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CHIMBORAZO RURAL INVESTMENT PROJECT (PIDD)

(EC-L1121)

EVALUATION PLAN

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1. INTRODUCTION

In 2008, the Ecuadorian Central Bank noted that the province of Chimborazo was one of the poorest in the country. In general, the province did not benefit from the broad-based economic growth that occurred in the country during the last decade and, as such, has seemingly stagnated. The poverty rate, for example, has oscillated and is currently around 70%. Much of Chimborazo’s population – which represents approximately 3% of Ecuador’s total – is of indigenous descent and resides in rural areas. The local economy thus revolves around agricultural production. Furthermore, part of the stagnation of the provincial economy can be attributed to a limited ability to expand and market agricultural production, which is generally considered to result from a lack of local infrastructure.

The most common crops produced in Chimborazo are potatoes, beans, and sweet peas. According to the provincial government, however, 99% of Chimborazo farmers lack formal training in production for high-value agricultural markets. Further, 96% of local producers have less than 20 hectares of land to cultivate, and 90% of those producers have between 1 and 5 hectares. Currently, 32% of the producers within the province have irrigation for agricultural production; however, most are in need of construction, improvement, or rehabilitation (GADPC 2012). Irrigation is, thus, a potential gateway to greater production and ultimately an improvement in welfare.

To address these issues, the *Proyecto de Inversiones de Desarrollo*-Chimborazo (PIDD) was initiated in 2008 with the objective of increasing agricultural production and improving access to markets for rural families. Towards this end, the project entailed two primary investments, the first in irrigation improvement and the second in roads improvement. As a result of the project, approximately 50 irrigation systems were to be rehabilitated, benefiting approximately 8,000 families. Further, just over 90 km of roads were to be improved, primarily benefiting families living along three road segments. Although the project did provide these investments, there does not appear to exist an impact evaluation, making the effectiveness of the project in achieving the stated objectives unclear.

The proposed loan is then a follow-up to the original PIDD-Chimborazo (i.e. PIDD-2) and retains a similar emphasis on irrigation and rural road rehabilitation. For PIDD-2, an impact evaluation is envisioned and the objective of this document is to describe in specific detail the plan for conducting this evaluation. Accordingly, the next section provides the underlying theory of change of the project and the primary evaluation questions that emerge. This is followed in Section III by a description of the key indicators for the evaluation, which of course correspond to those included in the Results Matrix. Section IV then provides the overall strategy for creating a counterfactual to ensure that any estimate of impact is unbiased. Given the nature of the project, a non-experimental approach is proposed. Section V then provides the technical and practical details of the evaluation plan.

1. MAIN EVALUATION QUESTIONS

Figure 1 provides the theory of change for PIDD-2 and includes the overall causal logic of the project. As can be seen under Activities, PIDD-2 contains two primary components to improve the welfare of Chimborazo producers.

The first component is an irrigation project designed to give farmers greater access to water, to improve their ability to manage that water, and to provide support to alter agricultural production to take advantage of that water. The irrigation component targets seventeen communities located across Chimborazo that were prioritized in a province-level participatory process. The investments include improving the infrastructure of the irrigation systems as well as the management of the systems through technical support to water users association (WUA). Watershed protection activities aimed at assuring the availability and quality of water at the source are also envisioned. The technical support should help maintain the irrigation systems in the long-term as the members of the WUA should be trained in management of the systems. To ensure that both men and women benefit from the training and development of the WUA, training will include men and women, and the WUA management structures are expected to include female leaders. To facilitate the beneficial usage of improved water access, technical training on agricultural production is also envisioned. Further, select beneficiary communities are expected to receive educational outreach consisting of workshops discussing issues of nutrition and health.

The second component is a road access project designed to reduce future cost of transportation thereby giving rural areas in the targeted region better access to markets, health facilities, and schools. The road access project focuses on two primary locations. First, a road between Pallatanga and Guamote – paved in sections and scheduled to finish in less than two years – that will connect two large agricultural markets located in each *canton*, respectively. The second road is a repaving project of an evacuation route in Penipe. While potentially a valuable investment, the benefits of investing in this road are likely to be seen only when volcanic events occur. Given the uncertainty associated with the occurrence of such events, the impact evaluation of the road component focuses on the impact of the Pallatanga-Guamote road.

The investment in the irrigation systems and roads should lead to a series of outputs or products. If the investments occur as planned, the irrigation systems should be created/rehabilitated and functioning efficiently and sustainably under the management of the water users associations. This should ensure improved water flow for rehabilitated systems and greater water access for everyone in the irrigation system. The project will aim to ensure that the management of the water users association includes both men and women in the management structure, thereby providing benefits to all members of the community. With the improved management of the irrigation systems, protection of the watersheds in which they operate should also improve water availability and quality. Farmers in the irrigation systems should also have received training on production practices that will allow them to take advantage of the improved water access. With respect to the roads, the expectation is that the rehabilitation activities should have occurred allowing for the road to be used.

Verification of whether and when these activities and products occurred will primarily be obtained through the monitoring system of the project, which is designed to capture this information. The Results and the Impacts identified in Figure 1 then note the expected effects of the project if farmers and households in the intervention regions respond in the anticipated manner. The impact evaluation plan is primarily designed to capture this level of effects and these drive our evaluation questions.

With respect to the irrigation system investment, the primary anticipated results are to come through farming practices. With improved irrigation systems and training both in managing water and in new agricultural practices, the expectation is that farmers will adopt efficient water use technologies, new agricultural practices, and expand the number of crop seasons in the agricultural year. These actions should lead farmers to increase their agricultural spending on inputs and increase their agricultural investments. The expanded production and new crops should lead farmers to increase the likelihood they will sell individual agricultural products and increase the ales amounts that farmers tend to receive. Taken together, the response to improved water access should lead to an impact on the level of crop and livestock production as measured by increased productivity and gross margins, as well as on agricultural income generated.

The ability to produce more on the land, given the increased water access, should also lead to higher land values, as the value of land is the discounted future stream of profits. Additionally, the project should create an incentive to invest in land management as it becomes a more important resource for the livelihoods of farmers. This combined with the other project components, especially related to management of the local watersheds, should lead to improved resource management.

With training of both men and women and the inclusion of women in leadership positions in the WUA, the expectation is that income gains will benefit both men and women within the households as well as children. These higher income levels, and the production of a diversified crop portfolio, should improve food security and nutrition. The active inclusion of women in the training should also enhance agency and empowerment for women.

The rehabilitation of the Pallatanga-Guamote road should lower transactions costs since it will decrease travel times between the two locations. It is also likely to reduce travel disruptions during the rainy season. The lower transaction costs should improve market access and allow for greater use of productive inputs and increased sale of outputs throughout the year. As with the irrigation project this should lead to improved agricultural outcomes as well as higher consumption. The lower transportation costs should also lower the cost of access to key services such as health centers and schools. Finally, since the roads will be improved, the operation and maintenance costs of vehicles should be reduced saving households income.

Given these impacts, the key evaluation questions that will be addressed in this impact evaluation will be the following:

1. Will the irrigation investment lead to an alteration of crop and livestock production practices, resulting in higher yields, higher gross margins, and greater agricultural income?
2. Will the irrigation investment result in improved food security and nutrition?
3. Will irrigation system investments and improved watershed management lead to better natural resource management?
4. Will the inclusion of women in the technical training and management of the WUA cause increased agency and empowerment for women?
5. Will improved road access lower transactions costs leading to greater returns to agriculture and thus increased agricultural income and food security?
6. Will improved road access lower transactions costs leading to greater access to services?

Before moving to the key outcome indicators, first it is important to discuss the existing knowledge linked to these questions. The idea that improved irrigation systems and road access can lead to the aforementioned benefits has indeed been considered in similar projects/studies from other developing countries. As such, it is beneficial to further discuss some of the associated literature.

Regarding road improvements, BIDS (2004) found that with improved road access, costs associated with production, consumption, as well as transportation for goods and services decreased for agricultural producers. Such decreased costs have been found to increase the probability and degree of participation in product markets (Vakis et al. 2003; Nkhori 2004). For example, for Peruvian farmers, an additional hour of travel was found to decrease the probability of selecting a particular market by 29% (Valkis et al. 2003). Moreover, Binswanger et al. (1993) and Khandke (2009) illustrated that better road access can lead to increased agricultural production. Benziger (1996) further demonstrated that long-term developments in productivity can be expected. For example, Levy (1996) found that with better access to markets additional agricultural inputs become available to producers, and further reduces the costs of existing inputs. Importantly, the author also demonstrated that with road improvements women potentially witness improved overall health and education outcomes. Finally, Bryceson (2008) echoed the findings of Levy (1996), as the author found that transportation access can lead to improved health and education for young girls.

Turning to irrigation, it has been suggested that such infrastructure is one of the primary determinants of productivity and yield stability (Turral 1995). An analysis of the portfolio of irrigation operations financed by the World Bank shows that between 1998 and 2008, 92% of the analyzed projects reported increases in agricultural production (IEG 2011). The effectiveness of investments has nevertheless been found to depend on the appropriateness of management schemes adopted. Irrigation systems under public administration tend to be operated and maintained inefficiently (Holden and Thobani 1996) and have inadequate cost recovery mechanisms (World Bank 1995). Management via irrigation associations, however, encourages water use efficiency (World Bank 1995) and may increase the demand for labor, the marketing of agricultural products, and lead to a general augmentation of economic activity in the regions of influence (IEG 2009). Further, irrigation can stimulate technological change as well as promote the use of complementary inputs, such as high yielding varieties and agrochemicals (Smith 2004; Bhattarai and Narayananmoorthy 2003; Hasnip et al. 2001; Hussain and Hanjra 2003; Huang et al. 2006). Overall, such changes in the realm of production have been found to positively affect household income (Shah et al. 2003; Van Den Berg 2005), land values (Van Den Berg 2005), as well as improve nutrition outcomes, educational attainment, and access to basic services (Hanjra et al. 2009).

1. KEY OUTCOME INDICATORS

Given the above discussion of the main evaluation questions, it is beneficial to specify in detail the key outcome indicators to be used in the analysis. Table 1 defines the proposed indicators, provides the associated frequency of measurement, as well as the expected data source. Of course, in providing an overall assessment of the program it is important to consider the mechanisms of impact and a complete impact evaluation will include a number of intermediate indicators. These will reflect the causal logic of the program as laid out in the theory of change (Figure 1). Most of these indicator variables are required to calculate the key indicators noted in Table 1 as they are intermediate variables and these will be reflected in the proposed data collection later.

Given the focus of the project on expanding agricultural production through irrigation and rural roads, the key indicators appropriately focus on agricultural outcomes. One concern in using these outcomes is that the project will lead to a shift in labor use as farm households take advantage of new agricultural opportunities. This is, of course, a desirable outcome of the project as labor is expected to move to its most efficient use. However, if labor is shifted from off-farm activities to on-farm activities there is an opportunity cost of that time (as measured in lost income from other activities). In evaluating the impact on agricultural outcomes, it is important to determine the degree to which this factors into the impact of the program and suggests a need to capture information on labor use and income from other activities. This will also be reflected later in the data collection.

**Table 1. Key Outcome Indicators**

|  |  |  |  |
| --- | --- | --- | --- |
| Indicator | Formula / Definition | Freq. of Measurement | Source |
| Yields | Value of output divided by the quantity of land operated | Baseline and follow-up survey | Household questionnaire |
| Gross margins | Returns to fixed factors of agricultural production | Baseline and follow-up survey | Household questionnaire |
| Asset values | Total value of agricultural (e.g. land) and non-agricultural assets | Baseline and follow-up survey | Household questionnaire |
| Agricultural income | Income from agricultural activities | Baseline and follow-up survey | Household questionnaire |
| Food security | Household dietary diversity index. | Baseline and follow-up survey | Household questionnaire |
| Agency/empowerment for women | Employment/occupation/time use, control over own earnings, participation in household decisions, attitudes about gender roles, etc. | Baseline and follow-up survey |  |
| Access to health and education services | Time to health/education facilities, number of visits, perceptions on education/health access, etc. | Baseline and follow-up survey | Household questionnaire |

1. EVALUATION METHODOLOGY

Similarities in the process of beneficiary selection for each component of PIDD-2 imply that a common evaluation methodology can be applied across the constituent elements. As such, in what follows, a general framework is laid out that will permit the evaluation of the intermediate and final impacts of both components of PIDD-2.

*Selection of Control Group*

The research design seeks to estimate the average impact of PIDD-2 on the household-level indicators described above. The principal challenge in the identification of the causal impact of PIDD-2 on these outcomes is answering the following counterfactual question: “What would have been the value of the outcome variable of households in project communities if the project had not been implemented?” Since it is not possible to know what would have happened in the absence of the project, estimating this counterfactual requires a control group that did not have access to PIDD-2, but is identical to the beneficiary households in terms of the distribution of characteristics that affect the outcomes of interest. One way to accomplish this task of obtaining a reasonable counterfactual is to do a randomized controlled trials whereby households are randomly assigned to treatment (e.g. receive PIDD-2) and control (e.g. not receive PIDD-2) groups. Because assignment is random, the average characteristics of treatment and control groups would be similar.

Randomization is not feasible, however, in the case of PIDD-2 for two main reasons. First, eligibility for the receipt of project services requires the expression of demand, either at the *canton*-, *parroquia*-, or community-level. Second, randomizing among the eligible – either across households or across sub-regions – would be politically infeasible, as beneficiaries have been pre-determined via participatory decision-making processes. Given that random selection of treatment and control groups is not feasible, the groups are selected through a carefully considered process as follows. Treatment households are selected from those communities that will receive PIDD-2. For the road component, this entails the selection of households in communities that lie along the Pallatanga-Guamote route. For the irrigation component, this entails selection of households that are members of the benefitting WUAs, as it is expected that all members of the associations benefit in some way. Control households will be selected from the communities that are in the pipeline for future services. To clarify, demand for infrastructure is expressed by initiating, with assistance from the provincial government, a feasibility study of the proposed investment. For the road component, *parroquia*- or *canton*-level public officials initiate such studies. For the irrigation component, the WUAs themselves initiate the studies. With the completion of the studies, for each component of the project a list is compiled of the investments deemed feasible. The number of demanded and feasible investments is, in both cases, nevertheless greater than the associated supply. As such, beneficiary communities have been selected via participatory decision-making processes, as mentioned above. Thus, control households will be selected from those communities that have completed (either fully or partially) the “application” process, but are not included in the current project, mainly due to budget restrictions.

The logic of using the pipeline as a counterfactual follows from the fact that pipeline communities have signaled demand for such services suggesting that they have similar demands, and therefore characteristics, as those receiving the project. Of course, the fact that certain communities have been prioritized in the project suggests the possibility that these early beneficiaries are different in some ways to those that are in the pipeline. This raises concerns the control group may differ from the treatment group in ways other than receipt on the project. To address these concerns, first a careful selection procedure is employed to enhance the possibility that treatment and control will be similar, and second empirical approaches are used to address any remaining potential bias.

Among these pipeline communities, the approach to creating a counterfactual is then to follow three steps. First, an initial assessment of potential control communities will be examined to consider those who do not meet basic criteria such as location. This will create a refined list of potential control communities. Second, using secondary data from the population censuses (2001 and 2010), the agricultural census (2000), and other potential data sources (e.g. Ministry of Agriculture) a statistical matching procedure will be used to identify the best possible counterfactual by identifying both treatment and control communities with similar types of characteristics. This will create a list of treatment and control groups that appear, at least based on observables, to be similar. Finally, this list will be examined by representatives of PIDD-2 for confirmation and modification as necessary. The final list of treatment and control groups will then be the best possible counterfactual for assessing impact given the available information.

*Identification Strategy: Difference-in-Difference*

In order to identify the causal impact of PIDD-2 and address any remaining concerns about the control group, the impact evaluation design will employ a difference-in-difference (DD) strategy. In this strategy, a baseline survey will be administered to both treatment and control households immediately prior to implementation of the project. One follow-up survey will then be administered to the *same* households after PIDD-2 has been implemented in the treatment communities. The basic intuition behind this strategy is as follows. The impact of PIDD-2 will be measured by comparing the change in the mean of the outcome variable(s) for the treatment households versus the control households. By comparing the change in the outcome variable, the DD strategy eliminates potential bias in the impact estimate due to systematic differences in those time-invariant characteristics of households or regions that affect the outcome variables but are difficult to measure.

Within the DD strategy, the following basic regression equation is estimated in order to generate estimates of the average project impact:

 (1)

where  is an outcome variable of interest, such as yields, is the “treatment” variable taking the value one if the household is in the treatment group,  is a period indicator taking the value one if the observation corresponds to the follow-up (post-project) period, and  is a mean-zero error term assumed uncorrelated with the treatment. The parameter  measures, *ceteris paribus*, the average pre-project difference in the outcome variable between treatment and control groups, while  measures the time trend – or the average difference in the outcome variable in the post- versus pre-project periods. Finally,  is the average impact, or treatment effect, of the project.

The regression in Eq. (1) above can be augmented in two ways, as follows:

 (2)

First, baseline values of characteristics that are hypothesized to affect the outcome variable can be included. In Eq. (2), these variables are represented by the vector . Assuming they indeed help predict the outcome variable, the inclusion of these variables reduces the standard error of the impact estimate,. This is important because the more precise is our estimate of (i.e. the smaller is the standard error), the smaller is the sample size required to detect an impact of a given size. It is thus important to draw on economic theory in order to decide what data should be collected and included in the vector . Second, the equation can be augmented to explore impact heterogeneity. In Eq. (2), the vector  represents conditioning variables that are hypothesized to affect the size of the project impact. For example, the impact of PIDD-2 may be expected to be greatest for those households that initially cultivate greater quantities of land (e.g. economies of scale in access to finance). The term , then, represents the difference in household *i*’s farm size from the sample mean. By interacting this term with the treatment and time trend dummies, the coefficient will indicate how this impact varies (relative to the average impact) across farms of different sizes. Again, it is necessary to appeal to economic theory to determine what data should be collected and included in the vector.

*Identification Assumptions and Robustness Checks*

Recall that DD approach identifies the causal impact of the project by comparing the change in the outcome variable across treatment and control groups. As such, unbiased estimation of the treatment effect, , requires that there are no systematic differences across treatment and control groups in terms of unmeasured variables that affect the change in the outcome variable. This is the assumption of “parallel trends,” which states that in the absence of PIDD-2 the average change in the outcome variable of treatment households would have been the same as the average change of the control households. Consider the following violation of the parallel trends assumption. Assume the treated areas have the highest quality public officials who, in turn, are able to attract greater rural infrastructure investment. As a result, even in the absence of PIDD-2, yield *growth* would have been higher in the treatment areas than the control areas (which – in the example -- have lower quality public officials). In this example, the DD estimate would overstate the impact of the project. Ultimately, this critical assumption cannot be tested. However, additional data can be collected in order to provide indirect evidence as to whether or not the assumption holds. Specifically, it would be highly beneficial to collect time series data on outcome variables prior to PIDD-2 for both treatment and control groups. A similar time trend across treatment and control groups for the 10 years prior to PIDD-2 would be strong supporting evidence that the parallel trends assumption holds. By including recall modules, the baseline household survey can also collect data to permit the evaluation of pre-project trends in key outcome variables such as yields, investment, and credit access.

1. TECHNICAL AND PRACTICAL ASPECTS OF THE EVALUATION

This section discusses a number of considerations of technical and practical relevance to the evaluation of PIDD-2. This includes discussion of the sample frame and power calculations, the rural household questionnaire, and data collection procedures, among other considerations.

*Sample Frame and Power Calculations*

The sample frame is the list of the population of interest. For the irrigation component, the population of interest for the treatment group is simply those households that belong to the water users associations receiving the project. With respect to the control group for this component, the population of interest is those households belonging to water users associations in the pipeline for future investments. Turning to the rural roads component, we define the population of interest for the treatment group to be those households residing within in two kilometers of the Pallatanga-Guamote road. Regarding the control group, the population of interest is again those households residing in pipeline communities. A complete listing of households in the population of interest for the irrigation component appears readily available, and thus construction of the sampling frame for this component is straightforward. For the rural roads component, it is envisioned that census data will be used to construct the sample frame on the basis of information available about the treatment and pipeline communities (e.g. community names, locations, etc.).

Given the sample frame, it is necessary to determine the number of surveys required for the evaluation. Accordingly, this section presents the results of power calculations that provide a rough estimate of the sample size needed in order to detect the impact of the project. Power calculations essentially answer the following question: “How large does the sample have to be in order to detect an impact of a given size at a given level of significance?” To answer this question statisticians tend to rely on the power formula. The basic power formula is composed of four pieces of information associated with the (null) hypothesis that the project has no impact on farm households (i.e.  in Eq. [1]). First, the significance level, , is the probability that the null hypothesis is rejected when it is in fact true. Second, the power of a test, , where  is the probability of finding a false negative, is the probability that the null hypothesis is rejected when it is indeed false. Third, the minimum detectable effect, , states how large the project impact must be in order for our strategy to detect the effect at a given significance level and power. Finally, the test incorporates the standard deviation, , of the outcome variable of interest.

Assuming simple random sampling, equally sized treatment and control groups, and that both groups have the same standard deviation, the power formula is then as follows:

 (3)

where  is the critical value associated with the significance level and  is the critical value associated with the power of the test (World Bank 2007). Consistent with the standard of most journal articles, the calculations throughout will be based on  (i.e. a statistical significance of 5%) and  (i.e. a power of 80%). To ensure a sample size sufficiently large for the hypothesis tests associated with each of the indicators of interest, the calculations will be conducted on the basis of a number of alternative outcome variables. Each such calculation will be based on a minimum detectable effect of a 20% increase or decrease in the mean of the associated outcome variable. Such a minimum detectable effect can, in this case, be considered relatively conservative. For example, after receiving the irrigation component, it is expected that beneficiaries will be able to harvest twice instead of once. In this event, a doubling of yields would not be uncommon.

All data used comes from a survey previously administered to agricultural and livestock producers in Chimborazo for an impact evaluation of *Plataformas* (see Cavatassi et al. [2011] for details). From this survey, it has proven possible to retrieve data on yields, time to Riobamba, livestock owned, and select educational outcomes. Table 2 presents the mean, standard deviation, minimum detectable effect, and the results of the power calculations associated with each variable. From the Table, it is evident that the largest sample size is required for yields. Given the stated interest in analyzing the project’s impact on yields and that a smaller sample may lead to difficulties detecting the impact, approximately 1,000 surveys seems appropriate. This number, however, corresponds to the number of surveys that must be collected per project component. Accordingly, 2,000 surveys is the targeted number of surveys.

**Table 2. Power Calculation Results**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variable | Mean | Std. Dev. | *D* | *N* |
| Yields (kg/ha) | 6,053.53 | 6,804.83 | 1,210.71 | 991 |
| Time to Riobamba (private transportation) (minutes) | 31.41 | 25.15 | 6.28 | 503 |
| Time to Riobamba (public transportation) (minutes) | 54.15 | 41.90 | 10.83 | 469 |
| Livestock (number) | 3.65 | 3.52 | 0.73 | 729 |
| HH Head Education (years) | 5.20 | 4.05 | 1.04 | 476 |
| HH Avg. Education (years) | 5.69 | 2.83 | 1.14 | 194 |
| HH Max. Education (years) | 8.70 | 3.95 | 1.74 | 162 |

In administering the survey in the baseline and follow-up periods, it is possible that some households cannot be located or may refuse to respond. Since the above estimate of the sample size is based on completed surveys, it is necessary to consider this in the sample design, thus requiring the sample size to be larger. Note this should not add substantially to costs since the surveys are not administered to the non-respondents. To ensure a large enough sample, it is (conservatively) assumed that non-response and attrition rates are expected to total approximately 20%, which would suggest increasing the initial sample size by that amount. Thus, for each round of data collection, it is recommended to survey 1,200 households for a total of 2,400 surveys.

**Table 3: Data required**

|  |
| --- |
| ***Intermediate household indicators*** |
| * Adoption of water use technologies * Diversification of crop and livestock portfolio * Expenditures on key inputs such as fertilizers and land preparation * Investment in fixed and movable farm assets, including natural resource investments * Placement of women in leadership positions * Access to new and participation in existing markets * Transportation associated transaction costs * Access to health and education facilities * Vehicle operation and maintenance costs |
| ***Final household indicators*** |
| * Farm yields * Gross margins * The value of household assets/wealth * Agricultural and total household income * Food security and dietary diversity * Agency and empowerment * Use of health and education facilities |
| ***Geographic information*** |
| * Municipality, parroquia, canton, etc. of the household * Access to infrastructure (e.g. distance of the household from nearest major road or primary/secondary school, location of nearest water source, etc.), preferably through the use of geographic position systems (GPS) |
| ***Household characteristics*** |
| * Age, gender, relationship to household head, marital status, etc. for each household member * Literacy and years of schooling of each household member * Household migration history and receipt of remittances |
| ***Agricultural assets*** |
| * Land holdings * Agricultural equipment * Existence of production issues (e.g. infestation, flooding, etc.) |
| ***Other assets*** |
| * Non-agricultural assets * Household durables (e.g. type, quantity, and value of durables) * Conditions of the household’s dwelling. |
| ***Organization/association*** |
| * Participation in other government programs * Participation in producer organization, cooperative, etc. * Receipt of technical assistance |

*Rural Household Questionnaire*

The objective of the PIDD-2 survey of rural households is to obtain – from both treatment and control groups from both project components – information pertaining to the impact/outcome variables of interest as well as a number of conditioning variables that are hypothesized to affect the outcome variables. The primary justification for the inclusion of conditioning variables is to improve the precision of the impact estimates. A detailed list of the outcome and conditioning variables is provided in Table 3. As discussed, the household-level impact indicators can be classified into two groups: intermediate and final. The consistent estimation of the project impact also requires gathering information on select control variables, which are noted in Table 3 following the indicators.

Given the variables required for the analysis, it is then possible to outline the questionnaire by which the data is to be collected. Table 4 provides an overview of the modules of the questionnaire. Each section of the questionnaire can be justified through its link to the variables noted in Table 3.

**Table 4: Modules of household questionnaire**

|  |
| --- |
| ***Set-up/Household Identification*** |
| * Section A.1: Identification of the household/production unit (e.g. name of respondent, location of household, project beneficiary status, etc.) * Section A.2: Identification of the interview/interviewer (e.g. name of interviewer, time started and finished of the interview, etc.) * Section A.3: GPS coordinates and related information |
| ***Module 1: Household Demographics and Social Service Access*** |
| * Section 1.1: Household members (e.g. age, gender, relationship to household head, marital status, years of schooling, etc. of each household member) * Section 1.2: Education and health access (e.g. individual school enrollment, attendance and access, use of health system and access, etc. ) |
| ***Module 2: Agricultural Parcels*** |
| * Section 2.1: General parcel information (e.g. location, area, use, etc.) * Section 2.2: Detailed characteristics of owned parcels (e.g. tenure status/security, irrigation, irrigation technology, soil type/quality, etc.) * Section 2.3: Parcels rented, sharecropped, or lent from others (e.g. payment information, use, irrigation, etc.) * Section 2.4: Parcels rented, sharecropped, or lent to others (e.g. payment received, use, irrigation, etc.) * Section 2.5: Land market participation (e.g. size, price, date, etc. of land purchased or sold in the past five years) * Section 2.6: Investment in parcel (type, cost, etc.) |
| ***Module 3: Agricultural Costs and Production*** |
| * Section 3.1: Parcel use (e.g. annual and permanent crops planted by season) * Section 3.2: Annual input usage and costs (e.g. type, quantity, and cost of seeds, fertilizers, pesticides, equipment, labor use disaggregated by gender, transportation, etc. utilized) * Section 3.3: Crop production, sales and post-harvest use (e.g. crops cultivated, area planted, revenue received, market access, etc.) * Section 3.4: Permanent crop inventory, production, and sales (e.g. crops cultivated, area planted, costs, and revenue) |
| ***Module 4: Livestock*** |
| * Section 4.1: Inventory (e.g. number and value of animals owned, investment in last year) * Section 4.2: Livestock production and costs (e.g. sales, household consumption, and costs) |
| ***Module 5: Off-farm Income*** |
| * Section 5.1: Wage income (e.g. occupation, hours worked, and earnings disaggregated by gender) * Section 5.2: Business income (e.g. activity, sales, and costs) |
| ***Module 6: Food diversity*** |
| * Section 6.1: Food diversity (e.g. consumption in previous seven days of key products that form household diversity index) |
| ***Module 7: Migration*** |
| * Section 7.1: Migration information (e.g. location of migration, migrating household member, and remittances received) |
| ***Module 8: Savings and Credit*** |
| * Section 8.1: Savings (e.g. institution of savings location, household member to which savings belongs, and amount saved) * Section 8.2: Credit (e.g. participation in credit market, quantity of any credit obtained, interest rate, and collateral requirements) |
| ***Module 9: Assets*** |
| * Section 9.1: Agricultural assets (e.g. type, quantity, and value of assets, investment in previous year) * Section 9.2: Non-agricultural assets (e.g. type, quantity, and value of assets, investment in previous year) * Section 9.3: Dwelling characteristics (e.g. location, material used in dwelling’s construction, nearby water sources, electricity, investment in previous year, etc.) * Section 9.4: Vehicle Ownership and Use (e.g. type, quantity, and value of vehicles owned, maintenance and operation costs in previous year.) |
| ***Module 10: Organization, Association and Social Standing*** |
| * Section 10.1: Participation in water user associations (e.g. position in association, meetings, etc.) * Section 10.2: Support from government or non-governmental organizations (e.g. source, type, and quantity of benefits disaggregated by gender) * Section 10.3: Social capital (e.g. participation in producer’s organization, cooperative, etc. disaggregated by gender) * Section 10.4: Social standing (e.g. questions indicating agency and empowerment) |

*Data collection*

Given discussion of the sample frame, sample size, and questionnaire, it is then beneficial to discuss the strategy and timing of the data collection. Table 5 provides the distribution of surveys across the treatment and control groups for the two survey rounds for each component of the project.

**Table 5: Distribution of household questionnaires**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Irrigation | | Rural Roads | |  |
|  | Treatment | Control | Treatment | Control | Total |
| Baseline | 300 | 300 | 300 | 300 | 1,200 |
| Follow-up | 300 | 300 | 300 | 300 | 1,200 |
| Total | 600 | 600 | 600 | 600 | 2,400 |

The baseline survey is to be conducted in the second half of Year 1 where a total of 1,200 surveys will be administered. For the irrigation component, it is envisioned that 16 surveys will be administered in each community in the treatment and control groups. As there are 19 treated communities to be matched with 19 control communities, 16 surveys per community yields approximately 600 baseline surveys. The specific households to be surveyed within each group are to be selected randomly from the sample frame. Regarding the rural roads component, it is envisioned that 12 surveys will be conducted in each community in the treatment and control groups. Given that there are 27 treated communities to be matched to 27 control communities, 12 surveys per community yields approximately 600 baseline surveys as well. Again, the specific households will be selected randomly from the sample frame.

The follow-up survey is to be conducted in the second half of Year 3 where an additional 1,200 surveys will be administered. Importantly, the follow-up surveys are to be administered to the same 1,200 households that were surveyed in the baseline. Thus, no further sampling is necessary at this stage. Given the 1,200 surveys administered at the baseline and the 1,200 administered at follow-up, it is then evident that a total of 2,400 surveys are planned.

*Expected Costs and Timing of Survey Administration*

The cost of survey administration includes all aspects of the administration, from implementation in the field through data entry and cleaning. A specific budget for all activities for survey administration should be obtained from the firm hired to do the work. However, estimates of survey costs can be constructed on the basis of previous experience and knowledge of labor and transportation costs in the project area. For Chimborazo, each survey is estimated to cost approximately $75. With 1,200 questionnaires required per survey round, the cost to administer each survey round is $90,000. Additional costs for supporting the survey and analyzing the data, however, must be included. These will be higher in the second round and are estimated to be $7,500 for the baseline and $12,500 for the follow-up. Table 3 presents the expected costs by key evaluation activity and the time at which each cost is expected to be incurred.

Table 3. Expected Costs of Survey Administration

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Key Evaluation Activities | Year 1 | | Year 2 | | Year 3 | | Year 4 | | Year 5 | | Cost  ($) |
| 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 |
| Baseline data collection |  |  |  |  |  |  |  |  |  |  | $90,000 |
| Baseline data analysis |  |  |  |  |  |  |  |  |  |  | $7,500 |
| Follow-up data collection |  |  |  |  |  |  |  |  |  |  | $90,000 |
| Follow-up data analysis |  |  |  |  |  |  |  |  |  |  | $7,500 |
| Final impact evaluation |  |  |  |  |  |  |  |  |  |  | $5,000 |
| **Total Cost:** | | | | | | | | | | | $200,000 |

*Responsibilities and reporting*

The project execution unit in the Province of Chimborazo will be in charge of implementing the impact evaluation. They will provide support from RND and SPD on the administration of the plan as well as the subsequent analysis of the data.

Four reports will be completed as part of the impact evaluation. The dates of completion will depend on the specific dates of implementation of the impact evaluation and so the expected date are noted relative to the data collection.

1. *Impact evaluation plan:* This document will provide a detailed design of how the impact evaluation will be administered. It will be largely based on this plan with changes made as necessary to adjust for changes in the project and with more detail on the implementation of the survey. *Completion:* Two month prior to the administration of the baseline survey.
2. *Baseline report*: This document will provide details of how the baseline was administered, including any deviations that occurred from the impact evaluation design. The report will include all documents associated with the baseline administration including the questionnaire, enumerator guidelines, etc. Basic descriptive statistics of the data will also be included as well as an assessment of the success of the evaluation to create a reasonable counterfactual. Completion: Three months after the baseline survey administration.
3. *Follow-up survey report*: Like the baseline report, this document will provide details of how the follow-up survey was administered, including any deviations that occurred from the impact evaluation design. The report will include all documents associated with the post-treatment survey administration including the questionnaire, enumerator guidelines, etc. Basic descriptive statistics of the data will also be included. Completion: Three months after the follow-up survey administration.
4. *Impact evaluation report:* Using data from both rounds of data collection, this report will provide an assessment of the impact of the program on the key indicators noted earlier in this plan. The ultimately objective of the report is to answer the questions posed earlier in the plan, provide an overall assessment of the effectiveness of the project and to offer lessons learned. Completion: Nine months after the follow-up survey administration.

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