REPORT

MCC Ghana Impact Evaluation Services

Evaluation Design Report

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TABLE OF CONTENTS

A. INTRODUCTION

MCC has contracted with NORC to assess the impact of up to five activities under the MCC Program in Ghana using the most rigorous methods possible. These activities include:

1. Agriculture Project, Post-Harvest Activity and Community Services Project, Electrification Sub-Activity
2. Agriculture Project, Irrigation Activity
3. Agriculture Project, Credit Activity
4. Rural Development Project, Community Services Activity, Education Sub-Activity
5. Rural Development Project, Financial Services

NORC noted in its proposal that there are several challenges that the evaluations of these activities must address at the outset. All the activities and sub-activities are already underway and at different stages of implementation; all of them must be completed by February 2012, when the MCC Compact with Ghana ends. Impact evaluation designs were not built into the implementation of the activities from their inception and, as such, rigorous impact evaluations with statistically valid control groups and unbiased impact estimates are difficult to achieve. Some projects, such as the Credit Activity, encountered implementation problems and, as such, did not progress as planned to the point where a measurable impact outcome could be detected. Finally, no baseline data was collected for the explicit purpose of evaluating these projects, although some data that may be of value to the impact evaluation exists.

In light of these challenges, in Phase 1 of this evaluation, the NORC team focused on understanding the specifics of each projects to determine how each activity can best be evaluated. Our objective at the outset is to design as rigorous an evaluation as possible, given project implementation realities and available baseline data. Towards this end, we undertook three information-gathering tasks:

- Review of background information for each of the six activities, including objectives, implementation details, background review of relevant geographical areas and economic sectors, as well as some baseline data that was available.
- Meetings with relevant staff from MCC, who provided additional details about the six interventions.
- A two-week trip to Ghana by key members of the NORC team in November 2011 to meet with MCC, MiDA, supervising and implementing agencies, and other stakeholders to gather critical information on project implementation and coverage, and data to inform decisions regarding evaluation designs. During this trip, NORC staff met with:
    - MiDA program staff and implementing/coordinating agencies for the six activities to gather information about the implementation status for each activity/sub-activity, discuss implications of the impact evaluation for project implementation, and discuss feasible options for identifying comparison groups for each intervention;
    - Entities responsible for the collection of data that were identified as useful baseline for the evaluation to discuss available data, data quality and data gaps, and explore

options for gaining access to the datasets. These organizations included ISSER for the GLSS5+ and FBO survey; Ghana Statistical Services (GSS) for the 2010 Census, and the Ministry of Education for EMIS data. Additionally, we had been in contact with UNICEF and Innovations of Poverty Action to explore access to data through them.

- Apex Bank to discuss options for gathering data from rural banks within the Confidentiality Regulations.
- Potential direct beneficiaries of several post-harvest and irrigation activities, such as anchor farmers, SPEG, and FBOs' members, rural bank automation, and the school construction sub-activity

Based on information gathered during Phase I activities, as well as a preliminary review and analysis of available datasets, we present below our proposed evaluation designs and potential data sources for the six activities/sub-activities.

B. PROPOSED EVALUATION DESIGNS

In this section, we discuss each of the MiDA activities and sub-activities separately. For each activity/sub-activity, we present the following:

- Background information about the intervention
- Key evaluation hypotheses and impact indicators
- Data sources
- Proposed Evaluation Methodologies, associated risk factors
- Key considerations

B.1 Agriculture Project: Post Harvest Activity

The Post-Harvest Activity aims to provide infrastructure – coolers, pack houses, agribusiness centers, and a Perishable Cargo Centre at the Accra airport – to producers and other actors in the value chains for horticultural exports and grains for local markets. These facilities will help maintain the quality of these agricultural products from the farms to their markets.

Post-harvest infrastructure, supported by adequate power sources, can affect the incomes of farmers, exporters, and other actors in the respective value chains by providing storage for farm products; reducing post-harvest losses of fruits, vegetables, and grain crops; and improving their quality at the time of arrival at their markets. These investments can thereby increase market prices and/or open or ease access into new markets (export markets, for example) for these agricultural products.

Based on our assessment of the post-harvest infrastructure activities and their close link with electricity, we have determined that it is logical to evaluate the two MiDA activities as a package. All the new post-harvest facilities that were constructed (public pack houses and agribusiness centers) required electricity investments, as did those improvements to SPEG pack houses where new cooling facilities were installed. Therefore, we are not proposing a separate evaluation of the electricity component of the MiDA Program.

B1.1 Agribusiness Centers

Background Information

The Millennium Development Authority (MiDA) is presently financing the construction of ten Agribusiness Centers (ABCs) that will provide services for the initial processing, storage, and marketing of grain crops produced by farmer-based organizations (FBOs) within their respective intervention areas. Each ABC will be outfitted with specialized equipment for processing either rice or maize, although its complement of installed equipment can later be modified for processing other grain crops, such as soybeans, as their operations expand. The initial crop that was selected for processing at the respective ABCs is based on the prevalent crop that is grown in the area. Each ABC is designed to store approximately 1,000 tons of grain and will serve as a grain processing and marketing center for FBO members located in the vicinity of the center, within a radius of approximately 20 kilometers. All ten ABCs are presently under construction, with their expected completion between December 2011 and January 2012. Initially, MiDA had planned to fund the construction of sixteen ABCs but budget constraints limited the number of facilities to only ten.

The ABCs will provide for-fee grain processing services including maize shelling or paddy rice de-husking and de-stoning, along with grain drying, cleaning, sorting, selecting, bagging, palletizing, and storing. If desired, the ABCs will market the grain inventory stored on behalf of its FBO clients; otherwise, the ABC will store the grain securely until it is sold directly by the client. In addition to grain processing, storage, and marketing services, the ABCs will sell inputs to its FBO members, including improved seed, fertilizer, and farm chemicals. It will also provide tractor services to small farmers who are members of its affiliated FBOs, to help them prepare their land for planting.

The ABCs will be privately-owned, privately-operated, profit-making service organizations. Each facility will be jointly owned by a private entrepreneur, known as a “lead investor”, along with twenty farmer-based organizations, each of which has a membership of approximately 50 members.[1] Each ABC will be managed by the respective lead investor, who was selected by MiDA through a competitive bidding process, and will own 70 percent of the ABC.

The ABCs are generally located within those areas where there are heavy concentrations of grain production. The lead investors have been instrumental in deciding the specific location of the respective ABC within the grain producing areas, and most are located along main roads with a nearby supply of electric power and water.

MiDA delegated the section of FBO partners at each ABC to its regional implementation consultants (RICs). Once the location of the ABC was decided, the RIC drew an imaginary circle with a 20-kilometer radius around the location, and all the FBOs within the defined area that had been registered and trained under the MiDA program became candidates for membership in the ABC. The RIC then invited these FBO leaders to an executive session to discuss the possibility of creating a FBO Union that would participate in the proposed ABC. Through this orientation process the FBO leaders became sensitized to the potential benefits of cultivating the selected crops and marketing them through the ABCs. Additional meetings and follow-up resulted in the

[1] Note that more than one member of a farmer household may belong to an FBO. This means that an FBO member does not necessarily represent one farm or one rural household.

creation of an FBO Union composed of 20 FBOs with approximately 1000 members that would become co-owner of the respective ABC. After the initial FBO selection took place, there was a second round of fine-tuning for the participants to reach the final composition of the FBO Union. Some FBO members decided not to participate in the venture, and in a few instances, FBOs with extremely poor credit repayment records were rejected. The rejection was conducted on a case-by-case basis, based on a subjective assessment by the MiDA staff on the past credit payment performance of the FBO.

Evaluation Hypotheses and Impact Indicators

Like other MIDA post-harvest infrastructure investments, ABCs aim to increase the livelihood of small farmers. This intervention in particular was designed to resolve three major issues that affect commercial agricultural production by small farmers: 1) deficient handling, processing and storage of agricultural products after harvest, 2) weak marketing systems that results in below-market prices for commodities produced by small farmers, and 3) lack of reliable agricultural input supplies and farm equipment services commercially available to small farmers.

The hypothesis is that solving the above problems should translate into 1) a reduction of post-harvest losses, 2) better market prices, and 3) higher crop yields. All this in turn increases total production, total profits and therefore farmers' income from crop harvest.

There are several indicators that can be used to measure the impact of the ABCs on the wellbeing and productivity of small farmers. They include the following:

1. Total annual household income.
2. Total annual farmer revenue from maize and rice production
3. Annual sales volume (in kilograms, for example) of the targeted crops per household.
4. Percentage post-harvest losses for the targeted crops
5. Crop yield – net amount of grain produced per unit area (e.g., kilograms of maize or rice produced per hectare)

Additionally, other intermediate outcomes can be measured in order to understand intermediate impacts. These could be use of fertilizers, insecticide, fungicide, and other production inputs and unit prices for the crops.

Without additional assumptions, for which there is no data-based evidence, there is no reason to think that this intervention should have differential effects by sex or age of the farmer. Thus, we do not recommend separating effects by gender or age.

Evaluation Methodology

As stated in NORC's original proposal, we propose to use a double-difference estimator with matching or covariate controls as appropriate, or a combined regression analysis/matching approach to assess changes in farmers income, production, crop revenue and post-harvest losses related to access to ABCs. Under this approach, we will try to find units in the comparison group that are as similar as possible to the treated units by computing the probability that a unit will belong to the treatment based on its observable characteristics. The goal is to mimic a

randomized assignment when it does not exist. We will use available data from the FBO Survey and the 2010 Census, as well as GIS data on climate and topography for the matching process.

Our sample would consist of farmers that belong to FBOs who will have access to and will benefit from the ABCs, and a comparison group comprised of farmers in similar FBOs that will not benefit from the ABCs. Sample farmers will be limited to those for whom we have baseline data in the FBO Survey.

The treatment group for each ABC will be comprised of farmers interviewed in the baseline FBO survey that belong to FBOs within a 20-kilometer radius around the ABC. The purpose of including all FBOs within the 20 km radius in the treatment group (as opposed to only the 20 co-owners of the respective ABC) is twofold: 1) we want to avoid selection into treatment bias (see details of selection process in Background Information Section above), and 2) we want to include all farmers that might benefit from the ABCs facilities even if they are not co-owners. [2]

In this methodology, it is also essential to identify an appropriate comparison group. In conversations the NORC team had with local experts during the design trip to Ghana, the MIDA team and other stakeholders suggested that the comparison group for each ABC can be selected from MiDA-trained FBOs located outside the approximately 20-kilometer radius around the ABC. In this regard, those FBOs forming the comparison group would be located between two concentric circles, centered on the respective ABC. The inner circle will have a radius of approximately 20 kilometers from its center, corresponding to the ABC location, and the outer circle will have a radius of approximately 30 kilometers from the ABC. Farmers linked to the MiDA-trained FBOs that were included in the baseline survey and are located in the area between these two circles would be defined as the comparison group.

In addition to the difference-in-difference methodology, we propose to use an Instrumental Variable two stage least square (IV-2SLS) approach, using a model where "treatment" is instrumented in a first stage by "distance from farmer to closest ABC". We will still select all sampled farmers within a radius of 30 km but rather than considering everyone within 20km as “treated” and the rest "controls," we will let the variable "distance to ABC" instrument participation into treatment. A second stage will estimate the effect of instrumented participation on outcomes of interest.

Data Sources

To evaluate this sub-activity we propose to use GIS data compiled by MiDA to geo-locate ABCs and affiliated FBOs for the purpose of identifying treatment and comparison FBOs and farmers based on their distance from the ABC. We expect that data from the FBO survey conducted by ISSER will serve as the primary source of information on individual farmers at the baseline. The FBO survey will allow the construction of the indicators mentioned above.

Based on the documentation we have at the time of preparing this report, the variables necessary for the calculation of indicators 1 to 4 were collected in the FBO survey. However, the dataset we have obtained does not match the documentation and some important variables are missing. We are currently working with ISSER on resolving this inconsistency and hope to have a satisfactory solution to the problem. It is not clear whether indicator 5 can be constructed from

the data. It does not seem possible to properly calculate crop yields with the questions included in the survey. However, ISSER reported crop yields in the summary report corresponding to Round 1. At present, we are investigating how these indicators were calculated and working to obtain any complementary data that would allow us to replicate these crop yield calculations.

A new round of the FBO survey will be needed in order to obtain a proper endline data within the defined area around each post-harvest facility. The post-intervention data collection could be carried out at any time after approximately one year from the time that each FBO begins operating, or at minimum, after two crop cycles of the targeted crops have been completed. We recommend going back to the same farmers interviewed in the initial FOB Survey to create a panel.

Key Considerations

It is important to keep in mind when interpreting the effects of the ABCs that this sub-activity involves more aspects that simply the physical ABC and associated services. As described in Section A1.1 above, the "lead investors" were selected in a competitive bidding process and they are important in the management of the ABCs. This is a central factor that must be taken into consideration when replicating this type of intervention. The location of the ABC is also not random. The Centers are located near main roads, power sources and water. Our analysis will evaluate the effects of this "ABC package" on farmers' economic wellbeing and the results should be interpreted accordingly.

B1.2 Public Pack houses

Background Information

MiDA's portfolio of post-harvest activities includes support for the construction and equipping of three large, state-of-the-art public pack houses (PPH) in Ghana's Southwestern Horticultural Belt. Two of the pack houses will serve the export pineapple agro-industry, and the third will be used for mango exports. The two pineapple facilities are located in the districts of Gomoa and Akwapin South and the pack house for mangos is in the Yilo Krobo district. The three pack houses have automated packing lines with the capacity for moving freshly harvested fruit on a conveyor to stations where it is automatically separated and sorted into batches of fruit of similar size that are then manually packed into carton boxes containing a standard weight. The packed fruit boxes are palletized for ease of handling and, once the palletized unit has been quick-cooled, it is stored in refrigerated rooms at the pack house until it is loaded into refrigerated containers and transported to the Tema Port. At Tema, the fresh fruit remains in the sealed container until the scheduled arrival of a container ship that transports the container with its refrigerated cargo to European ports for discharge and distribution to fruit wholesalers, brokers, and supermarket chains. The European market has extremely demanding quality standards for fresh fruit, and imposes rigorous procedures for post-harvest handling and temperature control as essential elements of an export program that serves this market. Consequently, MiDA's state-of-the-art pack houses and the capability to support the first link of the "cold chain" for export horticultural products from the farm to the final customer are an important part of Ghana's strategy to increase its horticulture exports to markets overseas.

The public pack houses will each serve from 500-600 farmers, and these will considerably increase the capacity for pineapple exports from nearby communities. While the anchor farmers

using these packhouses could pack their fruit for a fee at other packhouses that are further away, this alternative would increase their transport cost and would also increase post-harvest losses caused by additional transport and handling. Furthermore, since the distant facilities are utilized by other exporters, their availability is limited and may result in delays in packing services.

MiDA is providing grants to fund the construction of the three public pack houses and to install the required packing lines, cooling equipment, product handling equipment, and the extension of electrical power from the national grid, along with a standby generator. The pack houses are designated as "public" facilities. This means that they will provide for-fee services to any group of farmers, or any individual exporter that requires export packing services for mango or pineapple; and eventually, other products as well. Their services include fruit selection, sorting, packaging, cooling, handling, storage, quality control, and shipping fresh fruit for export. A "pack charge" amounting to roughly US $25.00 per pallet-load of fruit (equivalent to approximately 0.8 metric tons of fruit) is considered by the industry to be a reasonable charge for this service.

Fruit processed at the public houses that do not meet export quality standards will be sold into local markets, although at considerably lower prices. For example, fresh pineapples that are rejected at the pack house because they do not meet export quality standards can be sold to Blue Skies Company for processing and export as pre-cut, packaged fruit chunks; to local juice processors for making fruit juice; or on local markets as fresh fruit. Rejected mangos can be sold to juice processors or as fresh fruit on local markets.

The public pack houses will be privately owned and operated. The co-owners of the pineapple pack houses will be the anchor farmer (60 percent ownership) and the affiliated FBOs (40 percent ownership) that will serve as pineapple outgrowers (contract farmers) to the anchor farmer. In the case of the public pack house for mangos, where no anchor farmer is available, its owners will be the Dangme Union and its FBO members.

Ajanoa pineapple public pack house is led by Greenspan Farms Ltd, the anchor farmer, which has a network of 11 FBOs that are committed to supply the company with MD2 pineapples for export packing at the public pack house. Before the end of the compact, MiDA will transfer ownership of the pack house to a holding company that is now being incorporated to own the facility. Greenspan will manage and operate the public pack house on behalf of the holding company, charging a designated service fee in the form of a pack charge per pallet load of fruit processed. The holding company will, over time, transfer ownership of the pack house to Greenspan and its FBOs partners in proportion to the amount of initial investment, and the amount of throughput (in tons) that each entity moves through the pack house.

Gomoa Otwekrom pineapple public pack house is presently being constructed on a foundation that was placed earlier by Chartered Impex Limited (CIL). CIL has established an outgrower scheme by providing 500 acres (of its entire holding of 2,000 acres) to small farmers for pineapple cultivation. The network involves 13 FBOs. Under this scheme, individual farmers will grow pineapples on five-acre plots to be sold to CIL for export. CIL will provide planting material, technical support, production coordination, and for-fee agricultural chemicals. The outgrowers are required to pay a small land fee, to sell their production to CIL, and to assume responsibility for their growing costs.

Akorley mango public pack house will be operated and eventually owned by the Dangme Cooperative Mango Farmers and Marketing Union, known as the Dangme Union. The Dangme Union represents mango producers in the four districts of Dangme West, Yilo Krobo, and Upper and Lower Manya Krobo, which collectively form the biggest mango producing enclave in the country. It will be used to pack fresh mangos grown by the association members and other producers within the four districts, for sale to local and export markets. While this is a relatively large catchment area, mangos are quite hardy and can withstand greater transport distances than more delicate fruit such as pineapples. Dangme was created through the union of nine FBOs that produce mangos within the four districts.

Evaluation Hypotheses and Impact Indicators

The Yilo Krobo Mango Farmers Association (YKMFA), a key member of the Dangme Union, has made several attempts in recent years to export fresh mangos to overseas markets, although with mixed results. The main problem has been the lack of control over fruit quality packed at a third-party pack house, the processing delays experienced from external packing service, and its higher cost. In light of its export attempts, YKMFA has concluded that it can deliver good quality fruit to European markets from a pack house that is controlled directly by its union. The Akorley PPH will provide direct access to international, as well as local markets for its affiliated producers.

Without a group packing facility, individual, small-scale mango growers have limited access to reliable markets for their products. The only marketing option for most small producers is to sell their mangos at farmgate to middlemen whose bargaining power is considerably greater than that of the individual farmer. The stark choices facing most small mango farmers are to sell their mangos to the intermediary at the offered price, or not sell their mangos at all. For mangos sold into local markets, the purchase price falls at the peak of the harvest to a level that is only slightly greater than the cost to harvest the fruit.

- The public pack house will provide the members of the Dangme Union with access to local and international markets, and the ability to jointly market their products. Small farmers are expected to benefit from this facility in several ways.
- Linkage with the anchor farmer (Dangme) will provide a stable market for the members of the cooperative union, and will impose the discipline required to operate within a formal marketing system.
- By leveraging their efforts through the union, small and medium farmers alike will have much greater opportunities to obtain supplier credit for farm inputs they will require to produce each mango crop. The union can also serve as a channel for technical assistance and technology transfer that will likely be available from international organizations after the Compact ends.
- The public pack house will provide packing services for agricultural products to the anchor farmer, the associated FBOs and their members, as well as other independent FBOs that use the facility. This will have several positive effects:

- A well-managed, functional pack house should improve the quality of the agricultural products that are offered for sale in the targeted market reducing losses from handling and transportation and claims from buyers for inferior product quality
- A pack house that consistently ships good quality agricultural products can enable the exporter to increase his or her share of market for that product by displacing inferior quality products. This could increase product sales.
- Consistent quality can improve the position of the exporter and the average market prices received.

The idea is that the effect of improved product quality and consistent access to markets, in particular international markets, will provide higher average selling prices. Better prices are expected to increase the amount of income received by small farmers. To the extent that part of the increased income is used for orchard maintenance and reinvestment, the amount of mangos produced will gradually expand income. Based on these hypotheses and the data available these anticipated outcomes will be measured as follows:

1. Total annual household income
2. Total annual household income from farming
3. Annual output of the designated crop (mango or pineapple) by a producing farm, in kilograms.
4. Percentage of on-farm, post-harvest losses of the designated crop.

Unfortunately it is not possible to measure the amount of production that is exported from the available data.

In addition, there is an alternative channel that could affect small farmers in the area. If PPHs give incentives to the anchor farmers to increase their production they may want to hire additional workers for their farms. We therefore suggest including the following parameter as an impact indicator:

5. Paid employment for agricultural business.

Evaluation Methodology

We propose to evaluate the impact of the two pineapple PPHs using the same approach as that proposed for the evaluation of ABCs. Our discussions with local stakeholders in Ghana suggest that, similar to the ABC intervention, FBOs benefiting from the PPHs are likely to fall within a 20 kilometer radius around the PPH. Therefore, we also propose using for the PPH sub-activity: 1) a difference-in-difference methodology, combined with matching or using covariates controls where farmers linked to FBOs within a 20 km radius of the PPH will serve as the treatment group, and farmers within the next 10 km radius will serve as the comparison group; and 2) a Instrumental Variable approach in which we will use distance to the PPH as an instrument for treatment in a two stage regression, where the sample includes farmers within 30 km of the PPH.

The evaluation approach we propose to use for the mango public pack house will be slightly different by virtue of the fact that the PPH located in the Yilo Krobo district will serve as a base for FBO members of the Dangme Union that are located throughout the four mango producing

districts of Dangme West, Yilo Krobo, and Upper and Lower Manya Krobo. In this case, our treatment group will comprise FBOs in the four districts, while the comparison group could be drawn from mango producers that are not located within these four districts. Because of baseline data constraints, our conjecture at this point is that the comparison farmers will have to be drawn from other MiDA districts with MiDA trained FBOs.

Risk Factors

The number of farmers that produce pineapple and mangos represented in the FBO survey is not very large. This is particularly true for mango producers. Although we do not have final numbers for mango and pineapple farmers in the baseline FBO Survey due to some missing data, for the purpose of this report, we are estimating them at approximately 45 treatment and 45 comparison mango producers and 95 treatment and 95 comparison pineapple farmers.

Estimates of impact based on small samples tend to be imprecise, and in such cases detecting the impact of an intervention or program can be difficult. The power calculations presented in Annex 2, show that for the case of the Mango PPH, with only 45 farmers in the treatment group and 45 in the control group, the effect size would have to be 0.55 or larger to be able to detect an income change with a moderately high power of 0.8. A 55 percent average change in income is very ambitious, and in the event that it does not occur, we run the risk of concluding that the intervention did not have a positive effect. To mitigate this risk, we recommend that in addition to the proposed quantitative methodology be complemented with qualitative data collection through focus groups and/or key informant interviews.

In the case of pineapple farmers, the sample is likely to be around 190, with 95 treated farmers and 95 controls. In this case, the required change in income for detecting a change at a reasonable level of power would be lower than 55 percent. However, we suggest complementing the analysis with qualitative information in this case too.

Data Sources

Similar to the proposed evaluation of the ABCs sub-activity, we propose to use the MIDA GIS database for the PPH evaluation to locate Public Packing Houses and classify FBOs according to their proximity to the PPH for the purpose of identifying treatment and control groups. We will rely primarily on the 2008/2010 FBO Survey for baseline data on individual farmers associated with the MiDA-trained FBOs. The data limitations for the FBO Survey and ongoing efforts to resolve them, described in Section A1.3, apply here as well.

A new round of the FBO survey will provide endline data. The post-intervention data collection could be carried out at any time after approximately one year from the time that each PPH begins operating. As before, we recommend going back to the same farmers interviewed in the initial FOB Survey to create a panel.

Key Considerations

As is the case with the ABCs evaluation, it is important to keep in mind that in designing an evaluation for the PPH intervention, this sub-activity, in addition to the provision of the physical packing line and cooling rooms, is also linked to other interventions such as provision of electricity, feeder roads and, most importantly, an anchor farmer that leads the initiative and

offers training and inputs to small farmers. As such, we are evaluating a package of interventions, one of which are the physical PPH and associated services.

The situation is a little different in the case of the mango PPH where there is no anchor famer. The Dangme Union will be leading instead.

B1.3 SPEG Loans for Cold Rooms and Packing Lines

This intervention is similar to the PPH activity in terms of the infrastructure it provides. In 2008, MiDA provided a conditional grant in the amount of US $5.3 million to the Sea-Freight Pineapple Exporters of Ghana (SPEG) in order to create a loan program administered by SPEG that would enable its members to construct cold rooms, install automated packing lines and to provide a stand-by generator for their pack houses. In those cases where the electric power grid did not reach the pack house, as was the case at the 2K farm, MiDA's Rural Development Project provided electricity to the pack houses and to nearby communities by constructing an electric power line.

In September 2008, MiDA announced the approval of the first loan tranche in the amount of US $2.17 million for seven SPEG exporters who made up the first phase of the loan program. The loans were provided for a five-year term at a flat interest rate of 5 percent per year, with annual loan repayments amounting to 20 percent of the original loan amount, plus interest. Unfortunately, this first group of loan recipients was not able to repay their loans as scheduled. As of September 2011 around 17% of the loan has been repaid, and SPEG has unilaterally re-scheduled its repayment of the MiDA debt (without obtaining formal agreement from MiDA), and plans to complete all loan payments under its revised schedule by 2015.

Hypotheses and Impact Indicators

The competitiveness of Ghana's export pineapple industry depends on the quality of the fruit it exports to international markets, and on the cost of placing its export pineapples in these markets. Ghana cannot be competitive in export markets without packing facilities that minimize post-harvest handling damage and that enhance the capability of the exporter to provide good, consistent quality of the exported fruit under efficient, low-cost packing methods. Another key element in post-harvest handling of fresh pineapples is the ability to quickly reduce the temperature of the fruit ("remove the field heat") to the optimum storage temperature, and to maintain that temperature until the fruit is delivered to the buyer. Both these elements are required to compete in Ghana's export markets. The loans provided to the seven SPEG exporters were designed to increase their ability to compete in European markets.

The effect of these improvements on the SPEG exporters should follow a model very similar to the one described for the public pack houses. However, it may differ in the expected impact on small farmers. In light of the information that MiDA provided the assessment team, it appears that the SPEG equipment loans provide the greatest benefit to the exporters, whereas their impact on small farmers should be quite limited given that only three of the seven exporters that received equipment loans– Bomart, Prudent, and Georgefields – have outgrower programs. Each of these exporters is associated with a single FBO that has about a dozen members as outgrowers. The remaining four exporters - Jei River Farms, Koranco Farms, Gold Coast Fruits and 2K Farms - do not have an outgrower program.

While the evaluation model and impact indicators described for PPHs is relevant for the cases where exporters work with outgrowers, the rest of the exporters are unlikely to generate positive spillover effects for small farmers. The main reason is because in general, outgrower programs by most SPEG exporters are extremely limited, and without outgrower programs, small farmers receive little benefit from these investments. If these investments have any effect on small farmers it is more probable that such an effect would come from increases in paid employment at the exporter farms and pack houses.

Evaluation Methodology

For this intervention, it may be possible to evaluate the effects on small farmers linked to exporters that work with outgrowers, using the same methodology and indicators suggested for PPH evaluation. However, as we mention above, there are only three such exporters, and each of them is associated with only one FBO. This means we will on have a very small group of treated farmers that were covered in the FBO Survey (15 at best) and it is highly unlikely that under such conditions even a very large impact could be statistically detected. Therefore, our recommendation is to not pursue a quantitative evaluation of the impact of this intervention.

It is possible that we may be able to detect changes on employment at exporter farms associated with this activity.

B1.4 Perishable Cargo Center

Background Information

MiDA is funding the construction and equipping of a US $2.7 million perishable cargo center at the Kotoka International Airport (KIA) in Accra under its Agricultural Project, to support increased exports of fresh fruit and vegetables from Ghana.

KIA presently exports around 20,000 tons of fresh agricultural products annually. Just about all vegetable and cassava exports are shipped by air to overseas markets; around 80 percent of fresh papaya exports are shipped as air cargo, and around 10 percent of pineapple exports - mostly pre-cut packaged pineapple chunks exported by Blue Skies, Ltd. – are shipped by air from KIA.

The perishable cargo center (PCC) will be the final link of an integrated cold chain for the horticultural sub-sector that begins at the pack houses where products are initially cooled.

At present there is no packing shed at KIA where fresh produce can be consolidated, nor is there a cold storage facility to maintain the quality of exported fresh products. Even when the cargo arrives by refrigerated truck, the shipment must be discharged, palletized, and held for export at ambient temperature, breaking the "cold chain."

The PCC will be owned by the Ghana Airports Company Limited (GACL) and will be managed and operated by a consortium headed by Ghana Air under a concession from GACL. The consortium was selected through a public bidding process.

The PCC will be a public facility, providing for-fee export services to all horticultural exporters in Ghana, and possibly even some in neighboring countries, who wish to use its services. Its clients will be drawn from the community of active exporters.

Hypotheses and Impact Indicators

The PCC is a key element in the achievement of better quality of exported fresh produce shipped by air to markets overseas. The PCC could lead to higher market prices and increased volumes for its normal fruit and vegetable exports, as well as stimulating export growth in emerging export products such as cut flowers.

The benefits to be derived from the PCC are summarized as follows:

1. The perishable cargo center will serve Ghana's fresh horticulture exporters by providing the range of services required to ship their fresh products by air to buyers in foreign markets. Of critical importance will be availability of refrigerated storage at the PCC, which will keep the export products in good, fresh condition to maintain quality and shelf life. A second benefit is that with cold storage, the exporters will be able to deliver their products ahead of time to the airport, and will not have to precisely schedule their deliveries around the aircraft departure time. By ensuring the quality of export products, the PCC will enable horticultural exporters to effectively compete in upscale markets for fresh fruit and vegetables in the European Union (EU). The lack of a modern facility for handling fresh horticultural products has generally limited exports from Ghana to the lower tier of EU markets due to buyers' concerns of poor product quality. While data are not readily available on the amount of product loss due to spoilage under current handling conditions, a knowledgeable estimate would be a loss of around 5 percent. The greatest loss of exporter income under current conditions results from quality claims, and the foregone revenue resulting from selling into downscale markets.

2. Increased competitiveness of fresh fruit and vegetables from Ghana sold into European markets will result in an increased amount of products exported, with higher prices relative to the average market price for the export product. Many exporters, particularly those who export fresh vegetables, rely on small farmers to achieve a critical mass of their export product. The PCC will spur the growth of the export supply chain, and the corresponding benefits will be shared by small farmers who supply these export products. However, this benefit would be extremely difficult to measure, given the number of steps the small farmers are removed from the intervention.

3. Improved handling and storage of export horticultural products will reduce the amount of claims for poor quality by foreign importers, against the exporters in Ghana.

4. The greater convenience and improved logistics for handling perishable products at the PCC will make it easier for exporters to comply with aircraft schedules and to meet product delivery deadlines. This will result in increased exports and fewer shipments held over.

Based on these hypotheses, we propose to use the following impact indicators:

1. Volume of exports
2. Claims from foreign exporters
3. Product loss volumes

Evaluation Methodology and Impact Indicators

As described earlier, the services provided by the PCC will be available to any exporter of horticultural products in Ghana, and it is likely that most fruit and vegetable exporters will use the facility. While in some cases, groups of small farmers supply the community of exporters with agricultural export products, identifying these groups and determining the impact of the PCC on their farming operations would be extremely difficult, and impractical. As such, we do not propose to evaluate the impact of the PCC on small farmers.

Instead, we propose to conduct the evaluation using the exporter as the unit of analysis. We will focus our analysis on around 30 exporters of horticultural products who consistently air freight their products from KIA. Since most exporters will use the PCC when it becomes available, we see no opportunity to construct a comparison group of exporters who do not access the facility. Therefore, the evaluation approach will be a simple pre- and post-intervention design, which uses data from a variety of sources for a pre-PCC baseline period and a post-PCC endline period. This approach, in the absence of a control group, precludes the possibility of attributing change to the availability of the cargo center.

Data Sources

A broad spectrum of exporters will likely use the services of the PCC, including shippers of fresh fruit, vegetables, and root crops; as well as exporters of pre-cut, packaged fruit and vegetables. Consequently, there is no single organization that can serve as the source of data to measure the impact of the PCC. Instead, both baseline and endline data must be obtained from the Ghana Airports Company as well as from those individual exporters who have exported their products through KIA.

These sources would provide data on the following indicators: the annual throughput (metric tons) of fresh horticultural exports that pass through the perishable cargo center at KIA; the annual volume (kilograms) and value (US $) of fresh horticultural exports, by commodity, that are exported through the PCC; and the annual amount of claims against exporters as a percentage of the annual value of horticultural products that pass through the PCC.

B.2 Agriculture Project: Irrigation Activity

Background Information

MIDA's activities include the renovation of two irrigation schemes in the Tolon Kumbungu district in the Northern Agricultural Zone, and the construction of a new scheme in the North Tongu district in the Southeastern Horticultural Belt. The northern schemes are the Bontanga Irrigation Project and the Golinga Irrigation Project, both located near Tamale, the regional capital. The new southeastern scheme, known as the Kpong Left Bank Irrigation Scheme, is located in the Volta Region near the village of Torgorme.

The following table summarizes the most important characteristics of the three irrigation schemes[3]:

[3] The evaluation design team was informed by MCC that the costs shown in this table (provided by MiDA) include neither the feasibility studies nor construction supervision, nor the investments done for the anchor farmers in the irrigation schemes.

MiDA Construction and Renovation of Irrigation Schemes					
Scheme Name	**Area Small Farmers (HA)**	**Area Anchor Farm (Ha.)**	**No. FBOs**	**No. Small Farmers**	**Cost (US $000)**
Kpong Left Bank	450	1070	15	746	10,881
Bontanga	495	315	10	528	3,047
Golinga	40	None	5	246	
Source: MiDA and IFDC technical staff					

Small farmers operating within each of the three irrigation schemes will have the opportunity to participate in contract farming arrangements with a large, commercial farm known as an "anchor farm" located near the small farmer irrigation scheme. The anchor farmer will have access to irrigation water from the main canal that carries water from the reservoir to the irrigated area for small farmers. The anchor farmers will be required to pump irrigation water onto their farm, since the terrain does not permit gravity flow to these farms.

The anchor farmers will provide training, technical assistance, and seed to the contracted small farmers through their FBO Unions, for the production of the required crops. In addition to providing market outlets for their designated crops, the anchor farmers will help its small farmers to comply with international standards for export products (eg. GlobalGap) as required.

Kpong Left Bank: The Kpong irrigation system is presently being constructed just outside MiDA's targeted intervention area of thirty districts. The anchor farmer at the scheme, Vegpro, is planning to farm an irrigated area of 1,070 hectares located adjacent to the small farmer irrigation scheme. Construction of this irrigation scheme began on January 21, 2011; the expected end date is January 20, 2012. However, as described in Section B.5, the activity is facing significant delays.

Bontanga: The Bontanga irrigation project is the largest irrigation scheme in the Northern Region. Its water source is a large reservoir fed by the Bontanga River. MiDA is in the process of rehabilitating an area of 495 hectares, of a maximum potential area of 800 hectares. The anchor farmer, Solar Harvest, will cultivate an area of 315 hectares that is adjacent to the irrigation scheme. The company will pump irrigation water for its farm from a collection point that is being constructed at the extreme end of the main canal serving the Bontanga small farmers. Construction of this irrigation scheme began on March 15, 2011; the expected end date is January 31, 2012. As of mid-November 2011, three months before the end of the MCC Compact, construction of the Bontanga scheme was slightly less than 60 percent complete. However, given the rate of progress and the track record of the contractor for the Bontanga scheme, there is a fair chance that the construction work on this schemes will be finalized by the end of the Compact.

Golinga: The Golinga irrigation scheme was originally built in 1965 with a planned capacity of 100 hectares of irrigated land. The scheme draws water from a small reservoir fed by the Jolo River. Currently, the scheme covers of a total area of 65 hectares, with a net area under cultivation of 60 hectares. MiDA is now rehabilitating an area of 40 hectares. Due to the relatively small size of the Golinga scheme, there is no large, commercial anchor farm located

nearby. However, it is planned that Solar Harvest, the anchor farmer at the Bontanga irrigation scheme, will negotiate supply contracts with the Golinga farmers as well. Construction of this irrigation scheme began on March 15, 2011; the expected end date is January 31, 2012. The status of the Golinga scheme as of mid-November 2011 was similar to that described in the previous paragraph for Botanga. There is a good chance that this scheme will also be completed by the end of the Compact.

Evaluation Hypotheses and Impact Indicators

Due to poor scheme management combined with inadequate maintenance and repair, the performance of the Bontanga and the Golinga schemes has progressively declined and both schemes now operate at less than half their design capacities. These problems have worsened by the refusal of the farmers to pay the full amount of the assessed irrigation fees. In recent years only about 300 hectares have been cropped in the dry season, with a similar crop area cultivated during the rainy season. During the dry season, the poor condition of the irrigation canals limits the amount of water that can be provided for crop production. During the rainy season, poor soil drainage caused by clogged and silted drainage canals makes a large part of the scheme area too wet to cultivate.

The work being carried out by MiDA is the rehabilitation of the existing network of both irrigation and drainage canals. This work will increase their operating efficiency and should improve the overall performance of the entire scheme. The rehabilitation will also equip the scheme with monitoring equipment for better control and efficient use of irrigation water. The work presently being carried out by MiDA will make it possible for the small farmers on the schemes to cultivate their crops without regard to rainfall patterns, which would substantially increase their production output. Furthermore, contract farming arrangements with the anchor farmer will provide a reliable market outlet for the small producers, as well as access good-quality seed and to crop production technology.

The main expected hypotheses regarding outcomes of the irrigation activity are:

1. With irrigation water supply and good crop management, it will be possible to grow three crops per year in both the north and south regions. Presently, with the limited availability of irrigation at Botanga and Golinga during the dry season, and given the inadequate farm drainage that limits the use of land in lower producing areas during the rainy season, one to two crops annually is the norm for farmers in both locations. More crops would translate into increased farm production/output and greater farm incomes for small farmers.

2. Irrigation makes it possible to cultivate a mix of higher-value crops. For example, high-value vegetable crops, particularly leafy vegetables are greatly susceptible to losses from pests and diseases during the rainy season. With irrigation, these crops could be successfully grown during the dry season when prices tend to be higher. A higher-value crop mix provides greater farm incomes for small farmers.

3. Irrigated, commercial crop production is much more intensive and has a greater labor requirement than subsistence agriculture. Labor requirements for the anchor farms will be substantial – up to seven workers per hectare. In addition even small farmers could need to

engage hired labor, especially for harvesting crops. The resulting employment generation at the irrigation schemes could be substantial.

Based on these hypotheses we propose to use the following indicators to measure impact:

1. Total annual household income
2. Total annual household income from crop production
3. Paid employment per household
4. Crop mix: Annual production output (kilograms) for each of the five most important crops produced per household. We aim to measure the changes form low to high value crops.
5. Crop yield: A crop will be selected as a representative at each irrigation site and its output per unit area (kilograms per hectare) will be monitored for each crop cycle.

Evaluation Methodology

We propose a double difference estimate with matching and covariates controls as appropriate to evaluate the impact of irrigation activities on small farmers. The treatment group for each irrigation scheme will be the small farmers that belong to FBOs that operate within the geographic perimeters of the irrigation scheme and will be able to receive irrigation. The control group will be composed of the farmers outside the water supply perimeters who do not receive the benefits of the irrigation schemes but are similar in characteristics to the treatment groups.

In order to estimate the effect on paid employment we can use both a difference in difference approach and an IV approach, based on a distance indicator, similar to post-harvest activities. If we assume that small farmers who live closer to the anchor farmers are more likely to benefit from an increased demand for labor on anchor farms, we can instrument treatment by using "farmer's distance to the anchor farmer" either as a continuous variable or as discrete categories defined by distance of, for example, 20km radius and 30km radius as suggested before.

Risk Factors

Similar to the evaluation approach described for the PPH sub-activity, small samples can create a problem for the evaluation of the irrigation schemes as well. For the two Northern schemes for which we have FBO survey baseline data, there is information for a maximum of 75 farmers in the treatment group. Annex 2 presents power calculations for the Irrigation Activity. These power calculations show that to be detected with high probability (0.9 or higher), the effect size - the fractional change in income between baseline and endline that is measured by the double-difference estimator - would have to be 0.5 or larger. Again, to mitigate the risk that smaller positive changes in income may not be detected, we propose supplementing the quantitative approach with qualitative data collection and analysis.

Data Sources

For the evaluation of the irrigation schemes in the Northern area, Bontanga and Golinga, we propose to use data from the MiDA GIS database and the FBO Survey. GIS data will be used to geo-locate FBOs construct borders that separate FBOs/farmers that do and do not benefit from

the irrigation water supply. Data from the FBO Survey will provide baseline information for farmers associated with the treatment and comparison FBOs. For reasons described in Section C, we will not be able to use the GLSS5+ for this analysis

A second wave of the FBO survey will be needed in order to provide endline information. The data collection should take place as late as possible, given that there have might be delays in the completion of irrigation schemes, and sufficient lag time is required to allow the interventions to show results.

We have some serious concerns regarding the evaluation of the Kpong irrigation facility. First, the Kpong facility falls outside the MiDA Districts and, as such, no baseline data was collected through the FBO Survey. However, since the construction is still underway and lands are not going to be irrigated through the scheme till March 2012 at the earliest, there is still an opportunity to collect baseline data from farmers linked to the benefiting FBOs and a matched comparison group. This baseline data collection would use a modified version of the FBO Survey instrument. A data collection tailored to the evaluation would provide an opportunity to ensure that an adequate sample of treatment farmers are covered, and that a range of questions that address the evaluation hypotheses are included in the survey. However, these pros should be weighed against the cons of conducting a costly data collection for an irrigation scheme that in all likelihood might not be completed by Compact close-out. See discussion in Section B.5.

Key Considerations

As of mid-November 2011, three months before the end of the MCC Compact, the Bontanga and Golinga schemes were less than 60 percent complete, and the Kpong Left Bank scheme was less than 50 percent complete. Given the rate of progress and the track record of the contractor for the Golinga and Bontanga schemes, there is a fair chance that the construction work on these schemes will be finalized by the end of the compact. On the other hand, it is highly unlikely that construction of the Kpong Left Bank irrigation scheme for small farmers will be completed before the scheduled ending date for the compact, which is February 14, 2012. Contractor delays and exceptionally heavy rainfall during the 2011 rainy season have severely slowed the pace of construction of the small farmer irrigation scheme at Kpong. On the other hand, the delivery of irrigation water to the anchor farmer at the Kpong scheme is nearing completion, and there is an excellent chance that the anchor farm will be able to irrigate by the time the compact ends. Even though the anchor farm should be fully operational by the end of the compact, the most likely result for the small farmer irrigation scheme is that it will not reach its target of 486 hectares by the end of the compact. Fewer irrigated hectares will result in fewer small farmer beneficiaries at the Kpong scheme, which will diminish the impact of MiDA's irrigation investment at this location.

A related problem is that once the construction work has ended at the three sites, there will be insufficient time before the compact ends to organize the scheme management structure and to institute the management and operating systems needed to successfully manage the scheme. Furthermore, after the compact ends, MiDA will not be available to provide the leadership to coordinate the functions of the numerous organizations and service providers that will be involved in scheme activities. This could considerably slow the startup and prolong the time before the three schemes are able to achieve their full potential. These difficulties could diminish the impact of MiDA's investment over the near term.

Finally, this activity cannot be interpreted as just providing irrigation. The anchor farmer presence is an important and not random part of the intervention.

B.3. Rural Development Project: Community Services Activity, Education

Background Information

The Education Sub-Activity under the Rural Development Project funds the construction and rehabilitation of schools. Investing in educational facilities is expected to increase student enrollment and attendance and reduce drop-out rates by improving access (reducing travel time) and creating a better learning environment in the schools. Improved access to schools and conditions may also reduce absenteeism among teachers.

The Education Sub-Activity was rolled out in two phases. While waiting for the completion of Needs Assessment and the Environmental Impact Assessment Study Reports, the Community Services Project Department was allowed to select a few school blocks which were listed in the beneficiary Districts' Medium Term Development Plans and requiring urgent attention for rehabilitation under a limited budget. Phase I of the Education Sub-Activity (2007-2009) is viewed as a quick start project in pilot districts.

Phase II of the Project includes construction and rehabilitation of educational facilities in 151 communities. These facilities include the construction of 106 two-unit classroom blocks for the kindergarten level, 41 three-unit classroom blocks for the junior high and primary levels, and 29 six-unit classroom blocks for the primary level. Schools will all receive urinal facilities and a full complement of school furniture (wall-mounted black-board, furniture, desks and benches, teachers table and chairs, classroom cupboards and basic furniture) for all constructed classroom blocks and head teachers' offices. Electrical wiring of the school building also has been done where electricity is available or where the District Assembly has assured the availability of electricity in the short term. Phase II activities started in 2009 and will be completed by February 2012.

Phase I school selection did not follow a systematic selection process or defined criteria. Conversely, however, selection of intervention schools for Phase II followed strict selection procedures, which began with a close review of District Medium Term Development Plans to identify the District Assemblies' list of schools prioritized for construction and rehabilitation. These schools were then ranked and scored according to a preset set of criteria.

School Ranking and Selection Process:

At the National Level: the FBO concentration in each Zone was evaluated, taking into consideration the proportion of the total number of FBO in the Zone and the total number of FBO's under the MiDA project. The Zonal FBO ratio was then derived, and MiDA's budgets, including the Community Services Project budget, were allocated accordingly. Based on this allocation criterion, the Northern Zone received 30 percent of the MiDA education sub-activity funding, the Afram Basin received 50 percent, and the South region received 20 percent.

At the Zonal Level: two parameters were used to rank Districts. In order of priority they were:

- Poverty index (40% weight)
- Number of FBOs in the District (60%)

At the Community Level:

- The Communities with the highest number of FBO's were ranked in descending order
- Schools with sub-standard structures, Category A
- Schools with inadequate/deficient educational facilities, Category B.

Sub-standard School Structures -- Priority is given in the following order:

- Classes under Trees
- Classrooms in unsafe structures (Mud, Open Sheds, etc.)
- Uncompleted School Structures
- Schools in rented accommodation
- Schools in unclad Pavilions

Schools with Inadequate/ Deficient Facilities -- Priority is given in the following order.

- Schools with shortfalls in classroom accommodation
- Schools with Shift System
- Schools without prescribed ancillary facilities, shall be provided with the following in order of priority:
    - Toilet and Urinal,
    - Potable Water Facility
    - Staff Accommodation
    - Library
    - Computer Laboratory
    - Dining Hall
    - Sickbay
- Schools lacking Recreational and Sports Facilities

Schools in each target district were ranked and scored from 0 to 100 according to the community-level criteria, with high priority schools in need of urgent attention receiving a higher score. The final decision on which schools were selected for construction/rehabilitation in a given district was based on this eligibility index and the availability of MiDA funds for the district. Because of funding constraints, not all priority schools in a district were not built/rehabilitated.

Because the Phase II school construction/rehabilitation activities followed a systematic approach that is more conducive to a quantitative evaluation, we propose to focus our impact evaluation only on this phase of the Education Sub-Activity.

Evaluation Hypotheses and Impact Indicators

The hypothesis behind this intervention is that more and better educational facilities can improve educational outcomes. This is can seem obvious for the cases of new construction and outcomes such as enrollment. For example, a new Kindergarten facility where there was none will increase enrollment provided that there is demand from parents to send their young children to pre-

school. Rehabilitation of existent facilities may have a similar, although more moderate, effects on enrollment.

We also hypothesize that better educational infrastructure creates an environment that is more conducive to learning and staying in school, thereby reducing drop-out rates and increasing attendance.

Access to toilet facilities at the schools can be a benefit for all children and produce positive externalities for others. However, it has been argued that the availability of separate toilet facilities has a larger positive effect on girls' school attendance and enrollment, although empirical evidence is not conclusive on this point.

Based on the aforementioned hypotheses and available data, we propose to use the following indicators for measuring impact:

1. Gross enrollment rate (GER) in the catchment areas, total for all schools. Total, by gender, by age groups
2. Net enrollment rate (NER) in the catchment areas, total for all schools. Total, by gender, by age groups
3. School gross attendance rates: grade-wise number of children enrolled. Total, by gender, by age
4. Average % of days that students attend school. Total and by grade and gender.

It is important to note here that we propose to measure enrollment rates for the entire catchment area of the school, and not for the intervention or comparison school in the sample. We do this because the presence of a new school could well draw students away from other schools in the same area, creating a situation in which the new or improved school's enrollment increases, while older, less attractive school facilities lose students and suffer enrollment losses. In such cases the enrollment rate of the school catchment area may remain unchanged. Using catchment area enrollment rates will allow us capture this dynamic process and avoid overestimation of the impact.

Evaluation Methodology

As described in Section D.1, MiDA used an eligibility index to select the school units that were reconstructed or rehabilitated in a given district. Schools that received high scores (i.e. schools in dire need of attention) were selected for treatment with available funding; schools below the district-specific cut-off did not receive treatment because the available budget did not permit it. This selection process lends itself to using a Regression Discontinuity Design (RDD) to evaluate the impact of the Education Sub-Activity. This strategy exploits the discontinuity around the cutoff in the eligibility index to estimate counterfactuals. The assumption is that eligible schools with scores just above the cutoff are very similar to eligible schools with a score just below the cutoff that were not selected because of funding constraints. Therefore schools that were not selected for the program but close enough to the threshold can be used as a comparison group to estimate the counterfactual.

As a first step, we will analyze the baseline data to test the validity of the RDD. Specifically, we will compare indicators for eligible schools with scores just above the cutoff to eligible schools with a score just below the cutoff that were not selected because of funding constraints. In the RDD literature this analysis is done graphically and allows us to assess how the similarities, or lack thereof, in the two groups of schools. We will also check the school data to determine whether we face a case of sharp discontinuity (SRD) or a fuzzy discontinuity (FRD) and plan our regressions accordingly. In the FRD design, the probability of receiving the treatment does not need to change from 0 to 1 at the threshold. Instead, the design allows for a smaller jump in the probability of assignment to the treatment at the threshold[4].

Data Sources

School level data is collected each year through the Education Management Information System (EMIS). NORC has in its possession the EMIS database corresponding to 2010, which can be used as baseline data. In the future, we will need a new wave of this survey data to analyze post intervention indicators and evaluate the impact of the education activity.

Other data sources that are required for this evaluation are the following:

- 2010 Census data, which is still in the process of being compiled and, hence, unavailable to us at this juncture. NORC has submitted a request for this data to the Ghana Statistical Services through formal channels, and will also enlist MiDA assistance in obtaining the dataset when it is finalized. We propose to use age and sex specific population numbers from the Census data to calculate enrollment rates in school catchment areas for the impact evaluation of the Education Activity.

- Key pieces of data that will need to be collected at the district-level Education Offices. This information includes communities (or enumeration areas) that fall into the catchment areas of MiDA and comparison schools; other schools in each catchment area; and other education projects that have been or are being conducted in the districts. The District Education Offices may also be able to provide school-age population figures for each school catchment area; this may be a more direct way to gather this data, rather than estimating it based on Census figures. Collecting education information from 30 districts is a daunting task and relying on overburdened district education officers to fulfill this data collection task is not a recipe for success. Therefore, we will explore the option of hiring a local consultant for a 2-3 month period to visit district offices and schools and collect the requisite data.

In the RFP, MCC also expressed interest in evaluating the effects of the education sub-activity on household indicators such as time use, labor productivity, and income. However, the FBO Survey is not large enough to provide reliable data to be used in this analysis and GLSS5+ does not link household data to communities. As a result, we cannot identify the household location or relevant school. This prevents us from studying the impact of this activity on household level indicators.

[4] See for example, Imbens, G.W., Lemieux, T., Regression discontinuity designs: A guide to practice, Journal of Econometrics(2007)

B.4 Rural Development Project: Financial Services

Background Information

MiDA's Financial Services Activity seeks to establish a computerized networking system (through WAN using VSAT) between rural banks and the Apex Bank Server (financed by the project). The activity is aimed at improving financial service delivery, operations, and access to information at rural banks with the objective of enhancing the depth and value of rural financial services and widening access to savings services and cash transfers.

Computerization and Connectivity: To date, all Rural Banks (134) in Ghana have received computers and VSAT satellite dishes, although they are not yet all connected to the server for fully automated operations. In addition to the computers and satellite dishes banks receive a full commercial banking software package (eMerge) that enables them to access computerized front and back office applications for real time transactions with their customers, track cash flow, revenues, and expenses by profit/cost center, and update customer accounts with an easy end of the day processing. As of mid-November 2011, 77 of the 134 rural banks had received the full package of upgrades. Furthermore, all rural banks have received a scanner and software for the Check Codeline Clearing System.

According to information received from the Project Management Team, the Financial Services Activity used very strict prioritization criteria for the migration of the rural banks onto the eMerge platform. The guidelines for the prioritization were designed by the project management team (PMSC) and were deliberated and amended, where necessary, by the project technical committee for final approval by the project steering committee. The criteria however got changed several times as necessitated by the exigencies of the situations, including, the tight project schedule, limitation of the data center infrastructure, and the location of RCBs. The key prioritization criteria were as follows: availability of correct and balanced data (weighted highest), infrastructure readiness, information security compliance, and basic computer appreciation and training for staff. Unfortunately, no registry of the selection criteria and process was kept.

Once fully automated, all financial data will be stored centrally at the APEX Bank and Rural Banks use the software by connecting to the Apex Bank's Server. The accounting and banking data is therefore available in real time at the Rural Bank and at the Apex Bank. The Rural Banks are thereby enabled to provide accurate up-to-date, real-time statements to their customers.

Cheque Clearing and Cash Transfers: All rural banks have received a scanner and software for the cheque code clearing (CCC). However, due to the absence of data on cheque clearing times, the evaluation can provide only a qualitative assessment and not a quantitative measurement of the impact of this activity. Nevertheless, one of the key indicators (see below) to be analyzed quantitatively will be "non-interest income," which includes income from cheque clearing (one percent of the amount of the cheque).

The project did not finance a specific facility for cash transfers. The Apex bank has developed the Apex link software through internal resources that will be built on the platform of VSAT and computers financed by the project. The cash transfer module is expected to become live in 2012. Other cash transfer systems available at Rural Banks include the *e-zwitch*, a biometrically

recognized debit card that can be used for loading and unloading funds to the same card or from one card to another card. The Rural banks have a POS with a SIM card that transfers the information using the wireless telephone coverage. Irregular coverage and poor service has hampered the effectiveness of this product, which is no way competing with any of the services provided by the MiDA Financial Services Activity.

Evaluation Hypotheses and Impact Indicators

The computerization of operations and connectivity that MIDA has supported for the rural banks should have the following effects:

- Improvement of the speed and reliability of transactions
- Improvement accuracy and availability of accounts information
- Reduction in check clearing times

These improvements not only make bank operations more efficient and potentially less costly per transaction, but they also improve the customer experience with the services offered by the bank as well as reducing the incidence fraud. This, in turn, is expected to increase the number of clients, the number of deposits and credits, and the number of bank operations, among others.

The following indicators cover the key areas of operating efficiency, transaction costs, number and volumes of various types of deposits and changes in the customer base as compared to non-computerized rural banks.

1. Number of customers using deposit services
2. Number of customers using loans and overdrafts
3. Total deposits
4. Average size of savings and fixed deposits
5. Ratio of fixed and savings deposits to total deposits
6. Other Income
7. Monthly operating costs per customer = operating costs/number of customers
8. Monthly operating expense ratio (OER) = total operating costs/total income)

Due to the lack of data on check clearing times, we will not be able to quantitatively estimate the effect of the activity on the speed of clearing.

Methodology

We propose to use a difference-in-difference estimator (with matching or covariates controls when appropriate) where the staggered rollout of the intervention (VSAT, computerization, and connection to the server) can be used to define treatment and comparison groups. Because rollout occurred in batches, the treatment group would be comprised of banks that received the treatment early and the control group would include the rural banks that receive the treatment later.

The first bank was connected to the server in June 24th, 2010 and in the following months other banks followed. By July 25th, 2011, a total of 60 banks were connected to the server. We will consider this first group of connected banks our "early treatment" group. It was not until October

17th, 2011 that the first bank in the second batch received a connection and the process of linking the rest of the banks to the server is still going on. The second batch of banks will make up the control group.

Originally, we had proposed to do two separate analyses, one estimating the effect of distributing the equipment to the banks and a second one to estimate the additional effect of connecting the rural banks. Unfortunately, the distribution of equipment is not sufficiently spread out over time to allow creating treatment and comparison groups. In the case of connection to the server, there is a time lag that makes the approach feasible as half the banks were still not connected a year after the first banks went live.

Although using two groups of banks, early treatment and later treatment or control is appealing because of its simplicity, it is not the only way to approach this evaluation. Using the monthly data for each individual banks, the general difference-in-difference models can be specified as a fixed effects regression model for panels:

$$y_{it} = \alpha D_{it} + \beta \mathbf{x}_{it} + \lambda_t + \mu_i + \varepsilon_{it},$$

where y_{it} is the outcome of interest, $\mathbf{x}_{it}$ is the vector of the subset of control variables in the vector $\mathbf{x}$ that vary both across units and time, μ_i is a time-invariant effect unique to unit i, λ_t is a time effect common to all units in period t (month and year), and ε_{it} is a unit time-varying error distributed independently across units and time and independently of all μ_i and λ_t and finally D_{it} indicates treatment.

Alternatively we can perform this analysis in annual differences in order to remove seasonality such that

$\Delta y_{i\,y} = y_{it} - y_{it-12}$ where y denotes year

and estimate the effect of the variable "time since connected to server" on changes in the proposed indicators, while we control for covariates.

Risk Factors

There are two main complications that can threaten the feasibility of the proposed methodology. The first is the number of observations. There are only 134 rural banks and all of them will be eventually treated. With such a small sample is possible that no effect can be detected when using the two group difference-in-difference approach. We therefore recommend complementing the analysis with the fixed effects approach described above.

The second difficulty we face is that rural banks were selected for migration to the eMerge platform according to a set of prioritization criteria (availability of correct and balanced data, infrastructure readiness, information security compliance, basic computer appreciation for staff, etc.). The original priority order is not available to us. Although we learned that the order was altered because of different circumstances, we are concerned that the rural banks that went live earlier are also 'superior' in other unobservable dimensions that could introduce bias in our estimates. If this is the case, it is likely that the estimation of the activity will be biased upwards.

Data Sources

Having reviewed existing data sources, we are aware that the data necessary to estimate indicator of interest are available at the ARB APEX Bank in the form of monthly returns from individual rural banks (not by branch). The monthly returns for each bank are available in paper format for the period prior to full automation of a given bank, and electronically for the period following full automation of the bank.

We have initiated a request to access these data and are waiting for a response from APEX. Initial conversations with APEX staff have been encouraging, and we expect MIDA to help us facilitating the process of acquiring requisite data.

We note that the process of obtaining paper records of monthly bank returns for a period of several months for 134 banks is a non-trivial undertaking. Our understanding is that these paper reports will have to be photo-copied and the necessary information from these paper reports will then have to be entered into an electronic database. For this data gathering and entry exercise, we anticipate needing to hire several local consultants for a period of 2-3 months.

B.5 Rural Development Project: Credit Activity

Background Information

The Credit Activity sought to improve access to credit in intervention zones and enhance the ability of rural banks to assess, grant, and manage agricultural loans to facilitate investments, acquisition of inputs, adoption of technologies, and financing of recurrent costs. Expected outcomes included increased yields, productivity, and profits, as well as improved use of credit. However, there have been major implementation difficulties with the credit program, namely low repayment rates along the entire chain of credit resulting in substantial loan delinquencies both in the Bank of Ghana loans to Rural and Commercial Banks, and the Agricultural Credit Program Consultant's (ACPC) loans to FNGOs, as well as in loans made by these Participating Financial Institutions (PFIs) vis-à-vis to FBOs. The table below summarizes the status of the credit component as of 30 September 2011:

- ACP/Bank of Ghana Portfolio at risk = 96.07% (Loans to PFIs)
- PFI Portfolio at risk = 84.42% (Loans to loan clients)
- Funds received: repayments this month from PFIs to the Bank of Ghana: GH¢ 899,639
- ACP Fund cumulative return of undisbursed Funds (claw back) from PFIs: GH¢ 7,287,778
- Net Disbursal from the ACP Fund to PFIs: GH¢ 18,853,798 (Minus PFI repayments & claw backs)
- Current Loan balance outstanding due by loan clients to PFIs: GH¢ 18,555,990
- Balance in ACP repayment account at the Bank of Ghana: GH¢ 11,467,781.
- The cumulative amount of scheduled principal repayment overdue: GH¢ 14,837,588.

ACP in its September 2011 report presented the following loan allocation breakdown:

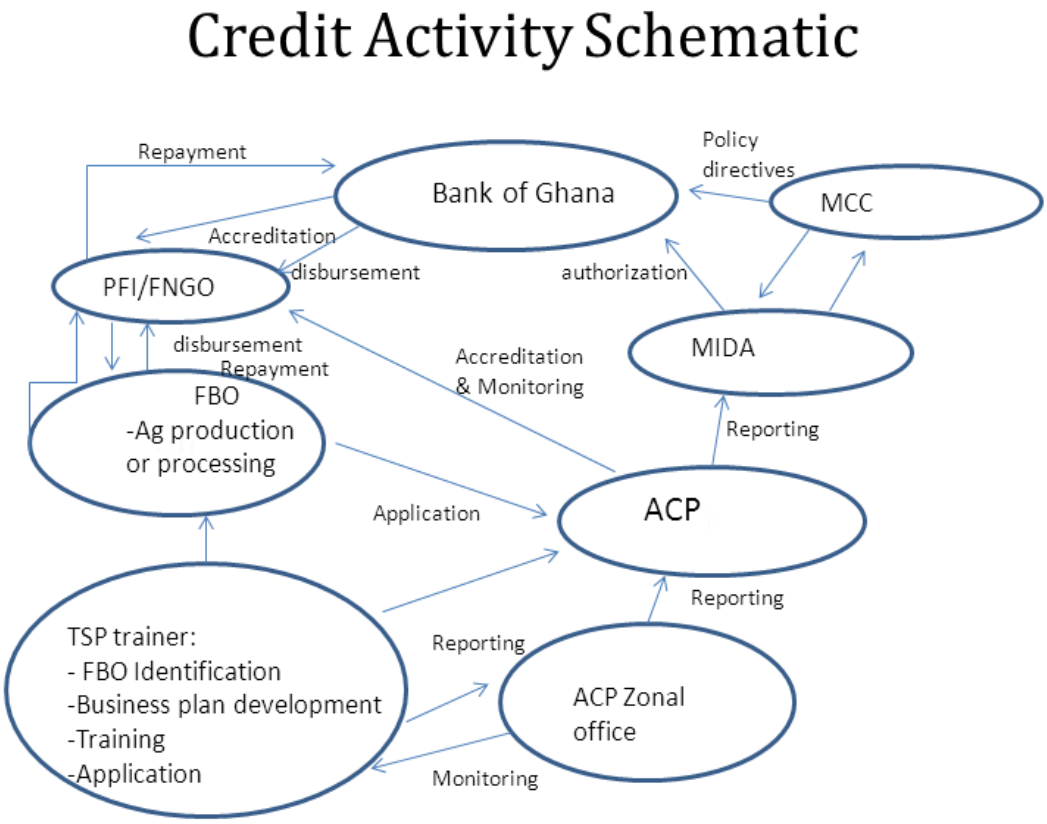
Loan allocation by amount and type of enterprise as at Sept. 2011 (Gh. Cedis)				
Item	**Loans Approved**	**% Loans Approved**	**# of Loans**	**Current Loan Balance**
Large scale SME	4,056,816.00	17.52	14	3,830,698.12
Non production FBO	1,965,286.23	8.49	49	979,143.76
Non production large SME	265,000.00	1.14	3	208,283.30
Other SME	1,475,850.00	6.38	9	1,016,288.88
FBO prod. group > 40 ha	14,086,215.36	60.85	191	11,331,756.81
FBO prod. group < 40 ha	1,301,150.63	5.62	4	1,189,899.17
Total	23,150,318.22	100.00	270	18,556,070.04

All loans are related to agriculture and can be traced to a crop. About 65 percent of loans were borrowed for investing in the production and processing of maize, pineapple, rice, and yams. The remaining loans were applied to other crops such as red pepper, mangos, and egg production.

Preliminary Findings

Given the problems with associated with the Agricultural Credit activity and termination by MCC of funding for loan fund, we have agreed with MCC that an impact evaluation is not feasible. Therefore, in accordance with our proposal and subsequent discussions with MCC representative, we propose to conduct an implementation evaluation of the activity to identify reasons for its failure. We initiated this process during our trip to Ghana in November 2011.

Our initial conversations with stakeholders and review of documents reveals a complex credit scheme with a highly diffused structure of responsibility and authority, which may have been a primary factor underlying the poor implementation results. The schematic is presented below:



Among the possible factors contributing to the implementation problems that the credit activity encountered are the following:

- Initial absence of a borrowing limit for PFIs (some PFIs were lent money in multiples of their total capital).
- Over-funding of loan recipients (end users) due to a high minimum loan size ($1000/borrower).
- Funds disbursed to PFIs that did not reach the FBOs and funds disbursed to FBOs that did not reach all their members.

- Absence of cross checking of loan appraisals by the PFIs and the Bank of Ghana.
- Insufficient stringency in borrower selection by the local consultants (TSPs), who all the parties (PFIs, MIDA, ACP and Bank of Ghana) relied upon as the principal checkpoint.
- Lack of understanding by the FBOs in providing cash flow budgets that adequately reflected the payment capacity of the borrower, which resulted in over-optimistic business plans that contained exaggerated cash flow estimations.
- Marketing problems faced by some of the borrowers that were not taken into account during loan appraisal.
- Repayment schedules that did not match the farmer's income stream from the crops being produced.

Data Sources and Methodology

Our recommendation is to limit this evaluation to an implementation evaluation based on qualitative methods directed at identifying and developing an in-depth understanding of the factors that led to the low repayment rates in Ghana.

We will review existing data from ACP, the various agreements between the PFIs and ACP, and monthly ACP reports. Through our discussions with implementing agencies, we have identified a list of information sources that could be used in a qualitative implementation evaluation. They include:

- ACP Monthly Monitoring Reports
- ACP Loan Eligibility Reports
- ACP Policies and Procedures Manual
- ACP/Bank of Ghana Unit Implementation Manual
- ACP Post Harvest Report
- ACP Monthly Zonal reports
- PFI Returns Files
- FNGO Reports
- CIG (Capital Incentive Grant) Monthly reports

NORC will combine review of these reports with additional field visits and key informant interviews with TSPs, rural banks, PFIs, and FBOs to gain a clear understanding of the key causes of the low repayments rates for this credit activity. Based on an analysis of administrative and qualitative information, we will develop a set of lessons learned and recommendations.

C. DATA SOURCES

In this section, we discuss the data sources that we have identified as useful for the evaluation. Since our initial proposal, we have had the opportunity to review various datasets mentioned in the RFP, as well as identify new data sources. Below, we present each possible data source, and discuss the pros and cons of each.

C.1 GLSS5+ Database

The GLSS5+ was a large-scale household survey conducted in 2008 that was funded by MiDA and covered many of the MiDA target districts. Specifically, 9,300 households in 27 Enumeration Areas in the original 23 program districts were surveyed. As such, we anticipated using this data source heavily for the impact evaluation of several of the MiDA activities and sub-activities.

During our trip to Ghana, we obtained the dataset and supporting documentation, and met with researchers from ISSER who were in charge of the survey. In the course of reviewing the data and discussing its contents with ISSER staff, we have become aware of two significant limitations to using the data for the evaluation.

1. GLSS5+ was designed to be used at district level, but not at more disaggregated levels such as communities or Census enumeration areas. The activities and sub-activities that NORC is evaluating, however, will have impact at lower levels, such as communities, FBO coverage areas, and school catchment areas. It is unlikely that the impact of these activities, particularly given the sample sizes available, would be detected at the district level.

2. The GLSS5+ household data does not include more specific information about the location of the household than cluster. As such, it is not possible to link households with the communities or schools catchment areas in which they are located. By extension, it is also not possible to link GLSS5+ households with MiDA intervention sites and boundary areas obtained from the MiDA GIS dataset. It is essential to be able to create correspondence between individual farmer data and MiDA GIS data in order to identify treatment households and potential controls. GLSS5+ data only allows matching at district level.

Although we are still thinking of strategies to get around these problems, at present, we have not identified any solutions. Therefore, for the purpose of design report, we assume that GLSS5+ can only be used at district level.

C.2 FBO Survey Data

The FBO survey, funded by MiDA, was fielded by ISSER during 2008. It covered 2,928 farmers in its first wave. The FBO collects data among farmers on demographic characteristics, education and skills/training, health, activity and occupation, migration, housing and housing conditions, assets, land ownership and land transactions, agriculture production, and non-farm household enterprises.

Currently, we have two versions of the FBO database: one provided by MCC, and a second one was provided by ISSER. Neither version is complete. For example, the ISSER's version is

missing some sections of the survey for Phase II FBOs; and the MCC version is missing data on variables such as phase of FBO training, FBO batch number, and degree of technological adaption. We are currently working on obtaining a complete version of the FBO survey from ISSER.

In theory, the FBO Survey dataset can be used as a baseline for the impact evaluation, and our preceding discussion of the evaluation designs for the agriculture activities assumes that we will do so. However, at this stage, the dataset is missing some key variables that are critical for the evaluation.

1. The only way to match the FBO data with the MiDA intervention sites in order to select a sample of treatment and control farmers for the evaluation is by using the geo-coordinates for the FBOs that are available in the MiDA GIS dataset. Although both datasets contain FBO IDs, these identification codes are different in the two datasets and, therefore, cannot be linked. FBO names are also quite different in the two datasets due to different versions of the names, different spelling, and abbreviations. We have found that we can do a fairly good job of matching FBOs with MiDA intervention sites by using geographical coordinates. However, both versions of the FBO survey we have include only the coordinates for Phase I FBOs. It is essential that we obtain these coordinates for Phase II FBOs as well if we are to use the FBO data in our evaluation. We have contacted ISSER about obtaining this missing data, and will request MiDA's help in facilitating this data acquisition.

2. Some sections in the dataset corresponding to Phase I (in both versions), do not contain variables specified in the survey instrument. In particular, questions contained in Section 10, Part G - Output Details, Main Season and Minor Season of the questionnaires do not have corresponding variables in the dataset – for example, quantity of crop produced, revenues, and post-harvest losses, among others. This section in the survey captures crop harvest during the main and minor seasons and, as such, is important for the evaluation of irrigation and post-harvest activities.

   Note that we are aware of the problem with the data in this section because of its critical importance to the evaluation. It is possible that there are problems with other sections of the database that we have not discovered yet.

   A second wave of the FBO Survey will need to be conducted after the activities are finished, preferably in late 2013. We strongly recommend re-interviewing the same farmers that were interviewed in the first round (Phase I and Phase II) in order to create a panel.

3. Reports produced by ISSER contain information about crop yields. It is not clear from the survey instrument which questions were used to calculate this indicator as there seems to be a mismatch between data and instrument. Crop yield is a very relevant indicator for the evaluation of the agricultural activities, and we would like to be able to compute it and use in our impact evaluations. We will work with ISSER on this issue, but at the present it is unclear if such an indicator is available at baseline or not.

C.3 MiDA GIS Database

We have obtained the GIS Database from MiDA, which contains shapefiles and data for MiDA interventions. While this dataset has proven to be very useful in geo-locating intervention sites

and matching them with FBOs, we have to date, discovered two problems. The first is that FBOs IDs do not match those of the FBO survey. However we are making good progress matching the FBOs and farmers in the two datasets by using the geographical coordinates found in the FBO survey data.

A second problem is that there are several missing data points. For example, shapefiles containing ABC locations were not included with the rest of the GIS data we received from MiDA. We are currently working with MiDA in trying to resolve this issue, but in the meantime we were able to approximate the ABC positions from the district maps that MiDA provided.

We are currently working with MIDA in trying to resolve these issue.

C.4 APEX Data

We have identified seven indicators that are suitable for analyzing the impact of computerization and connectivity of rural banks. The indicators, listed in Section D.2, cover changes in banks' operating efficiency, transaction costs, number and volumes of various types of deposits, and customer base. This data, as mentioned before, is available in banks' monthly returns in either paper or electronic form.

Specifically we need:

1. From the Efficiency Monitoring Unit at APEX, as discussed with Mr. S. Twumasi Ankrah, copies of the complete monthly paper returns for the 134 rural banks starting from January 2009 through month of automation (which would vary by bank).

   We would like to obtain copies of these paper records as soon as possible. We will need to capture these data in electronic format.

2. From the Data Centre at APEX, as discussed with Mr. Michael Appiah, an excel dataset that includes all reporting variables linked to the indicators listed above for the period following automation for each of the 134 banks. This list of variables includes the following:

   - # of customers using demand deposits
   - # of customers using savings deposits
   - # of customers using time deposits (fixed deposits)
   - # of customers using Susu deposits
   - # of customers getting loans
   - # of customers with overdrafts
   - total # customers
   - # of fixed deposits
   - # of demand deposits
   - # of savings deposits
   - total value of demand deposits
   - total value of savings deposits
   - total value of fixed deposits
   - total operating cost (expense)
   - non-interest income (commissions and fees)
   - total income

We do not need the electronic (post-automation) data at this time. However, we do need a firm commitment from APEX that they will provide us with the monthly data by bank for the listed variables when we make a request at a later date. Without these data, the impact evaluation we propose for the financial services activity will not be possible.

At present, we are working with MiDA to set in place an agreement with APEX to ensure that NORC has access to this data.

C.5 School Census, EMIS Database

School censuses are annual, and information is collected through the Education Management System (EMIS). We have identified this database as the main source of data for school-level indicators to be use in our impact evaluation. For this purpose, we will need to have a minimum of two waves of the data, one to be used as baseline and another as endline.

NORC obtained the EMIS for the 2009-2010 school year through our own contacts, and this will serve as a good baseline for the evaluation. It is important to note, however, that we were unable to access this data through the Ministry of Education. It is critical that we make arrangements through MiDA and MCC to ensure that we will be able to obtain the EMIS dataset for the endline, for the 2011-2012 and/or the 2012-2013 school year.

C.6 Population Data from Ghana Statistical Services

Through the EMIS 2010 database, we have access to school-level enrollment numbers. In order to calculate area-specific enrollment rates, we need age and sex specific population data for enumeration areas that fall within each school's catchment area. We hope to obtain this data from the 2010 Census when it is available. We have already made a formal request to Ghana Statistical Services, and would like to request MiDA's help in accessing this data as soon as the final dataset is available.

In order to compute enrollment indicators for the endline we will need population estimates for 2011-2012 or 2012-2013 based on the census 2010, if they are available. This data is usually computed by the statistical institutes, GSS in our case. Otherwise, we will need to use 2010 census data as the base and estimate endline indicators under the assumption that population growth rates are the same across geographical areas of interest.

C.7 School District Data

We have identified key pieces of information that we will to collect at district-level Education Offices, namely, communities that fall into the catchment areas of MiDA and comparison schools, other schools in each catchment area, and other education projects that have been or are being conducted in the districts. The District Education Offices may also be able to provide school-age population figures for each school catchment area; this may be a more direct way to gather this data, rather than estimates based on Census figures. We propose to hire a local consultant to collect necessary data at the district level.

C.8 Summary of Data Sources

Database	Baseline			Endline		
	Available to NORC?	**Status**	**Source**	**Available to NORC?**	**Status**	**Source**
FBO	Yes	Incomplete	ISSER	To be collected		NORC
MiDA GIS	Yes	Incomplete	MIDA	NA		
APEX	No	Requested	APEX	No	Requested	APEX
EMIS	Yes	Complete	IPA	No		MoE
GSS Population	No	Requested	GSS	No		GSS
School District	To be collected		Districts/ NORC	To be collected		Districts/NORC

D. PHASE II WORKPLAN

Below we present a preliminary workplan for Phase II of the evaluation. This workplan is based on the assumption that the evaluation designs presented in this report will be approved by MCC, and that the baseline data necessary to conduct the evaluations, as described in Section B of the reports, are available to NORC.

Task 1: Finalizing Evaluation Designs

During the first two quarters (Jan-June) of 2012, following approval of the Evaluation Design Report by CC, the NORC Team will focus on the following activities:

(1) Complete the collection and compilation of baseline data from existing and new sources (January – May 2012)

To date, we have gathered large amounts of information and some data that has permitted us to propose evaluation designs for each of the activities/sub-activities under consideration. However, as described in Section B above, for every one of the evaluations, we are still missing critical data that will confirm whether the methodologies proposed are feasible. For example, if we are unable to gain access to the complete MiDA-funded FBO Survey dataset, there will be no baseline data for the Irrigation and Post-Harvest activities. Similarly, failure to gain a written commitment from APEX Bank to release to MCC or NORC monthly returns statements for all rural banks would render us unable to conduct the rural bank impact evaluation as proposed. Key activities related to baseline data acquisition include the following:

- Obtain from ISSER the complete version of the FBO Survey dataset with full documentation (assistance from MiDA required before closeout)
- Obtain a complete GIS database, which includes shape files for the full set of MiDA interventions (MiDA cooperation required before closeout)
- As soon as it is available, obtain the Census 2010 dataset from GSS (MiDA assistance required before closeout)

- Sign an agreement from APEX Bank confirming that MCC and NORC will have access to paper and electronic monthly return for 134 rural banks, as specified in the letter sent by NORC to MiDA for transmittal to APEX Bank (MiDA assistance required before closeout; NORC will hire a local consultant to make copies of and conduct data entry of paper reports)
- Collect school-level data (as listed in Section B.3 of this report) from District-level Education Offices in 30 MiDA intervention sites (NORC will hire local consultants to collect this data; a letter from MiDA or MCC may be required)
- Collect export data from the Ghana Airports Company and up to 30 individual exporters who export their products through KIA

Although NORC does not recommend conducting a rigorous impact evaluation for the irrigation activity in Kpong (for reasons discussed in Section B.2), we understand that MCC might choose to pursue an evaluation of this program component. In this case, it will be necessary to conduct a full-scale primary baseline data collection in treatment and control sites before April/May 2012. Towards this end, NORC would revise the FBO Survey questionnaire to directly reflect the needs of the evaluation, and then work with a local data collection firm to develop a data collection plan and protocols, set in place quality control procedures, recruit and train enumerators, pilot test the questionnaire, conduct field work, and enter and process the data.

We anticipate using the better part of the first two quarters of 2012 to fill the gaps in our data sources. This includes collecting data from district-level education offices and paper return from APEX, and entry and processing of this data.

It is critical to emphasize the importance of MiDA support during January and February in helping NORC gain access to critical datasets that have been funded by MiDA, as well as to gain commitments from MiDA counterparts.

We anticipate up to two NORC trips during the first half of 2012 to support and implement these data gathering activities. If a full-fledged adapt collection activity in the Kpong region is required, a much higher level of effort will be required.

(2) Finalize evaluation design and update evaluation design report (May-June 2012)

Based on a review of the data collected/obtained in the first few months of 2012, as well as the commitments gained from data collection agencies and the APEX Bank, NORC will revisit the evaluation designs presented in this report.

One of the key tasks that we will perform using the complete GIS and FBO Survey datasets, as well as any school data collected at the district-level is the conduct of power calculations and identification of treatment and control groups for each intervention where such an approach is feasible.

We will prepare and present a final design report that contains this detail to MCC for review and approval.

(3) Conduct endline data collection (April-September 2013)

In our proposal, we discussed two types of data collection activities:

(1) data collection that will occur prior to Compact close-out (before February 2012); and
(2) post-compact data collection (endline).

Our expectation was that all data collection during the compact would be undertaken by MiDA and its implementing agencies, and that some of this data would be used by NORC for an interim analysis of results to be completed before February 2012. Based on our initial trip to Ghana and discussions with MiDA and implementing agencies, it does not appear to us that an analysis of results at Compact close-out will yield any information on the outcomes of the interventions primarily because many of the activities and sub-activities will not be completed until February 2012. As such, we would like to revisit the discussion of interim results analyses with MCC.

For endline data collection activities, which are listed in Section C.8, the NORC team will develop/refine data collection instruments, recruit and train interviews, pilot test instruments, develop field protocols and quality control procedures, conduct interviews/focus groups, and process the data. We anticipate that the endline data collection activities – namely the second round of the FBO Survey and district-level data collection from Education Offices - will occur in beginning in the second quarter of 2013, thereby allowing a least one year of lag time after Compact closeout. We will also conduct qualitative data collection that supplements the quantitative analysis in 2013; however, we propose conducting the qualitative research for the credit activity somewhat earlier, in mid- 2012, since it is important to gather the information about implementation while those details are still fresh in the minds of implementers and project participants. NORC will also collect secondary data from APEX Bank, GSS, ISSER, and the Ministry of Education through agreements established with these data collection entities to ensure access to data after Compact close-out.

(4) Conduct data analysis and prepare evaluation report (2013/2014)

- Consolidate data from different sources (as identified in Evaluation Design Report) into clean datasets that follow MCC's guidelines for Public Use Data. Ensure that all documentation exists for data collected by NORC and, to the extent possible, for other data sources. (July-December 2013)
- Conduct data analysis in accordance with the impact evaluation designs in the final Design Report – this may include regression analysis with matching, calculation of double difference estimators, qualitative analysis of focus group and/or key informant interview data. (January-May 2014)
- Recalculate ERR at defined endline for each project (January-May 2014).
- Conduct outreach sessions in Ghana for local academics, government statisticians, development professionals, and other interested stakeholders to discuss evaluation implementation, preliminary results, final results, and lessons learned. Conduct 2-3 outreach sessions in Washington for MCC staff and other stakeholders (June 2014)
- Prepare Draft and Final Evaluation reports (July-September 2014)

ANNEX 1: PROPOSED EVALUATION METHODOLOGIES

1. Difference-in-Difference

In this approach we compare changes in outcomes over time between a population that has been treated (treatment group) and a population that has not (comparison or control group). The first difference (the before-and-after) for the treatment group controls for factors that are constant over time in the group. The second difference (treatment vs. controls) aims to control for time varying factors.

The general difference-in-differences estimator is given by:

$$\hat{\varphi}=E(y_{t1} - y_{t0} \mid \mathbf{x}, D=1) - E(y_{c1} - y_{c0} \mid \mathbf{x}, D=0)$$

where,
y = outcome variable
x = observable independent variables
t = treatment group
c = control group
0 = baseline or beginning of study
1 = end of study

Note that treatment and comparison groups do not need to be identical at baseline, however changes in the comparison group should represent what would have happen to the treatment group in absence of the intervention. Difference-in-difference can take care of differences in the treatment and control groups (observable and unobservable) that are time invariant, but does not address the differences that change over time.

The general difference-in-difference models can be reduced to the fixed effect model if the expected conditional y variable only differs by a constant α

$$y_{it} = \alpha D_{it} + \beta \mathbf{x}_{it} + \lambda_t + \mu_i + \varepsilon_{it}$$

where $\mathbf{x}_{it}$ is the vector of the subset of control variables in the vector **x** that vary both across units and time, μ_i is a time-invariant effect unique to unit i, λ_t is a time effect common to all units in period t, and ε_{it} is a unit time-varying error distributed independently across units and time and independently of all μ_i and λ_t (see Galiani, 2002; Chamberlain, 1984; and Heckman and Robb, 1985).

Difference-in-difference can be combined with matching. When using propensity score matching (several different approaches to PSM exist), we try to find units in the control group that are the closest to the treated units by computing the probability that a unit will belong to the treatment based on the observable characteristics. The goal is to mimic a randomized assignment when it does not exist. External validity requires that we find matches for all treatment units, i.e. that we find common support.

We plan to use this approach to evaluate the impact of several activities such as ABCs, Public Pack Houses, Cold Rooms, Irrigation, and Financial Services.

2. Instrumental Variables

In addition to the difference-in-difference approach, we have also proposed using Instrumental Variables. A naive OLS estimator would be biased if the explanatory variables are correlated with the error terms. This is likely to be the case in most of the activities we want to evaluate given that participating FBOs where selected into treatment based on some characteristics unobservable to us. However, if an instrument is available we may obtain consistent estimates. Our instrument must be correlated with the endogenous explanatory variable (treatment, in our case) and uncorrelated with the error term.

We propose to use "distance to facility" as an instrument for treatment given that in our case the location of the farmer is not endogenous. The rationality behind this idea is that some farmers are more likely to participated into treatment given that they are located closer to a particular facility, for example an ABC.

We calculate IV estimates using two-stage least-squares (2SLS). In the first stage, treatment (T) is regressed on all the exogenous variables in the model, Z. The predicted values for T^* are obtained and in the second stage we regress:

$$Y_i = \beta T_i^* + \varepsilon_i$$

3. Regression Discontinuity Approach

In the case of the education activity there is an eligibility ranking and clear cut-offs by district to assign schools to treatment and control. We have therefore proposed a Regression Discontinuity Approach. The RDD strategy exploits the discontinuity around the cut-off score to estimate the counterfactual. The idea is that units close to the threshold, just above and just below the cut-off, are similar.

$$Y_i = \beta_0 + \beta_1 T_i + \beta_2 (X_i - X_c) + \varepsilon_i$$

where:

Y is the outcome variable
T is the treatment dummy
X is the assignment variable
X_c is the cut-off
β_2 predicts outcome from assignment
β_1 is the estimate of treatment effect

ANNEX 2: POWER CALCULATIONS

The objective of the analysis is to determine the power function corresponding to a specified sample size. The power function shows the probability of detecting an effect of specified size. In order to estimate the power, the following must be specified:

1. The impact estimator to be used.
2. The significance level of the test of hypothesis (that the effect is zero).
3. Coefficient of variation of the measure of interest.
4. Sample design and sample size.

Irrigation Activity

For the Golinga and Botanga schemes for which we have data, it is assumed that the sample size will be 75 treatment farmers and 75 control farmers in the baseline survey, and that these same farmers will be re-interviewed in the endline survey, i.e., a panel sampling approach will be used. It is assumed that the panel sampling introduces a correlation of .5 into outcome measures of interest. It is assumed that a double-difference estimator or covariate-adjusted double-difference estimator will be used. The significance level of the test (probability of making a "Type I" error of deciding that the effect is non-zero when in fact it is) is assumed to be $\alpha = .05$. For incomes in rural settings in developing countries, the coefficient of variation (standard deviation divided by the mean) is usually in the range .5 – 2. The value 1 will be assumed.

The following table shows the power function under these assumptions. The effect size, D, is the fractional change in income between baseline and endline, measured by a double-difference estimator. The sample size, n, is the sample size for each design group (treatment before, treatment after, control before, control after).

Sample Size per design group (n)	Power (probability of detecting an effect of size D)											
	D = 0	D=.05	D=.1	D=.15	D=.2	D=.25	D=.3	D=.35	D=.4	D=.45	D=.5	D=.55
75	.05	.092	.151	.234	.337	.455	.576	.691	.789	.865	.919	.956

This table shows that to be detected with high probability (.9 or higher), the effect size (fractional change in income between baseline and endline, as measured by the double-difference estimator) would have to be .5 or larger. This is a substantial change in income. For a smaller change in income, such as .10, the power is quite low (i.e., .151 for D=.1).

Post-harvest intervention: Mango PPH

We use the same assumptions will be made except for sample size, which is assumed to be 45 treatment and 45 control in the baseline and in the endline. It is understood that the distinction between treatment and control may not be clear, and that an instrumental variable may be used in lieu of a binary treatment indicator variable. In this case, the sample size is assumed to be 90 in

the baseline and 90 in the endline, and the sample-size parameter, n, refers to half the total baseline sample size. In this case, the power function is as follows:

Sample Size per design group (n)	Power (probability of detecting an effect of size D)											
	D = 0	D=.05	D=.1	D=.15	D=.2	D=.25	D=.3	D=.35	D=.4	D=.45	D=.5	D=.55
45	.05	.083	.123	.176	.244	.323	.412	.506	.600	.688	.766	.831

This table shows that to detect an income change with moderately high power (.8), the effect size (fractional income change between baseline and endline, measured by a double-difference estimator) would have to be about .55 or larger. If an instrumental-variable estimator is used, the power would likely be less.

ANNEX 3: INFORMATION ON POST-HARVEST INFRASTRUCTURE ACTIVITIES

The following table provides background information on the ten ABCs that are now under construction:

Details of MiDA-Funded Agribusiness Centers					
ABC Name	**District**	**Location**	**No. FBOs**	**No. Members**	**Cost US$**
Northern Region					
IPSL	Savelugu Nanton	Savelugu	20	1003	371,801.68
Savannah Farmers	Tamale Metro	Chanzini	20	826	371,801.68
AMSIG Resources	Tolon	Woribogu Kukuo	20	998	371,801.68
GAABIC	Karanga	Karanga City	20	754	375,178.85
Presbyterian Ag. Services	West Mamprusi	Kperiga	72	3508	390,934.97
Afram Basin					
CPDF	Kwahu North	Kwanpo Ng Nkwanta	20	978	356,818.82
Yawah Shalom	Ejura-Sekyedumasi	Dome (Aframso)	20	975	310,607.76
Victory Feed	Ejura-Sekyedumasi	Bonyon	20	1035	371,007.33
Southwestern Horticultural Belt					
Quality Ag. Services	Manya Krobo	Asesewa	20	984	359,214.82
Seed Shop	Gomoa	Abassa	52	2593	359,214.82
Total cost					**3,638,382.41**
Source: MiDA technical staff					

The following table provides background information on the three Public Pack Houses supported by MIDA:

Public Pack House					
Name	**District**	**Anchor Farmer**	**No. FBOs**	**No. Members**	**Cost (US $000)**
Ajanoa (Pineapple)	Akwapim South	Greenspan Farms, Ltd.	11	492	3,693
Gomoa Otwekrom (Pineapple)	Gomoa	Chartered Impex, Ltd.	8	394	
Akorley (Mango)	Yilo Krobo	None	9	587	
Source: MiDA technical staff					

The outgrowers that are affiliated with the three SPEG exporters with contract farming arrangements are shown in the following table:

FBOs Associated with SPEG Exporters			
Exporter	**FBO**	**Community**	**No. Members**
Bomart Farms	Millennium Co-operative Pineapple Farmers Society Limited	Dobro/Nsawam	14
Prudent Farms	Awutu Bereku Prudent Outgrowers Association	Awutu Bereku	11
Georgefields Farms	Akubresie Pineapple Outgrowers Association	Ayerasu Bendum	12