Department of Economics at Harvard University. He holds a Ph.D. in Economics from Harvard University. His recent research examines education, health, and agricultural technology adoption in developing countries. He has extensive experience managing randomized evaluations in the developing world and scaling-up successful initiatives, such as school-based deworming and chlorine dispensers to the global level.

Alphonce Odondo

Alphonce Odondo is Assistant Lecturer at Maseno University, where he is currently completing his Ph.D. in Economics. His research focuses on poverty reduction strategies with a particular emphasis on rural poverty and smallholder livelihood strategies. He has extensive experience in the analysis of the agricultural sector in Western Kenya and has published research on bamboo and tobacco smallholder farmers in the region. He has also published on the impact of microfinance on microenterprise performance. He has consulted for the Canadian International Development Research Center (IDRC) and the British Department for International Development (DFID)

John Shoven

John Shoven is Charles R. Schwab Professor of Economics at Stanford and Wallace R. Hawley Director of the Stanford Institute for Economic Policy Research (SIEPR). He specializes in public finance and corporate finance and has published on Social Security, health economics, corporate and personal taxation, mutual funds, pension plans, economic demography and applied general equilibrium economics. Shoven received his Ph.D in Economics from Yale University in 1973.

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Appendix H. Budget Narrative

Year 1
We allocate 110K to salaries and benefits in the first year of the project. This includes 75K for the hire of a qualified local field research team (20 field staff with an average yearly salary and benefits of 3,800USD each), 15K for an international hire to lead the team. In each of the four projects year, we include about 8K for in-country support from IPA management. The remaining funds include salary for local PI and money for a short-term actuarial consultancy during the insurance design phase.

In each year the project will partially contribute Alphonce Odondo's salary (7,500 yr). We do not request any other salary/benefit for other co-PIs. In each year, we budget 2,500 for doctoral students working on the project.

US-based PIs will travel to Kenya in Year 1 of the study. The new international IPA hire (Project Associate) will join the team in the same year. Odondo and/or IPA country management will fly domestically for early stage outreach meetings. International and domestic travel amounts to 7,700USD in the first year of the project.

The training budget in Year 1 includes a 22,500USD Master scholarship for a promising local research staff member to study abroad. In year 1 and 3 we include 9,400USD research funding for a project being undertaken by a staff member of the partner company. In year 1 and 2 we budget $8,800 for in research seed funding Maseno graduate students. There is also 1,500USD for in-house IPA global training for the Project Associate.

Survey and field costs feature in Year 1 of the budget. Two thousand farmers will be surveyed as part of the contract farming intervention and around half of these will be recruited to the partner company contract farming scheme. Of the 85K allocated to survey activities through IPA, 80 percent of these costs are for vehicle hire and transport. The remaining costs relate to research permits, communications, survey printing, data entry, project laptops and other administrative items.

The indirect cost rate on annual direct-expenses (ICR) is 57% for Stanford, 15% for IPA and 10% for Maseno. In addition, Stanford charges a 57% ICR on the first 25K for each of the two subcontracts, both charged in year 1.

Finally, we note that co-funders will bear the majority of the costs for the communication technology interventions in year 0 to 2.

Year 2
We maintain a smaller field team in Year 2 to implement the insurance piloting activities. This includes five field officers who will recruit treatment farmers who are eligible to sign up for insurance products, as well as a local IPA project associate with in-country support from IPA management. The 27,400USD allocated to salaries and benefits also includes an annual salary for the local PI.
International and domestic airfares match those in Year 1 of the study.

The training budget in Year 2 features a second 22,500USD Master scholarship for a local applicant, as well as additional research seed funding and RA salaries for Maseno graduate students valued at

11,200USD.

Supply costs of 3,500USD in Year 2 are allocated for Master student training to be held at Maseno University. Data collection costs of 6,400USD relate to transport costs and some minimal materials costs for the 5-person field team who will be recruiting farmers for the insurance scheme.

In each of year 2-4, we plan to hire a part-time U.S. based undegraduate research assistant. We budget for about $8,700/year for this. We also include additional 9,200 for another research project undetaken by partner company staff

Year 3
In year 3, we will hire again a large field team to complete the endline survey for the randomized evaluation of the enrollment into the contract farming scheme. Amounts and unit costs will be similar to those described for the baseline survey in year 1.

We will also retain the smaller field team in charge of marketing the insurance products and of collecting take-up data. We also budget about $17K to cover implementation costs for the insurance intervention, including partial coverage of the area yield insurance indemnity disbursement.

Year 4
We include $7,500 for Odondo's visit to the U.S. to collaborate on data analysis and writing. We also budget $5,000 for the final project workshop. We add further $5,000 for PI dissemination travel.