



Innovations for Poverty Action
& Ghana Ministry of Food and Agriculture

Research Proposal
for BASIS AMA Collaborative Research Support Program:

**Disseminating Innovative Resources and Technologies to Smallholders
(DIRTS)
in Northern Region, Ghana**

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Total project budget:

USD 2,600,000

Funds requested from AMA CRSP:

USD 700,000

Section A: Abstract

In Ghana's Northern Region, smallholder farmers cultivate rainfed crops, face significant risk of weather shocks, chronically underinvest in input technologies, achieve just a fraction of potential yields, maintain limited liquid savings and may be food insecure. Innovations for Poverty Action (IPA), the International Food Policy Research Institute (IFPRI), the Savannah Agricultural Research Institute (SARI), the University of Development Studies (UDS) and the Ghana Ministry of Food and Agriculture (MoFA) will partner to examine the barriers to smallholder farmer adoption of intensified cultivation practices and risk management tools, and measure the impact of three innovative, potentially scalable programs on farm production and profitability, consumption and food security, intra-household labor allocation, asset holdings and rural household resilience. The Disseminating Innovative Resources and Technologies to Smallholders (DIRTS) project will use the randomized controlled trial methodology to measure the impact of providing assured rural access to (a) improved information flows through Android-based extension applications, (2) improved-yield input technology packages at varying prices, and (3) commercial drought index insurance at varying prices. DIRTS will be implemented by MoFA, and rigorously evaluated by IPA. At the study's conclusion, partners will widely disseminate evaluation results, demand curves, cost-benefit analyses, programmatic tools, policy recommendations and scale-up strategies.

Section B: Narrative: Problem statement

The DIRTS project targets the typical smallholder farmer in northern Ghana who owns less than ten acres of land, cultivates rainfed maize and groundnut, may be food insecure during lean seasons, maintains very limited liquid savings and faces the risk of weather shocks. These smallholder farmers also chronically under-invest in farm technologies, including organic and inorganic fertilizer, high-yield seeds and farming equipment. Recent work by SARI and UDS estimates that farmers in northern Ghana are achieving just 30 percent of potential crop yields¹.

Two sets of study findings on agricultural investment motivate the proposed research project. First, the “Examining Underinvestment in Agriculture” (EUI) project conducted by IPA in northern Ghana since 2008 has shown a dramatic response of farm investment to rainfall index insurance, in the form of increased cultivation, land preparation, chemical input purchases and household labor.² There is strong demand for rainfall index insurance: more than two-thirds of farmers purchased insurance at commercial prices. However, there was no evidence in EUI of corresponding technological transformation, intensification or high returns to these additional investments. In other words, increased investment did not lead to significantly higher farm profits. Second, the ongoing Soil Health Project (SHP), a project managed by SARI and funded by AGRA, has demonstrated that technologies and agricultural practices exist that dramatically increase profits on test plots on farmers’ fields. Specifically, SHP shows that intensified application of both organic and inorganic fertilizer is highly profitable. The DIRTS project combines these two ideas: improving rural access to innovative financial markets in order to provide a less risky environment for farmer investment, while also providing complementary access to extension advice and input technologies with potential to translate investments into improved per-acre production and profits.

Most farmers in northern Ghana apply low levels of inputs per acre (e.g., median fertilizer use of EUI control farmers’ amounts to 25 kg per acre of maize compared to the recommended rate of 150 kg per acre). In response, SHP was designed to test whether agricultural technology intensification can improve yields and profitability in actual farming systems. SHP trained agricultural extension agents to apply intensified technologies to over 120 plots in communities across the Northern Region of Ghana, and compared them to matching plots receiving no intensified treatment. SHP documented extraordinarily high returns in 2010: with recommended care, intensified commercial inorganic fertilizer application on maize earns a net profit of GHS 200.00 (USD \$127.00) per acre (after deducting the costs of the fertilizer and additional labor required for cultivation). Returns to a combination of intensified commercial organic fertilizer and inorganic fertilizer application on maize were even higher, yielding a net profit of approximately GHS 300.00 (USD \$190.00) per acre. Because Ghana’s commercial organic fertilizer industry is nascent, IPA conducted a non-experimental pilot study in 2011 on commercial fertilizer application, and found that farmers were hesitant to adopt the labor-intensive requirements of new commercial organic technologies. DIRTS proposes to provide farmers with assured, timely access to high-quality seeds and inorganic fertilizers, alongside complementary extension information about home production of organic material, including fertilizer and compost.

However, DIRTS takes a unique approach in that it addresses the risk associated with rainfed cultivation in a warming climate, and incorporates risk management tools into the DIRTS program based on

¹ Fosu, Mathias. (2011). AGRA Soil Health Project 2010 Annual Report.

² Karlan, Osei, Osei-Akoto and Udry (2012) “Agricultural Decisions after Relaxing Credit and Risk Constraints”. Manuscript: Yale University.

evidence from another randomized controlled trial. In order to test whether risk aversion and/or capital constraints drive agricultural underinvestment in northern Ghana, IPA's ongoing EUI study provided a random sample of smallholder maize farmers with rainfall index insurance, unconditional capital grants, both insurance and a grant, or neither beginning in 2009. Farmers who received only capital used more inorganic fertilizer, but made no other significant changes to their activities. Meanwhile, farmers with capital and insurance increased their total investment by 16 percent. Insurance made up most of this effect since farmers with insurance alone increased total farm expenditure by 13 percent. Insured farmers were also found to have increased inorganic fertilizer use by 25 percent, cultivation area by 8 percent, expenditures on land preparation by 12 percent (mostly due to increased cultivation area) and total labor use on plots by 13 percent. Farmers with insurance also harvested more: their output increased by 8 percent. This was enough to cover additional purchased inputs, but not enough to cover the costs of the additional labor used. For most EUI farmers, the slight increase in output led to a small amount of extra cash and increased food security in the form of grain stocks, rather than significant gains in farm profitability. In sum, farmers with access to insurance strongly increased investment, but they earned only minimal returns on these investments; much lower returns than those the SHP have shown are feasible using much more intensive cultivation methods.

DIRTS seeks to understand the barriers that stood between these farmers and more profitable investments. This question is at the heart of the first strategic objective of the USAID Ghana mission, which is to “increase agricultural production, employment opportunities and income levels for poor Ghanaians.” This collaboration between MoFA and a set of Ghanaian and international research institutions contributes as well to the fourth strategic objective, being to “strengthen the capacity of Ghana's local governance institutions to plan for development, increase revenue, and seek input and respond to citizen needs concerning the delivery of services”.

In a country so dependent on agricultural production, it is imperative to understand economic barriers to smallholder input intensification, and higher agricultural production, farm employment income, and household consumption and resilience. DIRTS hypothesizes that insurance allows smallholder farmers to increase farm investment, and that complementary extension services and input technology access will permit these farmers to adopt intensified cultivation practices and thus to improve production and per-acre profitability. DIRTS takes special care to involve local institutions—the government institution, MoFA, the academic institution UDS, and the research institution SARI—in the program, in order to build capacity for local institutions to continue implementing effective programs. DIRTS is also designed as a randomized controlled trial and collects quantitative and qualitative data from beneficiaries to gain a granular understanding of program reach, areas for improvement and impact.

Section C: Narrative: Insurance, extension and input technology program implementation

EUI results show that farmers with insurance have failed to realize profitable returns despite increased investment, while SHP results indicate that fertilizer technologies have the potential to be profitable in farming systems when combined with recommended agronomic practices. DIRTS combines the financial market innovations developed through EUI with intensified agricultural extension and input supply innovations to test which of these three barriers – alone or in combination – are most salient in determining the patterns of adoption of intensive cultivation technologies. The study will be implemented at the community level and will include communities that received EUI or SHP treatments in previous years.

Through a comprehensive survey of 3,200 households, DIRTS will provide an integrated examination of three barriers to the adoption of apparently highly profitable fertilizer/seed technology by smallholders in Ghana. First, to test the importance of imperfect farmer knowledge of farming best practices, randomly selected communities will be provided with more intensive extension through a Community Extension Agent (CEA), a community member who will be trained to use Android phone extension applications as a supplement to existing MoFA extension services. Second, to test the importance of unsure, untimely and costly access to appropriate inputs, DIRTS will make commercial inorganic fertilizer and improved seed available just prior to land preparation at varying prices in a community. Third, farmers will be able to purchase a commercial rainfall index insurance product, developed by the Ghana Insurers Association (GIA) and sanctioned by the National Insurance Commission, at individually-varying prices. These individual treatments are interacted as described below. This design will allow study investigators to identify specific barriers that stand between insured farmers and increased productivity.

Input treatment design: Prior to land preparation, randomly selected communities will receive an opportunity to purchase commercial inorganic fertilizers and improved maize seed that will be delivered to farmers by SARI ahead of planting time. It was observed during the ATAI-funded pilot of this study that farmers who received fertilizer preferred to invest in the combination of inorganic fertilizer and Obatampa seeds, an improved-yield, open-pollinated, local variety of maize seed. SARI demonstrated during the IPA pilot their capacity to procure and deliver both fertilizers and seeds on schedule. Inputs will be sold at varying prices, randomized at the community level—at two initially low prices, and at increased prices during the second year—to allow investigators to establish a viable demand curve for commercial input technologies and to provide insight into the profit potential for value chain actors in the region. At harvest of the first year of the study, when most farmers have cash on hand, farmers will have the option to purchase vouchers for commercial inorganic fertilizer, to be redeemed at the time of land preparation the following year.

Extension treatment design: Communities receiving the intensive monitoring and extension treatment will be visited for interactive, group-level trainings on farming best practices conducted by MoFA-employed agricultural extension agents (AEAs). This is the standard practice of communities receiving extension services from MoFA. In addition, IPA, MoFA and SARI will train Community Extension Agents (CEA) to supplement AEA training sessions and farmer monitoring responsibilities in these communities, based on the “Community Knowledge Worker” model currently being implemented by the Grameen Foundation and evaluated by IPA in Uganda. Residents of the community, CEAs will be compensated per farmer interaction. CEAs will visit randomly selected farmers weekly to provide

supplementary assistance or trainings on field selection, land clearing and preparation, creation and application of organic matter, seed varieties, planting methodology, application of organic and inorganic fertilizers, weeding and field maintenance. Together, the AEAs and CEAs will provide a full package of training, including advice on optimal timing of key farming activities in the growing season. AEAs, CEAs and MoFA and DIRTS staff will also be fully connected by an innovative, two-way messaging application using both SMS and data channels.

Insurance treatment design: Outside pure control communities, farmers will have the opportunity to purchase rainfall index insurance at individually-randomized prices. This is a commercially viable drought index insurance product, designed by the Ghana Agricultural Insurance Programme (GAIP) with input from IPA, which is managed by the Ghana Insurers Association and customized to meet the demands of maize farmers in the northern Ghana. EUI results have shown that demand for rainfall index insurance is high in northern Ghana. During the 2011 farming season, demand ranged from 37 percent (for a 50 percent mark-up in communities that had not received a payout in 2010) to 93 percent (for a 50 percent mark-down in communities that had received a payout in 2010). The insurance product will be offered to all farmers living in randomly selected DIRTS communities, at either a fair-market or subsidized premium, and will be available for purchase at an individual level. Randomly varying the premium will allow investigators to further demonstrate the robustness of the insurance demand curve and explore how insurance price and take-up interacts with other treatment. The design will also allow investigators to measure the role of social networking in take-up.

Section D: Narrative: Study design, sample size, price variations and estimated take-up

A total of 3,200 households in 160 communities will be randomized into one of four treatment groups: (1) 1,000 control households; (2) 1,000 household receiving insurance and intensified extension through CEAs; (3) 600 households receiving insurance and inputs; and (4) 600 households receiving insurance, intensified extension, and inputs.

Within non-control communities, insurance costs are individually randomized. The actuarially fair price will be determined in the coming months according to product parameters set by the Ghana Agricultural Insurance Programme. The finalized commercial product will be marketed to the community as a group, and will also be available at a fair-market price to all non-sample farmers within the community. Based on past EUI studies, demand will vary significantly based on the product's premium and on farmers' past experience with insurance and payouts (if any).

The most challenging inference the project faces is estimating the impact of the adoption of intensified cultivation practices on farmer profits. We simplify for the next few sentences by assuming that adoption of intensified cultivation is a binary choice. If 70 percent of farmers in group (4) adopt intensified cultivation at the low fertilizer price, and 40 percent adopt at the higher fertilizer price, then our EUI data on the within-village covariance of profits implies that DIRTS has power of 90 percent at a significance level of .05 to detect an increase in profits of the magnitude documented in Fosu (2011) in the first year of the study, using groups (1) and (4) only. In other words, we hope that approximately 660 out of 1,200 households receiving the offer for an input package will opt to purchase. For the purposes of this proposal, we have estimated demand at three acres' worth of inputs per household, when applied according to SARI recommended dosages.

In an effort to reach the level of take-up necessary to detect the effects of the package in our sample—and to test the effect of limited value chain reach and high transportation cost on input demand—we will subsidize marketing and delivery costs and vary the prices of fertilizer and seeds to be competitive with market prices. We assume the government will continue to increase the price of inorganic fertilizer by reducing the national subsidy. For the purposes of the budget, we have assumed that the cost per bag will increase to approximately GHS 33.00 (USD 21.00) in 2013. This will make SARI's recommended inorganic-only recommended dosage per acre—two and one-half bags—cost approximately GHS 82.50 (USD 55.00). Based on these assumptions, we expect to offer inorganic fertilizer at GHS 15.00 (below-government-subsidized price) and GHS 21.00 (government-subsidized price) per bag in the first year. Prices will be increased in the second year. Varying prices will allow us to construct a demand curve for fertilizer when access is assured and transportation is inexpensive, a valuable test for private value chain actors and government subsidy decisionmakers.

To restate, inorganic fertilizer will be offered at the estimated government price, approximately GHS 33.00 (USD 22.00) per bag. Obatampa seeds will be offered at a fair-market price only, at approximately GHS 20.00 (USD 13.00) per acre, based on farmer willingness to pay demonstrated during the pilot. Input package prices will be randomized at the community level.

Section E: Narrative: Research themes

DIRTS is focused on three major obstacles to increased profitability amongst subsistence farmers in sub-Saharan Africa: excessive risk; input availability and cost; and lack of knowledge.³⁴⁵ The proposed study seeks to illuminate each of these constraints, and, crucially, the interaction of these constraints, on a large, random sample of smallholder farmers in Northern Ghana. The first evaluation question, therefore, is the effect of (a) access to insurance; (b) improved input supply; and (c) intensified extension—alone and in combination—on the adoption of intensified cultivation. The second set of questions is the impact of this improved technology on farmer profits, welfare, finances, and household organization. There are a number of specific issues of particular interest to development scholars which arise in the context of addressing these core evaluation questions. Among the more important of these are:

- **Risk management:** Will insured smallholder farmers change farm investment decisions like they did in EUI? Does insured risk increase adoption of recommended cultivation practices and demand for input technologies? Should risk management tools, especially financial ones, be offered in combination with products or services designed to improve agricultural production?
- **Land tenure:** How do perceptions about tenure rights affect adoption of intensified agriculture? How does this interact with plot allocation within the household, given women's less secure rights over plots?
- **Learning:** What are the spillovers from intensified extension and experience with the new technology to farmers not directly reached? This can be estimated given our data on social connections across communities.
- **Labor markets:** How is demand for gender-specific labor influenced by adoption of intensified cultivation? Are farmers constrained by lack of labor? What is the opportunity cost of using additional family labor on intensively-cultivated plots (e.g., rather than on non-farm activities)?
- **Savings and dynamic incentives:** Does illiquidity amplify the importance of imperfect insurance? When do farmers have liquid assets? How does a commitment to purchase at harvest influence demand for inputs?
- **Gender dynamics:** What role do women play in managing inter-cropping activities on otherwise male-managed plots (many women specialize in cultivating specific crops intercropped on men's plots)? How does effective inter-cropping impact household welfare and consumption, and how is the extent of this intercropping affected by the adoption of more intensive cultivation practices? Finally, are women poised to take on the role of Community Extension Agent?

³ Conley, Timothy G., and Christopher Udry. (2010). "Learning about a New Technology: Pineapple in Ghana," *American Economic Review*, 100(1): 35-69.

⁴ Duflo, Esther, Michael Kremer, and Jonathan Robinson. (2008). "How High Are Rates of Return to Fertilizer? Evidence from Field Experiments in Kenya," *American Economic Review: Papers and Proceedings*, 98(2): 482-488.

⁵ Duflo, Esther, Michael Kremer, and Jonathan Robinson. (2009). "Nudging Farmers to Use Fertilizer: Theory and Experimental Evidence from Kenya," NBER Working Paper No. 15131, forthcoming *American Economic Review*. <http://www.nber.org/papers/w15131>.

Section F: Anticipated outputs: impact evaluation results, programmatic tools, dissemination activities

Anticipated outputs of DIRTS, designed as a randomized controlled trial evaluation of three innovative solutions to agricultural underinvestment and low productivity and profitability in Ghana's Northern Region, are threefold: (1) randomized controlled trial evaluation of the agricultural and socioeconomic impacts of the proposed solutions; (2) development, implementation, monitoring and refinement of programmatic protocols, trainings and tools; and (3) development of resources for cross-sector stakeholders, including cost-benefit analyses, demand curves, policy recommendations, replication opportunities, and strategies for scale and/or privatization.

Evaluation: IPA's core competence is designing and conducting rigorous impact evaluations using the randomized controlled trial (RCT) methodology. DIRTS will be evaluated using the RCT methodology. Six evaluation tools will be used to study DIRTS households: comprehensive annual surveys of all 3,200 households; weekly farm input surveys of a randomly selected subset; weekly observation visits to fields of a randomly selected subset; random audits of all aforementioned surveys; GPS measurement of all farms; and agronomic crop cuttings and soil analysis of a randomly selected subset. Qualitative instruments, such as focus group discussion guides, will also be developed during the project's course.

Because household labor valuation is critical to estimating profitability, and because labor diaries and close substitutes tested during the pilot have not been fully effective, DIRTS will address the persistent issue of recall bias in measuring labor allocation through a CEA-style model, training and employing locally-embedded Community Survey Assistants (CSAs) to collect labor data on a weekly basis over the course of the agricultural season. These data are relatively less socially sensitive, but is psychologically unregistered and therefore difficult to collect retrospectively. Like CEAs, CSAs are community residents who are compensated per interview and supervised by IPA enumerators. In intensive extension communities, CEAs will play the role of CSAs.

These data collection methods and the study's research design will allow study investigators to collect high-quality data and to identify specific barriers that stand between insured farmers and increased productivity.

Dissemination products and activities: Results from this study will be particularly interesting to agricultural policymakers, insurance regulators, private agricultural input sellers and insurance companies, academic researchers, and not-for-profits. Through the DIRTS study's combination of continuous surveying, monitoring and fieldwork, we will be able to make evidence-based recommendations on policy or intervention scale-ups at the end of the two-year study. Specifically, DIRTS will generate:

- Bi-weekly meetings between implementation and evaluation teams, and bi-monthly meetings or dialogues between DIRTS teams, policymakers and other stakeholders
- Annual budgets and activity/accomplishment reports based on administrative data and field trips
- Annual review conferences/results monitoring dissemination workshops
- Regular capacity building and trainings for MoFA M&E leaders and extension agents
- Research collaboration with local investigators at UDS and SARI
- Cost-benefit analyses, both financial and socioeconomic, at study's conclusion

- Annually refined demand curves for drought index insurance and input technologies
- Evidence regarding social learning and the diffusion/adoption of new technologies
- Academic paper evaluating program impact after study's conclusion
- Policy memoranda (e.g. on government subsidies and extension programs), updated as new evidence comes in
- Replication opportunities at study's conclusion
- Strategies for potential scale and/or privatization at study's conclusion
- Technical tools, resources and content for sharing throughout implementation work

In-country project staff will regularly conduct meetings and host workshops and conference with key stakeholders in the insurance and agricultural sectors to disseminate technical knowledge and tools, evaluation findings and policy or scale recommendations.

Principal Investigators will write field trip reports, design and implement a data analysis plan, collaborate to produce an academic journal article and policy memoranda, and disseminate reports and findings to audiences in both academic and non-academic settings. They will also participate in the BASIS Technical Committee.

Programmatic tools: One of DIRTS' most valuable aspects is each of the three programs' potential to be scaled—certainly by a government or nonprofit institution, but also by private value chain actors. After DIRTS investigators have measured program impact, IPA and partners will be in a position to advise local institutions on implementing scaled versions of the insurance, extension and/or input technology programs. This might include by sharing information about program protocols, training materials, monitoring and evaluation tools, budgets and phone applications.

The Ministry of Food and Agriculture in particular are committed to scaling the electronic extension program provided the benefits outweigh programmatic costs. IPA will make all high-quality extension content developed during DIRTS publicly available.

Section G: Anticipated impacts: local research collaboration and capacity building, policy recommendations, scale-up strategies

Roughly half the 25,000,000 people living in Ghana are formally or informally engaged in agriculture, and agriculture accounts for over 30 percent of the country's GDP.⁶ DIRTS partners have the opportunity to influence agricultural and financial research, policymaking and privatization on a national level in Ghana. DIRTS will shed light on the costs, benefits, policy implications and potential scalability of innovative policies and programs designed to alleviate risk, imperfect agricultural markets and agricultural knowledge gaps as roadblocks to smallholder agricultural profitability. Information collected on the demand for index insurance, extension information and input technologies—as well as the impact on profitability of each—will also help to inform the potential of privatization and/or scale. Evaluation of the Community Extension Agent program will provide important information to MoFA and private agricultural schemes on the value of efforts to expand the reach of agricultural extension services.

Policy recommendations and program scale-up strategies: At the end of the study, DIRTS will be in a position to advise local institutions on whether (variations on) the insurance, extension and/or input technology programs would be more successful under different policy environments and/or are good candidates for scale. The Ministry of Food and Agriculture is especially positioned to advocate for policy change or program scale, considering its responsibility to administer both the national extension and fertilizer subsidy programs. The Ghana Agricultural Insurance Programme also currently engages IPA as an incubation site for potential marketing models, and non-insurance value chain actors may also decide to test whether offering effective insurance, extension or input technology programs is likely to improve customer agronomic outcomes and their own bottom lines.

For insurance: Take, as an example, IPA's experience marketing insurance to farmers through its ongoing EUI study. In 2009 and 2010, investigators sought to test risk as a constraint to farm investment; finding that agricultural insurance was not commercially available, IPA became the first institution to market a rainfall index insurance product in Ghana. IPA made continual efforts to disseminate information about demand curves, marketing protocols and program impact, helping fuel an initiative to launch a commercial agricultural insurance industry in Ghana. In 2011 and 2012, IPA Ghana formally partnered with the newly-formed Ghana Agricultural Insurance Programme, the Ghana Insurers Association and GIZ with the intention of influencing insurance industry regulations through research. Consequently, when the Ghana Agricultural Insurance Programme (GAIP) launched their first-ever pilot drought index insurance product to banks intended to cover aggregate loan portfolios, GAIP asked IPA to market the product directly to EUI farmers. Through this partnership, IPA has continued to provide information to stakeholders on product performance, basis risk, farmer behavior and demand for a commercially viable product. IPA, GAIP, GIA and GIZ intend to continue the partnership as part of DIRTS, so IPA can continue to act as an incubation site for scale-up models and to provide further information on agricultural microinsurance demand and need for subsidy in Ghana.

For input technologies: Farmers may have difficulty procuring inputs for several reasons, including lack of liquid savings, lack of rural infrastructure and access to value chain input suppliers, and government delays on input subsidy announcements. The proposed study invests in and measures the impact of a

⁶ Ghana Ministry of Food and Agriculture Statistics, Research and Information Directorate. (2011). *Agriculture in Ghana: Facts and Figures*. Retrieved from <http://mofa.gov.gh/site/wp-content/uploads/2011/10/AGRICULTURE-IN-GHANA-FF-2010.pdf>.

well-functioning value chain by marketing and delivering inputs directly to communities, which may be far from roads and input suppliers, at the appropriate time (i.e. regardless of subsidy announcement timing). As a result, DIRTS will be in a position to disseminate information about input demand, cost-effectiveness and commercial viability to suppliers and distribution channels.

For extension services: DIRTS will also provide information on agricultural knowledge gaps as a roadblock to intensified cultivation practices and improved production and profitability. In the case that extension services significantly improve farm production, MoFA will be well-positioned to continue building high-quality content and to test scale-up of the CEA program, through its own institution or potentially through a privatized model in partnership with the Grameen Foundation AppLab⁷.

Local research support and capacity building: By working with researchers like Dr. Mathias Fosu at SARI and Dr. Saa Dittoh at UDS, DIRTS encourages local researchers who are embedded in academic and government institutions to incorporate evidence-based design and technical tools into their own programs. IPA also builds capacity in SARI, UDS and the Ministry of Food and Agriculture to incorporate monitoring and evaluation components into programs.

⁷ Grameen Foundation AppLab. (2011). *Grameen foundation applab - community knowledge worker*. Retrieved from <http://www.grameenfoundation.applab.org/ckw/section/index>.

Section H: Principal investigators

Please see supporting documentation for the Curricula Vitae of Principal Investigators on DIRTS:

- Saa Dittoh PhD, Agricultural Economics Lecturer, University of Development Studies (Ghana)
- Mathias Fosu, Senior Research Scientist, Savannah Agricultural Research Institute (Ghana)
- Dean Karlan, Professor of Economics, Yale University
- Shashidhara Kolavalli, Senior Research Fellow, International Food Policy Research Institute
- Christopher Udry PhD, Henry J. Heinz II Professor of Economics, Yale University

Principal investigators on the project each have significant research and fieldwork experience in agriculture and/or development economics in Ghana. Christopher Udry PhD and Dean Karlan PhD, development economists from Yale University's Department of Economics, have run randomized controlled trials through IPA in Ghana since 2008 in the fields of agriculture, savings, health and microfinance. Udry has conducted extensive field research in West Africa on technological change in agriculture, the use of financial markets, asset accumulation and gift exchange to cope with risk, gender relations and the structure of household economies, property rights and a variety of other aspects of rural economic organization. Karlan is also President and Founder of IPA, and has focused his research on microeconomic issues of public policies and poverty. Mathias Fosu PhD is a Senior Research Scientist at the government Savannah Agricultural Research Institute, and has run dozens of field experiments on agricultural technologies in the Northern Region, including on new fertilizer and seed technologies as part of the Alliance for a Green Revolution in Africa's Soil Health Project. Saa Dittoh PhD is an agricultural economics lecturer at the University of Development Studies campus in Tamale, and is an expert in food security, sustainable natural resource management and value chain analysis, among other areas. Shashidhara Kolavalli PhD has worked for the International Food Policy Research Institute in Ghana since 2006, and has focused his work on growth strategies, the role of governments in private sector-led development, institutional development and governance. Together, the Principal Investigators are well-equipped to design, monitor and evaluate implementation programs with potential for scale in the private or government sector; to collect, audit and analyze high-quality data; and to combine learnings from qualitative field visits, operational pilots, quantitative data analysis and ongoing partner dialogues into academic papers, policy recommendations and scale-up recommendations.

Section I: Implementation and evaluation teams

Innovations for Poverty Action (IPA) Ghana has worked closely with local partners to design the proposed DIRTS study. Both the implementation and evaluation components of DIRTS were designed collaboratively by Principal Investigators Christopher Udry PhD and Dean Karlan PhD of Yale University, and Co-investigators Mathias Fosu PhD of SARI, Saa Dittoh PhD of UDS, and Shashidhara Kolavalli PhD of IFPRI. Study design was also informed by the expertise of Joseph Faalong, Regional Director for MoFA's Northern Region office.

Evaluation team: IPA will hire in-country project staff to design and conduct the evaluation component and support and monitor the implementation component. For the evaluation, a Senior Project Associate will manage research design, survey design and programming, data quality protocols and data analysis. The local hire Project Manager for evaluation will manage all aspects of evaluation fieldwork, including hiring, training and monitoring field staff to ensure data quality. The Implementation Coordinator will work with external implementation partners and the IPA evaluation staff to ensure implementation activities adhere to research design, and to monitor and evaluate implementation activities. The local hire Project Manager for implementation will support the IC with partners and fieldwork monitoring. The IPA project staff will be supported by IPA support staff in Ghana and the US. From Ghana, the project team will have management support from a Country Director and Deputy Country Director; research support from a Research Cluster Manager and a Survey Coordinator; and project management support from operations, finance and IT teams. The project staff will also be supported by US-based IPA staff, including by Dean Karlan's Research Manager, and by headquarter's grants, finance, IT and research support teams.

Implementation teams: IPA's implementation staff will work directly with the local institutions implementing the project. The National Insurance Commission will sanction marketing insurance in partnership with the Ghana Agricultural Insurance Programme and Ghana Insurers Association. MoFA and SARI, with the support of IPA, will implement the input and extension components of the study, including procurement and delivery of inputs, management of the Community Extension Agent program, and laboratory analysis of soil samples, as well as monitoring and oversight of these activities. The Ministry of Food and Agriculture will lend Agricultural Extension Agents (AEAs) to support and supervise the Community Extension Agent program. Experts from many sectors, including academia and the government, will participate in content development workshops to collaboratively produce high-quality extension content.

By leveraging local, cross-sector expertise and by working through existing institutions, the DIRTS study is in position to make a lasting impact on financial and agricultural policymaking in Ghana, and potentially to inform sustainable program scale-up through existing value chains. While the evaluation component aims to answer economic research questions about agricultural investment, technology adoption, risk and knowledge gaps, investigators will also be positioned to examine the scalability and sustainability of the interventions as implemented by local institutions.

Section J: Proposed budget and cost-share information

Please see supporting documentation for a detailed, by-institution breakdown of the DIRTS budget.

It is proposed that CRSP fund USD 700,000 of the total USD 2,300,000 budget, to cover the community-based extension and survey programs, an international conference on risk and agriculture, and a full-time data associate.

The DIRTS study will take place over two years, from January 2013 through December 2014. It is proposed that donors, in the interest of making progress on long-standing questions about agricultural investment and profitability and smallholder socioeconomic well-being in Ghana, fund the full cost of the DIRTS project, roughly USD 2,300,000 including implementation and evaluation costs. IPA and DIRTS implementation partners will write regular observational operations reports in order to inform future scale-up of any successful implementation program, and will widely disseminate study findings, policy recommendations and useful tools to policymakers, ministry officials, implementers, the private sector, donors and researchers and other critical stakeholders.

Evaluation funding: DIRTS has been awarded year-one evaluation funding of USD 380,000 from the Agricultural Technology Adoption Initiative (ATAI) at MIT. ATAI also awarded IPA funding in 2011 to conduct a pilot study on the input technology component. Year-two evaluation funding proposals are under consideration at several institutions.

Implementation funding: DIRTS was awarded funding from the local IFAD-funded Northern Rural Growth Programme in order to pilot the Community Extension Agent program in 2012. Currently, IPA, SARI and MoFA are seeking additional implementation funding from the Alliance for a Green Revolution in Africa (AGRA), the funder of the ongoing Soil Health Project, as well as from the United States Agency for International Development (USAID), the Rockefeller Foundation, the Ford Foundation and several large Ghana-based initiatives. The commercial insurance product marketed to farmers will again be reinsured by an international reinsurer, Swiss Re, in close partnership with the Ghana Insurers Association (GIA) and the German Society for International Cooperation (GIZ).

Past funding: IPA's ongoing "Examining Underinvestment in Agriculture" (EUI) study is funded by a Gates Foundation sub-award from the University of Chicago, the International Labour Organisation (ILO), the International Growth Center (IGC) at the London School of Economics, the German International Cooperation (GIZ) and anonymous donors. IPA's research cluster in Ghana is also funded in part by BASIS and anonymous donors.