IMPACT ASSESSMENT REPORT

Bolivia (Plurinational State of)

Plan VIDA-PEEP to Eradicate Extreme Poverty – Phase I

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IFAD
Investing in rural people

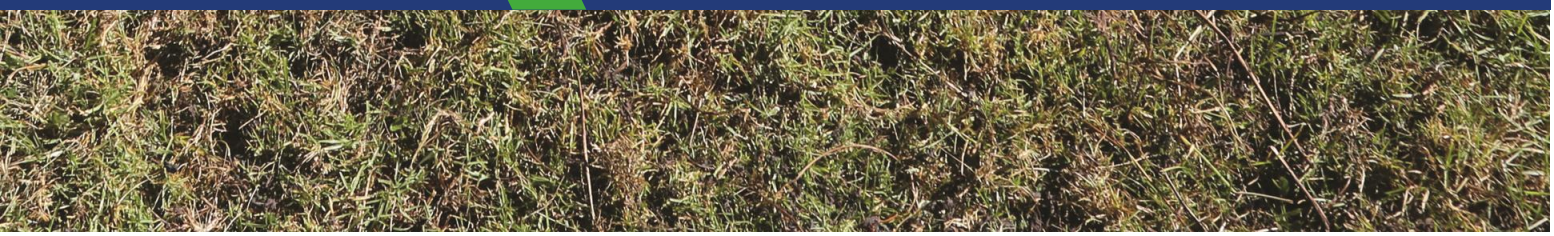

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Table of contents

Executive Summary

Over half of the rural population in Bolivia today live below the national poverty line. As agriculture represents the main source of livelihood for more than 75 per cent of this rural population, supporting the livelihoods of rural farming households is key to tackling extreme poverty in the country. In August 2011, implementation began on the project Plan VIDA-PEEP (PPV), an initiative financed jointly between IFAD and the Bolivian Government as part of the country's National Development Plan. It aimed to improve the livelihoods of households residing in vulnerable municipalities in the departments of Potosi and Cochabamba through capacity building, financing of rural development projects, and supporting citizenship and social inclusion. The project lasted five years in total and was completed in December, 2016. Plan VIDA was implemented in 8 municipalities in the southern part of Cochabamba department, and in 14 municipalities in the northern area of the Potosí department.

The current impact assessment examines the effectiveness of one component of the Plan VIDA project. Under this component, the project provided financial resources to communities for the implementation of rural development projects and to municipalities for the realization of production infrastructure projects. In particular, the evaluation focuses on a specific category of projects – Community Based Productive Investments (*Proyectos Inter Comunales - PICs*) – which account for more than 90 per cent of total beneficiary households reached by Plan VIDA

The interventions financed are chosen among a set of community-developed proposals and are therefore of a participatory and collective nature. Nonetheless, about 80 per cent of interventions provided involved distribution of new locally adapted (*criollo*) or improved livestock breeds to individual households. Thus, the project offers a unique research opportunity to assess both its community-based development approach and the effectiveness of its livestock inputs. This impact assessment investigates whether the Plan VIDA project contributes to well-being of beneficiaries measured through key outcome indicators of economic mobility, resilience and nutrition to respond to IFAD's strategic objectives and goals and to Bolivia's National Development Plan.

To answer these questions, this ex-post evaluation applies a mixed-methods approach that combines non-experimental statistical methods and qualitative analysis to compare a sample of project beneficiaries to non-participants.

Results show positive impact on a range of economic mobility indicators related to assets ownership as well as on agricultural income, which constitutes the larger share of total income for the households in the sample. Households' ability to recover from economic and climatic shocks does not show a significant improvement overall. Measures of dietary diversity and food security appear unchanged in the overall sample, but we find positive impact on dietary diversity for projects in Potosí when disaggregating by department. When constraining the sample to livestock projects – the project type chosen by around 80 per cent of *PICs* beneficiaries – the impacts on economic mobility indicators and agricultural income appear to be even stronger. Furthermore, the indicator for resilience detects positive and significant impact for all beneficiaries, as does the measure for dietary diversity where beneficiaries increased consumption of cereals and tubers, eggs , milk and dairy products.

For agricultural production, we find impacts for both crop and livestock net income, likely driven by greater holdings of improved breeds, and increased crop productivity and use of improved seeds.

Finally, indicators of social capital provide mixed results. Though there appear to be no differences in group participation between treatment and control communities, beneficiaries are more likely to have a household member as a leader in a community group. The strength of social networks shows no

impact, likely because social cohesion in the sampled communities was already high and acts as a facilitator of project impacts rather than an impact itself.

The results of this study show that even community-based development could be more effective when consisting of focussed interventions with a strong and clear constructed logic. This has relevance for the design of new community-driven development projects where there is an inherent risk of delivering scattered interventions in order to respond to the needs and preferences of participant communities. Concentrating on a less diversified set of development priorities, may lead to larger and more positive impacts not only in terms of direct project indicators but also of indirect ones (*i.e.* dietary diversity and the ability to recover from shocks) contributing to a virtuous transformative cycle.

The study particularly highlights that the specific logic of livestock interventions has created some decisive synergies determining positive overall impacts for their beneficiaries. However, the results suggests that there is scope for improvement particularly when it comes to market access. This finding provides evidence to support the case for a more strategic approach at design of future similar initiatives which should work along the entire value chain integrating components that focuses on linking farmers and livestock herders to the market in order to bolster impact.

1. Introduction

The most recent data from the Bolivia National Statistical Institute (2016) report that 56.93 per cent of the rural population in Bolivia live below the national poverty line. In rural areas, agriculture represents the main source of livelihood for more than 75 per cent of the population, while the remaining share of the population is employed in other activities such as small trade and vehicle reparation, manufacturing, and wage labour (INE, 2016).

In August 2011, implementation began on the project Plan VIDA-PEEP (PPV), an initiative financed jointly between IFAD and the Bolivian Government as part of the country's National Development Plan. It aimed to reduce extreme poverty in rural areas and improve the livelihoods of households residing in vulnerable municipalities in the departments of Potosi and Cochabamba through capacity building, financing of rural development projects, and by supporting citizenship and social inclusion. The project lasted five years in total and was completed in December, 2016.

The project was designed around two main components. The first component aimed at increasing means of production and at strengthening their management. This would be achieved through financial support to communities for the implementation of rural development projects and to municipalities for the realization of production infrastructure projects. The second component consisted on community training and capacity building focussed on organizational and productive capacity. It included campaigns aimed at documenting unregistered people in targeted municipalities which should lead to increased social inclusion and access to basic and financial services. In Bolivia, such documentation has been shown to mitigate cases of political and social exclusion (Harbitz and Tamargo 2009).

This impact assessment here reported looks at the effects of rural development projects funded by Plan VIDA on the livelihood of rural households residing in beneficiary communities (*i.e.* Component 1). In particular, the evaluation focuses on a specific category of projects – Community Based Productive Investments (*Proyectos Inter Comunales - PICs*) – which account for more than 90 per cent of total beneficiary households reached by Plan VIDA at completion and also constitute the vast majority of the recipients of capacity building activities (*i.e.* Component 2)[1].

There are two aspects of the project which are important to note: first, the interventions financed are chosen among a set of community-developed proposals and are therefore of a participatory and collective nature. Interventions financed are thereafter implemented and co-financed collectively by project beneficiaries that can be from the same or from neighbouring communities. The *PICs* were implemented through a collaborative effort among neighbouring communities (who formed what is called a *Grupo Zonal*) and managed at the local level by the same community members who were responsible for managing the project including the acquisition of inputs, bookkeeping, accounting and reporting to Plan VIDA implementers. As a community-driven development initiative, such project management intends to create social cohesion by encouraging community members to work together (White 2018). In addition to community-based project development and management, Plan VIDA required a financial contribution (*contraparte*) from participants equal to 20 per cent of the cost of inputs. Through this mechanism it was expected to ensure sustained participation and create a sense of community-level and household-level ownership over the project. Though this paradigm has

[1] The remaining 10 per cent of project's beneficiaries are rather scattered among different types of community level initiatives oriented towards various types of value added projects – called *Proyectos de Iniciativas Comunitarias con Valor Agregado* (*PICVAs*) which it was considered appropriate not to include in the impact assessment.

a well-established history among development projects both worldwide and in Bolivia (see Pouliquen, 1999), there is still little evidence linking beneficiary financial contributions to project efficacy.

The second relevant aspect of the intervention lies in the input itself. Though *PICs* differed according to the needs and preferences of the participant communities, it resulted that about 80 per cent of interventions provided involved distribution of new locally adapted (*criollo*) or improved livestock breeds to individual households. This is not surprising since the economy in the area is mainly livestock driven as livestock is a major source of income and livelihood for families residing in marginal rural areas of Bolivia and also an important coping and adaptation strategy to climate variability as pastoral systems are less susceptible to climate stress than cropping and other agricultural activities (Valdivia et al., 2003). However, poor households often lack access to the resources and to information needed to upgrade livestock care and health and increase or maintain the herd size as well as its productivity and profitability.

This impact assessment investigates whether the Plan VIDA project, with its unique mechanisms, contributes to well-being of beneficiaries measured through key outcome indicators of economic mobility, resilience and nutrition to respond to IFAD's strategic objectives and goals and to Bolivia's National Development Plan.

To answer these questions, this ex-post evaluation applies a quasi-experimental design approach that combines statistical methods and qualitative analysis to identify a valid counterfactual.

As sufficient data was not collected at baseline of the project, we rely on one round of data collected between August and September 2017 that is, about eight months after project completion. Data are collected from 2,751 household including beneficiaries of the project, indirect beneficiaries (those in the same community but not direct recipients of intervention), and households which serve as control group. The dataset contains information about households' socioeconomic characteristics, livelihood and income-generating activities, food consumption, social capital, and experience of climatic and economic shocks.

It is important to note that the sample is restricted to *PICs* whose last disbursement date fall before August 2016 and with a duration above nine months. This is justified by the specific type of inputs received by beneficiaries through Plan VIDA finance (*i.e.* introduction of new livestock breeds, improved seeds or new crop varieties) for which production benefits are reasonably expected to happen within at least one year from the completion of the investment. Our project population of interest is therefore comprised of households residing in communities where livestock or agricultural *PICs* had been fully implemented by August 2016 and lasted at least 9 months.

The remainder of the report is structured as follows. We begin Section 2 by outlining the project's theory of change and elaborating on its key objectives and activities. A description of the target population follows with the main research questions of the assessment. Section 3 provides details on the methodology employed for the assessment, including the construction of the counterfactual, and on the data collected with main summary statistics for our sample reported in Section 4. Section 5 presents the results of the assessment for the full sample and for the subsamples of interest, followed by a discussion of the implications of the results and a summary of the main lessons learned in Section 6.

2. Theory of change and research questions

The Plan VIDA project was designed to address the problem of extreme poverty in rural areas of Bolivia, a major obligation of the country's National Development Plan. To address this challenge, in addition to increasing income and assets, the intervention aimed to impact measures of well-being that contribute to the sustainability of such gains; namely, increased food security and resilience. We expect these two impact-level measures to be bolstered by increased income and asset holdings thanks to higher productive gains and diversification. The project theory of change is illustrated in Figure 1 and detailed in full in the Impact Assessment Plan (Paolantonio et al., 2017). For this report, we briefly highlight some important causal pathways.

2.1 Plan VIDA theory of change

Vulnerability is one of the many dimensions of poverty and it is mainly related to exposure to risk and, therefore, to household's ability to prevent, mitigate and cope with various shocks. The causal relationship between risk exposure and poverty operates in two directions. On one hand, poor households are typically more exposed to risk and least protected from it, with direct consequences on their well-being and welfare. However, on the other side, poverty can also increase the degree of exposure by pushing households into insecure or unsafe situations to avoid extreme income poverty or food insecurity (Hoogeveen et al., 2004).

Heltberg et al. (2015) provide a useful review of case studies which finds that responses to climate and disaster shocks often include selling assets and, particularly in the case of poorer households, consuming fewer food items. Unsurprisingly, households' ability to protect against shocks correlates greatly with their chances of upward economic mobility, where the latter is defined as any change in household's economic status including income, wealth, food diversity or nutrition.

Concurrently, an increase in income, thanks to income diversification strategies or to improved agricultural production and revenues, would contribute – in the long run – to increased ownership of assets, both durable and productive. This seems particularly important for families who rely on a single main asset, as it is the case of livestock in rural Bolivia, for which the evidence of "poverty trap" is robust (McKay and Perge, 2013). Increasing other types of assets would prepare those households for negative economic shocks thus contributing to reduced vulnerability, while also enhancing their current and future well-being, social empowerment, and civic engagement (Quisumbing et al., 2015).

Crop diversification and diversification of farm production more broadly (Pellegrini and Tasciotti, 2014; Sibhatu et al., 2015) is another important livelihood strategy in rural communities, such that increasing the productive diversity of a household should lead to mitigation of the risk of crop failure but also to greater dietary diversity and, therefore, improved nutrition and food security.

To examine the causal chain from project activities to the diversification of household production and the overall income of rural smallholders in Bolivia, the assessment measures sales of crops and livestock and, more specifically, the diversity of the crops and livestock managed. We expect to see an increase in income diversity as a result of farmers being more able to sell crops, livestock or livestock products to the market thanks to greater production. Additionally, increased income would free resources to engage in other non-farm income-generating activities.

Figure 1: Plan VIDA theory of change

In order to achieve its impact, the project adopted a participatory planning approach through which community members could choose their own development pathway based on the community's productive potential, economic interest and cultural inclination. Project activities involved concrete agricultural investments, mainly in the form of production inputs and services. As already pointed out, these interventions are referred to as *PICs* in project documents and constitute the core of Component 1[2].

Although the exact nature of the intervention differs between communities, as each *Grupo Zonal* had considerable decision-making power over the investments to be realized using project's finance, activities most often included livestock and to a less extent crop production, water management (mainly micro-irrigation) and soil reclamation. In particular, the vast majority (about 80 per cent) of communities choose to receive finance for livestock projects, which included the provision of new locally adapted or improved livestock breeds and support and training in care and reproductive strategies.

Camelids, cattle, sheep and goats are a major source of income and livelihood of many families in marginal rural areas in Bolivia. However, poor households often lack the resources and information needed to upgrade livestock care and health and, consequently, increase the herd as well as its productivity and profitability. Improved bovine and ovine breeds[3] offer good promise for boosting livelihoods thanks to their greater economic potential: that is, higher quality and quantity of meat, milk and wool produced, increased animal growth rates and lower mortality rates. Further, in rural communities, ownership of exotic breeds is often associated with social status and prestige (MACA, 2004). Improved livestock raring, however, requires certain knowledge and expertise to guarantee full adaptation to local conditions and the realization of expected benefits. Research in neighbouring Peru found that moving toward improved breeds of livestock had mixed results on households' movement out of poverty: in some cases livestock production doubled, with over half of beneficiaries moving out of poverty. While in other cases, production suffered in households with higher rates of improved breeds (Kristjanson et al., 2007). Though there is a wealth of evidence supporting the productive potential of improved livestock breeds, the mechanisms determining the success or failure of such projects are still understudied. Nonetheless, locally adapted breeds can be less productive compared to the "high-yielding" exotic breeds but they are better adapted to their environment and can better survive the harsh conditions compared to introduced species.

Finally, as individual projects were community-driven and managed, positive impacts would be more likely for communities who are well trained in project and financial management. Indeed, literature shows that such community-based livestock breeding programmes are most effective when local institutions are involved in their planning and implementation. Such institutions need both organizational and technical support, in addition to the financial support received (Mueller et al., 2015). Thus, as a supportive foundation for the inputs detailed above, the project also involved a second component which provided training and capacity building at the community level in order to strengthen the organizational ability of community members as well as their project management skills. Additionally, activities included the use of gender analysis tools in the participatory rural appraisal at the community level to increase and facilitate women participation and inclusion in collective planning as well as campaigns to document beneficiaries (*i.e.* providing registered forms

[2] More precisely, *PICs* ended up constituting the core of the whole intervention as they comprised about 90 per cent of beneficiaries of Component 1, where the latter accounted for more than 80 per cent of total project's cost, and more than 90per cent of total project's beneficiaries (more precisely, 14,500 households out of a total fo 15,850 households reached).

[3] The most common improved breeds in Bolivia include exotic cattle and sheep species that were adapted to local conditions such as Holstein, Brown Suiss, Jersey, and Hamphire down (MACA, 2004).

of identification[4]) to increase their access to institutional or financial resources such as credit and savings. These impacts are expected to contribute to communities' social capital and empowerment more broadly. On the other hand a strong social capital is expected to work in synergy with mechanisms leading to impacts related to income, dietary diversity and resilience. It is important to note that while the requirement of a *contraparte* from project's beneficiaries is not an input nor an activity per se, it is expected to serve as an important mechanism through which the project multiplies its impact. In theory, this financial contribution functions as a sort of community deposit on the intervention: ensuring that beneficiaries are committed enough to participate for the whole duration of the project.

2.2 Project coverage and targeting

Plan VIDA was implemented in 8 municipalities in the southern part of Cochabamba department, and in 14 municipalities in the northern area of the Potosí department. The population comprises members of rural communities characterized by extreme poverty, limited access to resources, and deteriorated means of production. Figure 2 shows the areas covered by the project under assessment, while Table 1 lists all targeted municipalities by department.

The project was approved in December 17th, 2009 and became effective in August 10th, 2011. The original duration of the project was 5 years but it was extended for 15 additional months as per request of the Bolivian Ministry of Planning and Development due to initial delays in implementation. The closing date of the project was June 30th, 2017 (completion date was December 31st, 2016). The total cost of the project was US$15.3 million with a contribution from IFAD of about US$7.1 million. The rest was financed by the Bolivian Government (US$4.3 million), and with contributions of beneficiaries (US$2.9 million).

Figure 2: Plan VIDA project areas

Source: IFAD

[4] The type of documents conferred were mainly ID cards and birth certificates.

Table 1: List of project municipalties by department

Department	Municipality
Cochabamba	Arque, Bolívar, Cocapata, Independencia, Morochata, Sicaya, Tacopaya, Tapacarí,
Potosí	Acacio, Arampampa, Caripuyo, Colquechaca, Chayanta, Chuquihuta, Llallagua, Ocurí, Pocoata, Ravelo, Sacaca, San Pedro de Buena Vista, Toro Toro, Uncía

Source: Project's documents

The targeting strategy for the project involved a complex process with multiple stakeholders. Municipalities were selected based on an integrated analysis of a various poverty indicators, namely (i) country poverty line, (ii) Food Security Analysis, (iii) Human Development Index (HDI), and (iv) Unsatisfied Basic Needs (NBI). Within each municipality, the selection of beneficiary communities was done by *ad hoc* constituted committees – the so called *Comités de Priorización y Aprobación de Proyectos* (*CPAP*) – formed by members of the municipal government, provincial government, and civic organizations and overseen by Plan VIDA representatives. Each committee established their own selection criteria, but generally prioritized communities with: high levels of poverty, productive potential, and physical accessibility. Furthermore, members of the communities must have been willing to provide labour as well as to contribute in-cash and in-kind to the project. Finally, as the project involved implementation via *Grupos Zonales*, communities which were geographically close to each other (and thus could more easily form a collaborative group) were more likely to be selected – particularly if the communities had not recently received support from any other project (Gerenssa, 2017).

2.3 Research questions

Keeping the project's theory of change and its target population in mind, we conducted an impact assessment with the aim of answering the following questions:

- Does the project translate into a higher income and increased asset? Did this happen through increases in production, sales and therefore profits of agricultural and livestock production?
- Does the project translate into more diversified income sources and crop/livestock activities ? Does this translates into more diversified diets and better food security?
- Do project's beneficiaries exhibit greater resilience to negative exogenous shocks?
- Is there a stronger social capital in beneficiaries' communities in terms of larger number of associations and stronger participation or leadership? And have female household members in beneficiary communities been able to play a stronger role in social capital and social participation?
- How the above results differ across groups of beneficiaries based on the type of project intervention received and their the area of residence?

3. Impact assessment design: Data and methodology

3.1 Data

In order to answer the posed questions, this ex-post impact assessment employs a quasi-experimental mixed-methods approach, using both qualitative and quantitative data to aid the construction of an appropriate counterfactual.

The main problem of impact evaluation lies in the impossibility of observing the same unit of analysis in the presence and, at the same time, in the absence of the project and therefore being able to compare the situation with and without the project for this same unit of analysis. The solution to this problem implies identifying a proper counterfactual to compare a representative sample of project's beneficiaries with a control group that has the same characteristics of the beneficiary (treatment) group except for the fact of not having received the intervention. When the intervention is not assigned randomly, the identification of a valid control group is not a trivial task as, in order to represent a valid counterfactual, the distribution of its observable characteristics has to be similar that of the treatment group and not being related with treatment assignment nor its impact indicators.

In the case of Plan VIDA, though the project was assigned at the community level, individual households could opt in or out depending on their willingness to participate and provide cash contribution to the project. Consequently, the evaluation methodology must address two rounds of selection bias: first, the targeted selection of communities, and second, the self-selection of community members. Thus, both the sampling methodology as well as the econometric approach were chosen with this challenge in mind.

The qualitative work was conducted prior to quantitative data collection and consisted in a number of Key Informant Interviews (KIIs) and Focus Groups Discussions (FGDs) with key project stakeholders (Plan VIDA staff and implementers, members of the *CPAP*, etc.) as well as with participant and non-participant households. The original scope was to gain additional information to improve the design of the impact assessment, especially its sampling framework and the identification of a valid control group. In particular, the qualitative exercise focused on acquiring a better understanding of: (i) project targeting and the selection process of beneficiary communities; (ii) the characteristics of participant and non-participant communities as well as of direct and indirect beneficiaries (to be able to shed some light on possible self-selection mechanisms); (iii) potential spillover and unintended effects.

Results from the qualitative analysis (Gerenssa, 2017) identify six main factors that drove selection of communities for project implementation: incidence of poverty, productive potential (whereby this required agricultural use of land and livestock herding in a given community), road access, willingness to provide labour and in-kind or cash contributions (*contraparte*) to the project, and the ability to form *Grupos Zonales* with other neighbouring communities.

Based on these findings, we elaborated a two-stage sampling strategy that would ensure the most appropriate communities and respondents were selected to act as controls. First, a sample of communities was to be conducted.

To replicate community selection the following steps were undertaken: first a high resolution map for Cohabamba e Potosí, the two areas of project intervention, was obtained divided by municipality and communities; second the beneficiary communities were located and key data on road access,

population, and poverty level were reported for each participant village; third a random selection of 90 beneficiary communities was selected; fourth a set of villages similar to the selected treated villages with regard to the above mentioned criteria and located within a polygon of 10 km was also mapped; fifth a selection/validation exercise was conducted to select control villages to associate with treated villages on the basis of addition criteria mentioned above and based on key informants' and Plan VIDA implementers' knowledge of the area. The result of this exercise consisted in the selection of 90 treated and 90 control communities.

The next step in sampling refers to the household level selection. Again the selection was inspired by information gathered through desk review and scoping mission but above all from qualitative analysis conducted. The interviews conducted with project beneficiaries and non-beneficiaries indicated that the project was directed to poor people that however had to have some land and/or livestock, had to be resident in the community and had to form groups and associations. In addition, the analysis revealed three key considerations that influenced households' self-selection into the project: financial contribution to the project and level of trust in government entities. Given all the above elements are rather common to all the identified eligible communities, and others are unobservable, it was decided to proceed through a random selection of households and to verify within the survey that the above elements are indeed respected in collecting the data.

Within all communities, enumerators randomly selected respondents either by sampling from a list of community members or, when this was not available, by conducting a random walk. Finally, enumerators conducted a community survey with a selection of community leaders in every survey location. As pointed out above, the initial sample comprised a total of 180 communities (half treatment and half control) with 15 households to be interviewed in each community[5] in order to reach the total estimated sample size of 2,700 households. However, due to some communities being particularly small (less than 15 households), an extra 31 communities were used as back-up options for the original sample ones in order to comply with the estimated sample size[6]. Cross-sectional quantitative data have been therefore collected for a total of 2,751 households and 211 communities.

In order to ensure stronger comparability across treatment and control groups, we ran propensity score matching (PSM) analysis on household level data based on a linear probability model to predict each households' probability to both be selected and to self-select into the project, using variables that act as indicators or proxies of each determining factor identified with qualitative research. Table 1 of the Appendix presents the list of the variables used for matching with the corresponding selection factor proxied. PSM provides a way to balance observed (measured) characteristics across treatment and control groups and better approximate the counterfactual for treated households by verifying and/or implementing the common support condition. In other words, it ensures that any combination of characteristics observed in the treatment group (ideally prior to the intervention) can also be observed among the control group (Bryson et al., 2002). In its simplest version (Austin, 2011), the propensity score formula can be written as follows:

$$P(x) = \Pr(T = 1 \mid X = x)$$

where *T* is a binary variable indicating participation in the project (treatment) and *X* is the set of measured characteristics. The propensity score *P(x)* is the probability that action *T = 1* (*i.e.*

[5] Given an average take-up rate of 66 per cent at community level, and in order to provide a full representation of the Plan VIDA intervention, the sample included direct and indirect beneficiaries within treatment communities. The number of direct and indirect beneficiaries to be interviewed was determined using the available information on the actual take-up rate in each treatment community in the final sample.

[6] For further details on the sampling strategy and field operations see Paolantonio et al. (2017) and CIES Internacional (2017).

participation in the project) will be chosen by a participant with characteristics $X = x$. This implies that, instead of attempting to create a match for each participant with exactly the same value of x, it is possible to match on the probability of participation. PSM though rely on a few important assumptions. First, internal validity of the assessment (that is, the extent to which treatment is comparable to control on all relevant aspects except assignment to treatment) is only achieved if the model above includes all variables which simultaneously influence a household's participation in the project and the outcomes of interest. Any unobserved characteristics which influence both participation and outcomes could potentially bias results. However, we are confident that the qualitative research preceding data collection provided a thorough description of the key factors influencing households' selection into the project, and thus supported our ability to effectively capture this variation in the matching model. Secondly, the external validity relies on the sample's representativeness of the project population of interest. Because the communities in the data were randomly selected from a list of all project communities, the results should accurately reflect the project's impact as a whole. With this in mind, results will be interpreted as the impact of the project as a whole, rather than impact only limited to communities in the data.

We choose nearest neighbour (NN) algorithm to match on the propensity score. Using five nearest neighbours and a caliper of 0.01, the model leaves only one observation off of common support. Matching results using the pooled control group are presented in Figures 1 and 2 of the Appendix, and both demonstrate the success of the sampling strategy to select a control group that can be used as an appropriate counterfactual. In particular, the kernel plot for probability of treatment (Figure 1 of the Appendix) shows perfect overlap between treatment and control therefore confirming the common support assumption. Furthermore, results on the relative bias between unmatched and matched groups (Figure 2 of the Appendix) shows that matching considerably reduces the bias across nearly all matching covariates[7].

Table 3 provides summary statistics of the relevant matching variables for treatment and control households before and after matching. The final sample has 2,721 observations, as some households were missing information on the matching covariates. While there are a few significant differences between the two groups, they appear to be comparable on the majority of characteristics.

[7] More specifically, the two statistics that assess the quality of the counterfactual achieved through the matching, *i.e.* the Rubin's B and Rubin's R, shows a reduction of bias from 41.2 per cent before matching to 10.4 per cent after matching (which is lower than the recommended threshold of 25 per cent) and a ratio of treated to (matched) non-treated variances of the propensity score index of 1.02, which is within the recommended bound of (0.8, 1.25).

Table 3: Descriptive statistics of matching variables for treatment and control households before and after matching

Variable	Before matching (N=930/1821)				After matching (N=922/1799)			% reduction in bias
	Treat. Mean	Control Mean	p-value	SMD	Treat. Mean	Control Mean	SMD	
Number of adult equivalents per dwelling room	1.372	1.389	0.605	-0.021	1.368	1.351	0.022	4.29
Households with dwelling roof of good quality (%)	77.849	73.970	0.026	0.091	77.983	77.498	0.012	88.12
Households with dwelling floor of good quality (%)	31.935	24.657	0.000	0.162	31.887	31.236	0.014	91.06
Households that own dwelling (%)	87.742	88.468	0.576	-0.022	87.636	87.939	-0.009	64.05
Households that have access to electricity (%)	68.925	63.976	0.010	0.105	68.872	68.265	0.013	87.24
Households that have access to private toilet facility (%)	27.097	20.538	0.000	0.154	27.007	27.068	-0.001	99.06
Households that have access to piped water (%)	58.925	53.048	0.003	0.119	59.219	58.612	0.012	90.43
Households that use gas to cook (%)	14.516	12.630	0.168	0.055	14.425	14.407	0.001	99.10
Share of owned land over total land used by the household (%)	92.103	93.991	0.047	-0.078	92.377	91.747	0.025	63.41
Dependency ratio (below 14 years : above 14 years)	0.642	0.541	0.000	0.142	0.638	0.620	0.025	81.75
Household size in adult equivalents	2.671	2.461	0.000	0.229	2.669	2.661	0.009	96.28
Households with at least one adult member who is wage employed (%)	25.914	24.876	0.553	0.024	26.139	26.106	0.001	97.72
Households with indigenous head (%)	79.355	80.560	0.453	-0.030	79.501	78.510	0.024	-8.82
Age of household head (years)	47.777	49.811	0.001	-0.132	47.821	47.833	-0.001	99.41
Households with female head (%)	10.215	14.333	0.002	-0.126	10.195	10.412	-0.007	94.85
Number of years of education of household head	4.280	3.793	0.001	0.138	4.281	4.367	-0.024	82.64
Households with head who voted in the last elections (%)	93.333	87.754	0.000	0.192	93.275	93.102	0.007	96.75
Households with at least one member belonging to a group in 2012 (%)	67.634	66.063	0.408	0.033	67.679	68.785	-0.024	40.01
Altitude (m.a.s.l.)	3 660	3 650	0.635	0.019	3 659	3 671	-0.025	-42.12
Households in Potosi department (%)	52.366	56.013	0.069	-0.073	52.278	52.661	-0.008	89.79

The altitude variable shows a higher standardized difference between treatment and control after matching, as does, even if at a much lower extent, the variable indicating the number of rooms per adult equivalent in the dwelling. However, a look at the means in each group, shows a difference in altitude of just about 12 meters, and a difference of less than 0.02 for the number of rooms per adult equivalent in the dwelling. In order to confirm that this is not a problem, we examine the kernel density plot of the covariate balance for the most concerning variables in Figure 3 of the Appendix. The covariate balance densities do not show any obvious anomaly. Further, an overidentification test for covariate balance is not able to reject the null hypothesis that the two concerning covariates are balanced between groups – that is, we are confident that balancing on relevant variables has been achieved using our model.

As already noted, the sample differentiates between three types of households: namely beneficiaries, non-beneficiaries in control communities and non-beneficiaries in treated communities (which we call indirect beneficiaries). This differentiation allows us to examine project impacts as well as potential spillover effects on indirect beneficiaries. Including indirect beneficiaries in the sample, therefore, serves a dual purpose: on one hand, and most important, it makes possible to observe and measure the existence and extent of spillover effects, while, on the other hand, in case no spillover effects are detected, indirect beneficiaries can be pooled with "pure" control households to enlarge the counterfactual group.

With this in mind, the analysis uses two types of impact estimates, depending on the project component under assessment. The first component involved a more targeted intervention to community members who chose to directly participate in the project. As this component supported agricultural and livestock production, those indicators measuring impacts on results related to income, productivity, dietary diversity, and resilience will constrict the treatment group to only direct beneficiaries. We first run estimates comparing direct beneficiaries to the "pure" control group to check for the presence spillovers. Having confirmed the absence of spillover effects on these impacts, we include indirect beneficiaries in the control group to increase sample size and gain statistical power.

As the second component of the project involved a community-wide campaign, strengthening organizational capacity, and emphasizing other mechanisms of social inclusion (documentation, for example), it follows that these impacts would be best detected by combining all project community members into the treatment group, regardless of whether they received direct support from the first component. Thus, indicators related to social capital will use intention-to-treat (ITT) estimates, including both direct and indirect beneficiaries in the treatment group.

3.2 Questionnaire and impact indicators

The main data collection instruments for this impact assessment are household and community questionnaires. Both surveys were administered between August and September 2017 and the information collected refers to the twelve months preceding the survey implementation (in particular, data on crop production take as reference period the last completed agricultural cycle namely, from July 2016 to June 2017). The household questionnaire collected information at the household level on a number of socio-economic characteristics, land and asset ownership, agricultural and livestock production and marketing, shocks and risk management strategies, dietary diversity and food security, access to financial services, social capital, participations to organizations and networks. The type of data collected through the community questionnaire included access to infrastructure and basic services, main economic activities, social capital and collective action, organizations and networks.

This very rich set of information collected was used to construct outcome and impact indicators to answer the posed research questions and assess the impact of Plan VIDA on the population of interest. In particular, we focus on estimating project impact on four sets of indicators which are described in the next paragraph and respond to the causal pathways that are expected to be activated by the project as illustrated in its theory of change in Figure 1. The full list of indicators used in the analysis, as well as details on their construction, is included in Table 2 of the Appendix.

Impact indicators are conceptualized in four groups. We first examine those that measure economic mobility using total household net income, income diversification, and asset indices. We then examine other outcome indicators related to diet diversity (FAO, 2011), experience of food insecurity (Ballard et al., 2013), resilience to climatic and economic shocks. The analysis follows with agricultural production and market access indicators, including net crop income, crop diversification, harvest-to-seed ratio, and use of improved seeds. Also included in this productivity group are measures of livestock productivity: net livestock income, livestock diversification, quantity and value of livestock, rate of reproduction, and adoption of promoted techniques for maintenance and care. Finally, we analyse project effects on a range of indicators related to social capital, gender, and financial inclusion. This group includes measurement of group participation, binary indicators for internal and external community networks as well as measurements of frequency of internal and external community interaction, indicators for female group leadership, a ratio of household members who have documented identification, and binary indicators for possessing a bank account or savings.

3.3 Impact estimation

After confirming the two samples share sufficient common support and are well-balanced on all matching covariates (see Section 3.1), we employ a number of estimators – namely nearest-neighbour matching (NNM), inverse probability weighting (IPW), and inverse probability weighting with regression adjustment (IPWRA) – to estimate the average treatment effect on the treated (ATET) for principal outcomes, as well as intention-to-treat (ITT) impacts for outcomes with strong potential for spillovers (*i.e.* those related to social capital, gender and financial inclusion).

The ATET is the average treatment effect among subjects who received the treatment and can be written as follows:

$$ATET = E(y_1 - y_0 \mid T = 1)$$

Where $y_1 - y_0$ is the unobservable individual-level treatment effect namely, the difference between the outcome obtained for having received the treatment (and which can be observed) and the outcome that the same individual would have been obtained if he didn't get the treatment (and which is not observable).

In this report, we chose to report ATET estimates obtained using the IPW estimator (Horvitz and Thomson, 1952; Imbens, 2000; Hirano ate al., 2003; Busso et al., 2009a,b; Wooldridge, 2010) given its simplicity of application and documented good performance especially when the common support assumption holds strongly (as it is the case of our counterfactual as shown in Section 3.1). Under this circumstance, one big advantage of the IPW estimator is that it models the probability of treatment without any assumptions about the functional form for the outcome model. Nonetheless, the estimates obtained using the other classes of estimators confirm the robustness of the results for almost all outcome variables[8].

[8] Results using the NNM and IPWRA estimators are available upon request.

The IPW estimator uses estimated probability weights computed as the inverse of the probability of a subject receiving the treatment (in our case the probability of a household being a Plan VIDA beneficiary or a control) to correct for the missing-data problem arising from the fact that each subject is observed in only one of the potential outcomes that is, y_1 (the outcome with the project) or y_0 (the outcome without the project).

With the IPW estimator average treatment effects are estimated following a two-step approach:

1. First, once the treatment model has been specified, the parameters of the treatment model are estimated and weights are computed as the inverse of the estimated probabilities of receiving the treatment (*i.e.* being a Plan VIDA beneficiary);
2. Secondly, the estimated inverse-probability weights are used to compute weighted averages of the outcomes for each treatment group. Average treatment effect estimates are finally obtained by contrasting the computed weighted averages for the two groups (beneficiaries against controls).

The two steps are implemented at once and they produce consistent estimates of the effect parameters because the treatment is assumed to be independent of the potential outcomes after conditioning on the covariates.

The above described approach, therefore, implies estimating the potential outcome mean for treatment $T = 1$ namely, $E(y_1)$. Using the observed data, $y_i T_i$ is $y_{i1}$when $T = 1$, but y_{i1} is unobserved when $T = 0$. The IPW estimator for $E(y_1)$ is given by the following formula:

$$E(y_1) = \frac{1}{N} \frac{\sum_i^N y_i T_i}{p(x_i)}$$

where $p(x_i)$ is the probability that $T_i = 1$ and it is estimated using a linear probability model as a function of the covariates x_i (in our case, a thoroughly thought set of variables that proxy project selection criteria and self-selection determining factors as already discussed in Section 3.1). If y_{i1}were always observed, the weights would all equal 1.

All standard errors in our estimations are clustered at the community level, in accordance with the sampling strategy (Abadie et al., 2017).

4. Profile of the project area and sample

The design of the Plan VIDA project prioritized the poorest municipalities of the country which are located in the Northern part of Potosí and in the Andean region of Cochabamba (the high plateau and interandean valleys). These regions mark out for a very rough topography, with rural communities often difficult to be accessed, and proneness to adverse climatic events such as frosts, hailstorms and droughts. Additionally, given its physical conformation, the soil of the area is characterized by low levels of organic matter, high salinity and a variety of textures (from clay to sandy mud). The main economic activities are constituted by subsistence farming (potatoes and cereals are the main crops grown) and livestock (mainly camelids, cattle, sheep and goats), which is the main source of income for the rural families living in the area.

Table 4 shows the sample distribution of households by municipality in the two project's departments and the incidence of poverty in our sample based on the two approaches used to measure poverty (*i.e.* an asset-based and a monetary-based poverty line) also comparing them with official data from the last National Population and Household Census (INE, 2012). It is clear from the data that targeted municipalities are among the poorest in both departments, with poverty rates that are well above the averages for Cochabamba and Potosi (45 per cent and 58 per cent, respectively). These figures are well captured in our sample, especially when using the monetary-based poverty line approach.

Table 4: Sample distribution of households and incidence of poverty by municipality

Cochabamba	Household population in the sample	% poor in the sample, monetary-based poverty line	% poor population in the sample, asset-based poverty line 40th percentiles	Total household population (INE, 2012)*	% poor (INE, 2012)
Arque	67	96.6	35.8	10,352	95.4
Bolívar	191	68.8	50.3	7,093	93.4
Cocapata	67	86.0	35.8	17,430	96.7
Independencia	360	77.0	22.2	23,183	86.4
Morochata	52	89.1	32.7	12,611	92.5
Sicaya	27	81.0	11.1	3,680	83.8
Tacopaya	135	86.3	47.4	9,784	92.6
Tapacarí	333	86.1	47.7	24,141	94.9
Total	*1,232*				

* Total household population is computed using INE data on total individual population divided by an average household size of four members.

Potosí	Household population in the sample	% poor in the sample, monetary-based poverty line	% poor population in the sample, asset-based poverty line 40th percentiles	Total household population (INE, 2012)*	% poor (INE, 2012)
Caripuyo	60	84.2	26.7	2,142	88.8
Chayanta	165	79.6	15.2	3,948	76.1
Colquechaca	264	82.0	43.9	8,597	87.6
Llallagua	89	77.6	27.0	9,966	37.5
Ocuri	88	84.8	53.4	3,905	92.7
Pocoata	197	84.6	28.9	6,462	90.8
Ravelo	30	67.9	43.3	5,068	91.6
S.P. De Buena Vista	235	86.9	42.6	7,354	93.3
Toro Toro	27	91.7	14.8	2,630	88.7
Uncia	244	78.9	29.1	5,338	60.3
Villa de Sacaca	90	92.3	48.9	4,797	88.9
Total	*1,489*				

* Total household population is computed using INE data on total individual population divided by an average household size of four members.

Tables 5a and 5b presents summary statistics, prior to matching, of the households in our sample with respect to the main impact indicators and based on the comparison groups chosen for the analysis namely, direct beneficiaries against pooled controls (controls and indirect beneficiaries) for all economic mobility, productivity, dietary diversity, and resilience indicators, and ITT group (direct and indirect beneficiaries) against controls for all indicators related to social capital[9].

In order to have a comprehensive picture of the households in our sample, we also make reference to the summary statistics for the matched sample previously reported in Table 3. The average household size in adult equivalent for both treated and control households is less than three adult members with a dependency ratio of 0.64 (for every household member above 14 years old there are around 1.5 members aged below 14). Household heads are on average 48 years old, and almost 80 per cent of them is indigenous. Level of formal education is low, with less than five years on average. Only a low proportion of households in our sample is female headed, though the share is slightly higher in control compared to treated group (14.3 per cent against 10.2 per cent, respectively).

In terms of housing characteristics, a fair proportion of households in our sample has access to electricity (66 per cent on average) and piped water (55 per cent on average) with higher shares in the treated group, whereas indicators of access to private toilet facilities and use of gas to cook show much lower percentages in both treated and control groups (around 23 per cent and 13 per cent on average, respectively).

[9] It is important to note that the difference in the number of observations across the variables (when not determined by logic) is due either to no-response cases or to trimming performed on outliers. Clearly, the number of observations for impact and outcome indicators will determine the sample size used to estimate impacts on the given indicator. Nonetheless, to gurantee unbiaseness of the results, we performed a number of checks and verified that there are no systematic differences between responding and non-responding households and that the non-response problem and the presence of outliers affects in the same way treatment and control groups, with no systematic differences across the two.

Interestingly, the share of household heads who declared to have voted in the last electoral process is considerably high. This is certainly attributable to the fact that Bolivia has a compulsory voting system , however, given the geographical remoteness of many of the sample communities one could expect lower political participation due to objective difficulties in reaching the election sites or registering with electoral notaries.

Another interesting aspect is group participation at baseline (*i.e.* when Plan VIDA activities begun) and now. In particular, around 66 per cent of the households in our sample had at least one member belonging to a group in 2012 and this percentage increased by about four percentage points in 2017. This is probably due to the fact that since 2006 the country underwent a series of institutional reforms aimed at increasing social inclusion and cohesions, which may have favoured social capital formation especially in rural areas where such reforms where intended to have the strongest effect.

Table 5a: Descriptive statistics on the main impact indicators for beneficiary and pooled control groups (unmatched)

Variable	Beneficiaries			Pooled Control (Control + Indirect Beneficiaries)			p-value	SMD
	N	Mean	SD	N	Mean	SD		
Total net household income (US$)	820	990.61	1 246.16	1 640	883.33	1 098.10	0.029	0.091
Number of income sources	922	2.85	0.87	1 799	2.69	0.89	0.000	0.183
Durable assets index	922	0.84	0.20	1 799	0.79	0.18	0.000	0.291
Productive assets index	922	1.55	1.09	1 799	1.32	0.94	0.000	0.225
Total assets index	922	0.88	0.43	1 799	0.77	0.37	0.000	0.258
Households below asset-based poverty line, 40th percentile (%)	922	29	45	1 799	40	49	0.000	-0.231
Households below asset-based poverty line, 60th percentile (%)	922	50	50	1 799	60	49	0.000	-0.211
Households below monetary-based poverty line (%)	820	82	38	1 640	82	38	0.970	0.002
Household Dietary Diversity Score (HDDS), weekly (0-12)	922	7.19	2.35	1 799	6.88	2.37	0.001	0.134
Food Insecurity Experience Scale score for adults	922	2.59	1.95	1 799	2.71	2.03	0.137	-0.061
Food Insecurity Experience Scale score for children	922	1.50	1.95	1 799	1.39	1.98	0.161	0.057
Ability to recover from shocks score	792	2.05	0.95	1 546	1.99	0.98	0.146	0.064
Net agricultural income (US$)	903	721.90	1 072.15	1 787	556.28	858.49	0.000	0.171

In terms of asset and monetary wealth, we note some relevant differences between treated and control households. In particular, beneficiary households have an average annual net income of 991 US$[10] (about 248 US$ per capita, if we consider an average household size of four members) while control households' income is 883 US$ per year. Although figures look low, they are consistent with official data for the two departments and with poverty rates found in the area (as also shown in Table 4). More precisely, we used data on total household income for rural areas from the latest nationally representative household survey carried out by the National Statistical Institute (INE, 2015)[11] and looked at the lowest percentiles of the distribution (since our sample comprises extremely poor households as per project's targeting strategy) to validate our figures. Official data indicate a value of 648 US$ per year at the 10th percentile and of 1,605 US$ at the 25th percentile of rural households income distribution, an interval that contains the average values recorded in our sample.

Treated households seem to rely on a higher number of income sources as well as on more assets compared to control households.

Households in our sample have and average dietary diversity score of about 7 out of a total of 12 food groups and eat around three meals per day. Finally, beneficiaries and non-beneficiaries households seem to perform similarly in terms of their ability of recovering from different types of economic and natural shocks experienced.

Table 5b: Descriptive statistics on the main social capital impact indicators for ITT and control groups (unmatched)

Variable	ITT (Beneficiaries + Indirect Beneficiaries)			Control			p-value	SMD
	N	Mean	SD	N	Mean	SD		
Households with at least one household member belonging to a community group (%)	1 362	71	0.45	1 359	70	46	0.531	0.024
Households with a member who actively participates in a community group (%)	1 362	41	49	1 359	38	48	0.042	0.078
Number of groups in which the household currently participates	971	1.41	0.73	954	1.31	0.62	0.003	0.138
Households with a female member who participates in community group (%)	1 362	33	47	1 359	32	47	0.621	0.019
Household members with ID documents (%)	1 362	97	10	1 359	97	10	0.956	0.002

Summary statistics for the main social capital indicators all look very similar across the two groups and, as already pointed out, show a fairly high level of social capital in our sample. Similarly the ratio of household members with ID documents, where increasing documentation across beneficiaries represented one important objective of Plan VIDA, is particularly high and almost close to 100 per cent for both beneficiaries and non-beneficiaries. This can have two important implications. If on one hand, it anticipates that the project may have not obtained any impact on those set of indicators simply because levels of both social capital and documentation were already high, as confirmed by the control group. On the other hand this circumstance may have favoured the implementation of the project itself and helped in putting in place those mechanisms that allowed to

[10] For all monetary figures the exchange rate used is 1 US$ = 6.9 Bolivianos.

[11] It is worth noting that the methodology followed by the National Statistical Institute to compute total household income is very similar to the one applied in this study.

reach more direct impacts on income, productivity, dietary diversity, food security and resilience, for example. Particular caution is needed when examining impacts on documentation, as this portion of the project was independent of beneficiary participation in the other components. It is likely that many indirect beneficiaries received support for documentation, and also likely that many direct beneficiaries did not need such an intervention. Additionally, as the movement for documentation was a nation-wide effort implemented by multiple agencies, there is a high risk of contamination in non-project areas. Thus, the attribution of impact in this particular outcome may be difficult to detect.

The analysis presented in the next section of this report begins by comparing the control group with all *PICs* beneficiaries irrespective of the type of intervention received. However, as already pointed out, *PICs* differed according to the needs and preferences of the participant communities. Table 6 describes the distribution of sample beneficiaries among the two departments and the type of project intervention received, with details on the main type of input received.

Table 6: Sample distribution of beneficiary households by department and type of *PIC*

Type of *PIC*		Cochabamba	Potosí	Total
Livestock	Cattle	234	197	431
	Camelids	34	83	117
	Cattle and camelids	20	0	20
	Sheep and goats	40	152	192
	Pigs	0	8	8
	Poultry	15	0	15
	Sub-total	343	440	**783 (85%)**
Agriculture	Land reclamation/protection	35	0	35
	Potatoes	53	13	66
	Wheat	0	5	5
	Maize	0	10	10
	Fruit trees	9	0	9
	Bee-keeping	0	14	14
	Sub-total	97	42	**139 (15%)**
Total		**440 (48%)**	**482 (52%)**	**922**

As can be seen, almost 85 per cent of households in our sample received interventions related to livestock. The remaining 15 per cent of beneficiaries were involved in other types of projects either focused towards improving the production of primary crops and/or certified seeds, or towards upgrading water and soil management through micro-irrigation, restoration of productive soils, construction/expansion of defensive walls in river beds, for example. Within livestock interventions, project data indicate that more than 95 per cent of them consisted in activities related to the improvement and breeding of cattle, camelids and sheep.

Given the strong preference of Plan VIDA beneficiaries for livestock interventions, we explore potential heterogeneous impacts of the project based on the type of intervention received. For the purpose of our analysis we have therefore constructed two mutually exclusive categories for the types of project's interventions: (1) livestock related interventions, and (2) agriculture interventions,

including all types of interventions that are more agriculture oriented in a broader sense. Beneficiary households have been classified accordingly and the results for the two groups are presented and discussed in the next section.

5. Results

This section presents the results of the various analysis of Plan VIDA impact. Following our research questions and the indicators identified through the theory of change, we start our analysis looking at key impact and outcome indicators for the entire sample and breaking down the results for the departments of Cochabamba and Potosí as they present some relevant differences. This analysis therefore looks at the complete set of interventions (*i.e. PICs*) realized in the sampled communities. However, as anticipated in Section 4, given the high prevalence of livestock interventions at implementation, the second set of results presented refers to the analysis of impact for the livestock projects subgroup.

All impact estimates presented in the sub-sections that follow are based on IPW estimator and are reported in absolute values. As the control group represents how beneficiary households would have fared in the absence of the project, the mean value of the control group is reported (also in absolute values) next to the impact estimate in all tables and for all indicators. This facilitates interpretation of results as the ratio of the impact estimates to the mean value of the control group will represent the percentage increase/decrease in the given indicator attributable to the project. The total number of observations is reported for each outcome variable. As already pointed out the number of observations can vary across variables due to either no-response or to trimming performed on outliers. In all other cases where sample appears reduced this is due to the logical flow of questions (for example, the ability to recover from shock score is computed for households who actually experienced a shock). Notes at the end of tables provide detailed explanation for each specific case[12].

It is worth to remember that impact estimates for economic mobility, food diversity, food security, resilience and agricultural production indicators represent average treatment effect on the treated (ATET), and are obtained by comparing the beneficiary group against pooled controls (control households and indirect beneficiaries), whereas results on social capital, gender and financial inclusion indicators represent intention-to-treat (ITT) impact estimates where beneficiaries and indirect beneficiaries are compared against control households. Lastly, it is important to note that some estimates of heterogeneous project impacts rely on small sample sizes that might affect the significance of the results. This is definitely the case of the analysis performed on the agriculture intervention subgroup for which we choose not to present results as no significant impacts were found most likely due to a very small sample size (only 139 beneficiaries) and therefore lack of statistical power. In all other cases, results should always be interpreted with caution.

[12] In particular, a more conservative trimming of outliers was performed on the total income variable, which, after careful validation using nationally representative data for the project area, was found to be noisy. This resulted in a reduction of 261 households in the total sample size. Given this situation, we were faced with two options: (1) perform the entire analysis on the restricted sample of 2,460 households to ensure comparability across samples; (2) perfom the analysis on the actual number of non-missing observations available for each outcome variable, but only after having confirmed that restricting the analysis to the 2,460 households for all outcome variables would still produce consistent results. As this exercise confirmed robusteness of all main results to the elimination of the 261 households from the sample, we chose to report on option 2 to have higher statistical power and therefore gain confidence in our results.

5.1 Overall impacts of Plan VIDA

We start by reporting results on economic mobility in Table 7a. Results are quite satisfactory in that they show positive and significant impacts on some key economic mobility indicators across all the beneficiaries and in both departments. This upward move in economic status seems to be driven mostly by a positive increase in assets for all types of beneficiaries with households in Cochabamba showing better results on durables than those in Potosí apparently investing more on productive assets; and by significant changes in diversification of income sources, induced mostly by Potosí. In particular, descriptive results suggest that this greater diversification seems to be mainly linked to livestock production and family enterprise (*i.e.* self-employment) as in the treated group a higher proportion of households with a number of income sources at or above the control mean obtain income from these two sources compared to the control group (whereby results for the other income sources are similar between the two groups).

A significant reduction in the probability of being poor is reported especially among the lower percentile of the population using an asset-based poverty line whereas the (non-significant) increase in total household income was probably insufficient to obtain a significant reduction in the probability of being below the extreme monetary-based poverty line.

Table 7a: Results on economic mobility indicators from the whole sample and by department

	Whole sample (N=2721)			Cochabamba (N=1232)		Potosí (N=1489)	
	ATET	Control mean	N	ATET	Control mean	ATET	Control mean
Total net household income (US$)	47.208	943.403	2 460[a]	32.796	911.713	63.433	969.196
Number of income sources	0.106**	2.749	2 721	0.091	2.652	0.121**	2.836
Durable assets index	0.025**	0.816	2 721	0.036**	0.802	0.015	0.829
Productive assets index	0.160***	1.395	2 721	0.193**	1.378	0.153**	1.386
Total assets index	0.068***	0.811	2 721	0.084**	0.800	0.062**	0.812
Households below asset-based poverty line, 40th percentile (%)	-6.2***	35.2	2 721	-7.5**	37.9	-5.5**	33.1
Households below asset-based poverty line, 60th percentile (%)	-6.2**	56.0	2 721	-7.3*	57.5	-6.1	55.5
Households below monetary-based poverty line (%)	-1.6	83.8	2 460[b]	-1.4	83.0	-1.8	84.6

note: * p<0.01, ** p<0.05, *** p<0.1
[a] Lower number of observations due to outliers trimming performed on income sub-components and aggregate using 3 standard deviations above and below the mean.
[b] Constructed using trimmed total net household income variable.

Moving to food diversity, food security and resilience indicators (Table 7b), even though they all show positive results, we do not find overall any significant difference with the exception of the HDDS for the department of Potosí[13].

[13] We also checked whether the project had any positive impact on the frequency of consumed by beneficiaries, however, as in both departments people seem to be on average able to eat three meals per day it is not surprising that no significant impact was found on this indicator.

With regard to households' ability to recover from shocks, no significant differences are found between beneficiaries and non-beneficiaries across the sample, nor when the sample is disaggregated by department. This seems to suggest that the project overall did not make a significant difference in improving people's capacity to bounce back when hit by a shock. However, it is worth noting that implementation of *PICs* for the majority of the beneficiaries happened between 2014 and 2015. This is probably too little time to allow to see any significant effect on increasing households' resilience, which is more of a long-term challenge.

Table 7b: Results on food diversity, food security and resilience indicators

	Whole sample (N=2721)			Cochabamba (N=1232)		Potosí (N=1489)	
	ATET	Control mean	N	ATET	Control mean	ATET	Control mean
Household Dietary Diversity Score (HDDS), weekly (0-12)	0.202	6.991	2 721	0.010	6.877	0.375**	7.098
Food Insecurity Experience Scale score for adults	-0.142	2.730	2 721	-0.091	2.693	-0.169	2.746
Food Insecurity Experience Scale score for children	-0.100	1.602	2 721	0.040	1.516	-0.190	1.643
Ability to recover from shock score	0.056	1.993	2 338[a]	0.018	2.197	0.071	1.833

note: * p<0.01, ** p<0.05, *** p<0.1
[a] Computed for households who experienced a shock since 2011.

Table 7c presents results on agriculture production indicators. Interestingly, we find a significant positive impact on net agriculture income for the whole sample, which, again, appears to be mainly driven by beneficiaries in Potosí[14], who experienced an increase of about 22 per cent. In particular, in the case of Potosí this increase in total agriculture income seems to be determined by livestock activities whose earnings are almost 31 per cent higher for beneficiary households. A closer look at the mechanisms that may have triggered this result seems to suggest that ownership of livestock of better quality and the use of improved seeds played an important role. This offers also additional justification for looking at heterogeneity of impacts across types of interventions implemented to better understand the pathways through which the project affected beneficiaries' wealth.

The positive results on agricultural production indicators should be read with particular attention keeping in mind that, on average, income from agriculture constitutes about 70 per cent of total income for the households in our sample. This evidence coupled with the fact that we do not find a corresponding significant increase in total household income but we do find a positive effect on income diversification and productive assets capital, seems to suggest that beneficiaries have reinvested the additional earnings coming from agriculture into other sectors (*i.e.* family business activities) which, however, may have higher variability on economic returns and/or need time to produce them[15].

[14] The fact that the intervention seems to have produced the stronger effects in Potosí may be attributable to the very extreme situation of this department which is one of the poorest in the country and where, in general, households have less opportunities of accessing markets and services and therefore diversifying their livelihoods.
[15] Another possible explanation for not finding any impact on total household income is the reduction in the number of observations due to outliers trimming as the statistical power may be too low to detect any significant effect. However, as discussed, the results on the other indicators seem to point towards a coherent story putting the lack of statistical power hypothesis in perspective.

Table 7c: Results on agriculture production indicators

	Whole sample (N=2721)			Cochabamba (N=1232)		Potosí (N=1489)	
	ATET	Control mean	N	ATET	Control mean	ATET	Control mean
Net agricultural income (US$)	126.668**	595.229	2 690[a]	125.059	570.913	133.966**	611.188
Net livestock income (US$)	74.714*	280.299	2 690[b]	52.751	256.061	94.347*	302.111
Net crop income (US$)	51.954*	314.930	2 690[c]	72.308	314.852	39.619	309.078
Livestock diversification (Gini-Simpson index)	0.010	0.323	2 358[d]	0.023	0.314	-0.006	0.336
Crop diversification (Gini-Simpson index)	0.006	0.436	2 515[e]	0.029	0.363	-0.017	0.501
Mechanisms:							
Number of large and medium size livestock (TLUs)	0.547	5.224	2 721	0.828	5.257	0.347	5.138
Number of large and medium size livestock of improved breed (TLUs)	0.364***	0.309	2 721	0.339***	0.344	0.432***	0.232
Value of animals owned (US$)	178.128*	1 289.801	2 721	324.604**	1 323.017	61.819	1 242.076
Number of cultivated parcels used by the household	0.111	3.144	2 721	0.263	2.821	-0.023	3.433
Potato harvest-to-seed ratio	0.627**	5.977	1 810[f]	0.290	6.394	0.850**	5.688
Households that used improved potato seeds (%)	4.2**	5.4	2 132[g]	7.7*	7.3	1.6	3.6

note: * p<0.01, ** p<0.05, *** p<0.1

[a,b,c] Lower number of observations due to outliers trimming using 3 standard deviations above and below the mean.
[b] Constructed using trimmed total net household income variable.
[d] Computed for households who raised large and medium size animals in the past 12 months.
[e] Computed for households who grew crops in the past agricultural year.
[f] Lower number of observations due to outliers trimming using minimum and maximum thresholds found in Godtland et al. (2003).
[g] Computed for households who grew potatoes in the past agricultural year.

Moving to the set of social capital indicators, we find no strong effects on social capital increase if not for an increase on leadership particularly in the case of Potosí, as shown in Table 7d. A result that holds also disaggregated by gender with a significant increase in women's leadership. While slightly surprising, given the emphasis the project team placed on community capacity-building and networking, these results do not differ from recent literature on similarly community-driven development (CDD) projects and social cohesion. White and colleagues (2018) point out the differential rates of participation in CDDs between established community leaders and more marginalized community members – intuitively, more marginalized participants are more likely to experience barriers in their participation, essentially cutting off the causal chain toward community-wide social cohesion impacts. The authors then conclude that "CDD programmes may actually be users rather than producers of social capital". As a matter of fact Bolivia is notably a country where social activities are rather strong and social capital is the driving force for a large number of local and international policy initiatives, as also demonstrated by the high number of control households participating to community groups (around 72 per cent).

Table 7d: Results on social capital and gender indicators

	Whole sample (N=2721)			Cochabamba (N=1232)		Potosí (N=1489)	
	ATET	Control mean	N	ATET	Control mean	ATET	Control mean
Households with at least one household member belonging to a community group (%)	-0.4	71.7	2 721	-0.7	72.0	-0.9	72.2
Households with a member who is a leader in a community group (%)	2.7**	10.4	2 721	1.1	11.9	3.6**	9.6
Households with a member who actively participates in a community group (%)	1.4	40.0	2 721	2.9	38.0	-0.1	41.9
Number of groups in which the household currently participates	0.055	1.351	1 925[a]	0.073	1.401	0.035	1.315
Households that are part of a group that interacts outside the community (%)	3.1	15.1	1 925[b]	3.0	12.7	2.9	17.3
Households with social networks inside community (%)	-2.7	73.7	2 721	-0.3	73.9	-4.5	73.4
Households with social networks outside community (%)	-1.3	40.6	2 721	-2.8	44.2	0.0	37.5
Number of times respondent has stayed with non-family outside of community in the past year	0.104	0.768	2 720[c]	0.215	0.701	0.029	0.807
Households with a female member who is a leader in a community group (%)	0.7	2.0	2 721	-0.0	2.0	1.7**	1.5
Households with a female member who participates in community group (%)	0.2	32.4	2 721	-1.6	34.4	1.4	31.1

note: * p<0.01, ** p<0.05, *** p<0.1
[a,b] Computed for households who participate to community groups.
[c] Lower number of observations due to non-response.

Our qualitative findings seem to support this theory. We make use of data from eight focus groups of project participants and eight additional focus groups of non-participants, which included questions about the main effects of Plan VIDA. Respondents call attention to social norms and practices that had existed before Plan VIDA implementation, but which were put into practice during the course of the project. These social norms are principally practiced by indigenous groups, to which about 80 per cent of beneficiaries and non-beneficiaries in our sample identify (see Table 3). One recurring example given by respondents is that of *ayni* – working in solidarity with community members – which is a concept that has historically been regarded as a strong value in the region[16]. The existence of such strong ideas of social solidarity before the project accounts for why impacts on social capital (if they exist) would be difficult to detect, as these indicators are already high at baseline, and are bolstered by positive cultural values in control communities as well.

However, qualitative findings also highlight an important mechanism which was not captured in the quantitative work: through work with other communities, project beneficiaries witnessed members of nearby communities practicing these same values as well. Results suggest that interactions with other communities via the G*rupos Zonales* increased feelings of trust and confidence between communities. While we do not see this immediately reflected in proxies for out-community interaction (that is, beneficiaries are not more likely to be in groups that interact with other

[16] "*Por ejemplo nosotros tenemos nuestros principios, nuestros valores, a lo que es el "ayni", por ejemplo el "ayni", la solidaridad en castellano, como podríamos decir "hoy día para ustedes, mañana para el otro", entonces esa parte se ha visto en si se maneja todavía en Uncía el "ayni", o sea la ayuda, la solidaridad, pero esto ha sido una fortaleza más al contrario de perder nuestros valores*" words pronuonced by a male beneficary community leader during focus group discussions.

communities, nor are they more likely to spend time with members of other communities), it seems reasonable that this increased trust would provide benefits to future projects that require inter-community collaboration.

Table 7d shows that beneficiary households are not more likely to be documented than control households. This result, however, should be interpreted in light of what already discussed in Section 4 and therefore it does not represent a weakness of the project as it is most probably attributable to already high rates of documentation in both treated and control communities due to the many related governmental initiatives taking place in rural areas.

Furthermore, although exhibiting a positive sign, we do not find any significant impact on increasing beneficiaries' capacity in terms of financial inclusion. Plan VIDA required participant communities to open a bank account where transfers could be made and managed by community members. In order to support this operation, project teams provided training and organized meetings to illustrate the basic principles of project management, accounting, and the use of banking services. Community bank accounts had to be closed after project completion, however, we expected to see some positive impacts in terms of the proportion of households using banking services as a result of the knowledge and skills newly acquired through the intervention.

Table 7d: Results on documentation and financial inclusion indicators

	Whole sample (N=2721)			Cochabamba (N=1232)		Potosí (N=1489)	
	ATET	Control mean	N	ATET	Control mean	ATET	Control mean
Household members with ID documents (%)	-0.0	97.4	2 721	-0.4	97.5	0.2	97.3
Households with at least one member with a bank account (%)	0.1	9.5	2 721	-0.2	10.7	0.6	8.2
Households with at least one member with voluntary savings (%)	0.2	5.4	2 721	-0.4	5.6	1.1	4.8

note: * p<0.01, ** p<0.05, *** p<0.1

Generally speaking, it has to be highlighted that some of the overall null effects may be in part due to the diversity of the interventions implemented – if some types are less effective than others, the overall impact may be "watered down". Since the large majority of *PICs* involved a livestock intervention, and given that some key livestock related indicators seem to show significant impacts, we decided to narrow the sample to only those participants who received livestock support from the project. Though this was not part of the original impact assessment plan, we feel it provides valuable insight into the effectiveness of the project and could provide lessons for future implementation. The results on the same set of indicators plus a number of additional variables for this subgroup are shown in the next section.

5.2 Heterogeneous impacts of Plan VIDA by type of project intervention

5.2.1 Analysis on livestock interventions subgroup

As foreseen earlier, the project did have stronger effect on the subsample of beneficiaries whose intervention focussed on livestock. The results on economic mobility indicators are very similar to those found for the whole sample.

Table 8a: Results on economic mobility indicators from the livestock sample and by department

	Livestock sample (N=2339)			Cochabamba (N=996)		Potosí (N=1343)	
	ATET	Control mean	N	ATET	Control mean	ATET	Control mean
Total net household income (US$)	74.616	956.235	2 117[a]	75.534	947.666	77.277	959.641
Number of income sources	0.129***	2.758	2 339	0.133**	2.654	0.134**	2.829
Total assets index	0.068***	0.812	2 339	0.107***	0.794	0.051	0.814
Households below asset-based poverty line, 40th percentile (%)	-6.4***	35.4	2 339	-8.6**	38.6	-4.9	33.1
Households below monetary-based poverty line (%)	-1.7	83.6	2 117[b]	-1.1	82.0	-2.1	84.7

note: * p<0.01, ** p<0.05, *** p<0.1
[a] Lower number of observations due to outliers trimming performed on income sub-components and aggregate using 3 standard deviations above and below the mean.
[b] Constructed using trimmed total net household income variable.

With regard to dietary diversity, a significant increase of the HDDS is reported overall in the livestock subsample and, particularly, among livestock beneficiaries in Potosí. This may be due to an increased and more diversified diet linked to the consumption of livestock related products. In this regard, we thus move one step further and report the breakdown of the food groups consumed by household members in the week prior in Table 8c. The results support our hypothesis as we find that beneficiary households have added eggs, milk and dairy products to their diets as well as cereals and tubers whose distribution was, in some cases, combined with livestock related activities and part of the same intervention. Further analysis sheds light on the mechanisms behind this impact. Indeed, communities with livestock projects are more likely than their control counterparts to produce milk and milk products. Additionally, dietary diversity is significantly correlated with net agricultural income (with a coefficient of 0.14 and p <0.001). As treatment communities have higher income from agriculture (see Table 8d), the increased dietary diversity is likely a product of increased access to sub-products: both in their supply within the community and households' ability to purchase them.

Participants to livestock projects also seem to perform slightly better in terms of their ability of recovering from negative shocks, as shown by the positive and significant result on their resilience score. This may be due to the fact that livestock production can help stabilizing the food supplies and provide households with a buffer against economic shocks and natural disasters. Moreover, accumulation of livestock assets is a key risk management and coping strategy in poor and variable environments: as climate variability increases livestock becomes more valuable since it provides a range of options to mitigate the effects of this variability on food production (FAO, 2013).

Table 8b: Results on food diversity, food security and resilience indicators

	Livestock sample (N=2339)			Cochabamba (N=996)		Potosí (N=1343)	
	ATET	Control mean	N	ATET	Control mean	ATET	Control mean
Household Dietary Diversity Score (HDDS), weekly (0-12)	0.272**	6.989	2 339	0.203	6.777	0.384**	7.097
Food Insecurity Experience Scale score for adults	-0.156	2.709	2 339	-0.131	2.682	-0.133	2.688
Food Insecurity Experience Scale score for children	-0.116	1.590	2 339	0.001	1.506	-0.165	1.613
Ability to recover from shock score	0.090*	1.951	2 022[a]	0.075	2.157	0.084	1.817

note: * p<0.01, ** p<0.05, *** p<0.1
[a] Computed for households who experienced a shock since 2011.

Table 8c: Results on dietary diversity from the livestock sample

	Livestock sample (N=2339)	
	ATET	Control mean
Cereals and tubers	1.9**	94.8
Leafy vegetables	-0.7	44.7
Vitamin A fruits and vegetables	2.1	61.8
Other fruits and vegetables	3.5	37.1
Organ meat	-1.7	33.1
Flesh meat and fish	2.0	50.4
Eggs	5.8**	63.2
Milk and milk products	7.5***	25.5
Legumes, nuts and seeds	1.5	60.2
Sweets	3.1**	83.7
Oils and fats	1.3	93.1
Spices, condiments, beverages	1.0	51.5

note: * p<0.01, ** p<0.05, *** p<0.1

Table 8d reinforces our perception, also obtained from qualitative analysis conducted, that livestock interventions have been quite efficient and effective. As a matter of fact net agriculture income reports significant (and stronger) improvement for the livestock subgroup of beneficiaries.

Looking at outcomes we understand that this increase is mainly due to the possession of higher value animals and to positive and significant gross revenues and margins from selling these animals, and/or their by-products and services. Although, the larger number of improved animals owned by beneficiary households may suggest that beneficiaries are able to sell this better quality at a higher price, it has to be noted that our method of analysis does not allow to take into account differences between local and improved breeds in the price of livestock sales. Therefore these findings of higher revenues and margins only indicate that beneficiaries sell more livestock, livestock by-products, or livestock services than their counterparts.

When exploring the mechanisms that may have triggered the above discussed results, we find that the specific logic of livestock interventions has definitely created some decisive synergies that have determined positive overall impacts. Not only the rate of reproduction is higher (at least for sheep)[17], but having provided livestock with shelters and sheds as well as with a more nutrient and more stable feed thanks to the provision of forage crops (mainly alfalfa and *cebada berza*) has ensured their increased value and good maintenance.

Table 8d: Results on agriculture production indicators

	Livestock sample (N=2339)			Cochabamba (N=996)		Potosí (N=1343)	
	ATET	Control mean	N	ATET	Control mean	ATET	Control mean
Net agricultural income (US$)	138.990***	592.171	2 304[a]	168.591*	597.615	111.780	591.850
Net livestock income (US$)	85.309**	265.170	2 304[b]	92.426	237.314	83.003	283.768
Livestock diversification (Gini-Simpson index)	0.006	0.318	2 043[c]	0.024	0.308	-0.013	0.331
Outcomes:							
Gross revenues from livestock sales (US$)	43.038*	163.985	2 304[d]	31.499	167.956	48.076	164.894
Gross margins from livestock sales (US$)	38.730*	135.790	2 304[e]	26.074	135.662	45.757	138.806
Number of large and medium size livestock (TLU)	0.727	5.027	2 339	1.165	5.006	0.378	5.051
Number of large and medium size livestock of improved breed (TLU)	0.442***	0.318	2 339	0.422***	0.384	0.484***	0.239
Value of animals owned (US$)	202.161**	1 247.855	2 339	374.469**	1 339.375	63.371	1 180.979
Households that obtained any livestock sub-product in the past 12 months (%)	2.2	12.9	2 339	3.3	10.1	1.4	15.0
Mechanisms:							
Cattle rate of reproduction	0.073	0.421	349[f]	-0.015	0.508	0.183	0.312
Sheep rate of reproduction	0.656***	0.908	595[g]	-0.096	1.007	1.140***	0.857
Households that adopted reproductive strategies for livestock in the past 12 months (%)	0.4	1.7	2 339	1.2**	1.3	-0.0	2.0
Households whose livestock experienced some illness in the past 12 months (%)	1.5	14.1	2 339	0.7	12.9	1.9	15.3
Households that used shelters/sheds to protect livestock in the last 12 months (%)	3.8***	26.3	2 339	4.5**	21.1	3.3**	30.2
Households that produced forage crops in the past agricultural year (%)	6.1***	12.3	2 339	7.7**	9.2	4.7	14.8

note: * p<0.01, ** p<0.05, *** p<0.1
[a,b,d,e] Lower number of observations due to outliers trimming using 3 standard deviations above and below the mean.
[c] Computed for households who raised large and medium size animals in the past 12 months.
[f,g] Lower number of observations due to missing data; calculated from a subsample of respondents who provided information for birth rates.

[17] It is worth remebering that the results on reproduction rate should be interpreted with caution as it is based on a small subsample of respondents that provided information for birth rates.

In order to study other potential drivers and mechanisms in place, we run within-group correlations to identify patterns among those households exhibiting higher impacts. As a proxy for market access, we use categorical variables that specify where the household sold most of its livestock products. Households are split into three categories: those that most often engage in direct community sale (by selling directly to their neighbours or through an intermediary – called *rescatista*), those that make use of a market within their community, and those that principally sell in a market outside of their community. We found that households who engage in direct sales for their livestock are more likely to be in higher tertiles of shares of livestock sales with a correlation of over 0.52. Correlations diminish as we observe households who sell using within-community markets (0.19), and further drop when observing those who principally use markets outside of their community (0.16). This provides evidence that households with convenient points of sale will be more likely to sell a higher proportion of their livestock and livestock products. Thus, project impact is higher when compounded with easier market access and, for this reason, future similar interventions may consider further elaborating components focusing on market access in order to bolster impact.

In some cases, Plan VIDA also provided training to community members which complemented the community's rural development projects. While only 40 per cent of direct beneficiaries in the livestock subsample reported having received any form of training since project baseline, they were more likely to have received training than their counterparts in the control group and among non-beneficiary members in their community (only 15 per cent). According to the project's theory of change, community training is intended to pass knowledge to beneficiaries which aids in increased productivity and sales. We find some evidence which illustrates this mechanism: respondents who received any form of training (in agriculture, livestock, elaboration of sub-products, or management) have higher total net income. The overall correlation, however, is small at 0.08 and, surprisingly looks higher for non-beneficiaries (0.13) in project communities and lower for direct beneficiaries (0.04). If on one hand this may suggest that offering training at the community-level can be an effective way of capitalizing on the spillover effects of projects, on the other hand it casts some doubts on how effective the training delivered by this project was. However, this training could be improved if more integrated to project's objectives and to market access. For example, while those households who received livestock training were more likely to adopt reproductive strategies for their livestock, there is no evidence of a reduction in livestock illness for the same households (and actually no significant correlation is found for project's direct beneficiaries). The consequences of this may be significant. Approximately 23 per cent of Plan VIDA beneficiaries who received livestock from the project reported that at least one of these animals had since died. Unfortunately, there appears to be almost no correlation between livestock training and instance of livestock death, suggesting that the training was not very effective at preventing either illness or death.

Results on social capital, gender, documentation and financial inclusion indicators are very similar to the one observed for the whole sample and therefore the same considerations applies. Table 8e confirms a positive impact on increased leadership for beneficiaries in general and for female household members in particular in Potosí. The only relevant difference is found in Cochabamba where livestock interventions seem to have favoured interaction with other communities mainly in terms of the amount of time spent with members of these other communities.

Table 8e: Results on social capital and gender indicators

	Livestock sample (N=2339)			Cochabamba (N=996)		Potosí (N=1343)	
	ATET	Control mean	N	ATET	Control mean	ATET	Control mean
Households with at least one household member belonging to a group (%)	-0.8	71.2	2 339	-1.1	71.1	-1.8	72.4
Households with a member who is a leader in a community group (%)	2.7*	9.8	2 339	2.9	9.7	2.8	9.6
Households with a member who actively participates in a community group (%)	1.6	40.6	2 339	3.1	39.3	0.0	41.9
Number of groups in which the household currently participates	0.039	1.355	1 630[a]	0.086	1.391	0.015	1.317
Households that are part of a group that interacts outside the community (%)	3.3	15.0	1 630[b]	3.7	12.1	2.7	17.4
Households with social networks inside community (%)	-1.5	72.2	2 339	1.5	72.1	-3.5	72.0
Households with social networks outside community (%)	-0.4	39.4	2 339	-0.4	42.0	0.3	36.7
Number of times respondent has stayed with non-family outside of community in the past year	0.106	0.768	2 338[c]	0.336**	0.632	-0.035	0.839
Households with a female member who is a leader in a community group (%)	0.8	1.9	2 339	0.0	1.8	1.8**	1.5
Households with a female member who participates in community group (%)	-0.3	32.3	2 339	-1.8	33.2	1.5	30.9

note: * p<0.01, ** p<0.05, *** p<0.1
[a,b] Computed for households who participate to community groups.
[c] Lower number of observations due to non-response.

Table 8f: Results on documentation and financial inclusion indicators

	Livestock sample (N=2339)			Cochabamba (N=996)		Potosí (N=1343)	
	ATET	Control mean	N	ATET	Control mean	ATET	Control mean
Household members with ID documents (%)	0.1	97.4	2 339	-0.3	97.4	0.4	97.3
Households with at least one member with a bank account (%)	0.7	8.8	2 339	0.8	9.0	0.8	8.4
Households with at least one member with voluntary savings (%)	0.5	4.8	2 339	-0.3	4.7	1.5	4.7

note: * p<0.01, ** p<0.05, *** p<0.1

5.2.1 Analysis on agriculture project subgroup

Restricting the analysis to only agriculture-specific interventions would have helped shading some light on the mechanisms of production leading to project impact. However, the sample size for this subgroup is too small to detect any potential effects as they are very likely to be hindered by a lack of statistical power. Still, some positive impacts were found in the attempt to perform this type of analysis on improved seed usage as beneficiaries are more likely to use improved seed varieties for the most common crop grown in project areas namely, potatoes.

Interestingly, in terms of social capital and gender, a positive result is found on increased participation of female household members in community groups despite the restricted group of beneficiary households. However, because of the above mentioned reasons, we choose not to report results for this specific analysis.

6. Conclusions

Overall the project, although being rather diversified in its different types of interventions, shows some significant impacts on key economic mobility indicators proxied by an increase in asset ownership and, given the particular focus of the project, on livestock ownership. The results also show a significant reduction in the probability of being poor among beneficiary households when using an asset-based poverty line. Agricultural income, which includes livestock income, is another key impact which displays positive results that are statistically significant.

It is important to note that the impacts we find across the entire sample, are stronger and more significant for interventions that focus on livestock. These projects represent 80 per cent of all interventions under analysis, and correspondingly of the sample analysed. The stronger and significant results are likely attributable to a more robust and better constructed and interlinked logic of intervention. Livestock interventions consisted not only in the provision of livestock and new breeds but, in most of the cases, they also ensured better maintenance and care, therefore creating synergies that have determined positive overall impacts.

These results suggest that a more focussed and stronger type of intervention of less diversified development priorities may lead to larger and more positive impacts. This is true for direct indicators, such as livestock ownership and income, but also for indirect but interlinked indicators such as increase in dietary diversity, which is significantly positive for the treated group and driven by higher consumption of livestock related products such as eggs and dairy products.

Livestock ownership and its value have positively increased as a straightforward impact of the project, determining both a higher value of livestock capital and also a buffer value in case of needs, which is corroborated by the higher ability of the treated group to recover from shocks.

Additionally, results on market access indicate that livestock beneficiaries are able to obtain higher gross revenues and higher gross margins from selling livestock suggesting a better connection with, or greater willingness to connect to, market buyers. In this regard, it is important to note that given the strong role played by middlemen (*rescatistas*) in Bolivia, focussing on linking farmers and livestock herders to the market – ensuring higher gross margin – would also be a strategic approach of focussed intervention. Such linkages in this case would work along the entire value chain.

Another interesting result is the higher number of income sources for beneficiaries as compared to the control group. This greater diversification seems to be mainly linked to livestock production and family enterprise (*i.e.* self-employment). Whereas diversifying into livestock can be considered a direct expected impact, diversification into self-employment and family business activities, combined with higher productive assets capital, indicates that the increased income from agriculture is probably re-invested in micro and small enterprises whose increase in income takes some time to return and is not yet captured by total net household income, although both crop and livestock income are significantly higher for the beneficiaries.

In terms of expected impact on social capital, this study cannot find any significant increase except for greater leadership among beneficiaries in general and women household members in particular. While this is a positive result of the project, the nil effect on the general level of social groups and social capital is likely to be due to two factors: first, to the already large participation in social groups and activities, and second, to the fact that social capital can be considered the main driver of project's implementation rather than a result.

In summary, the project shows good results, which are stronger for more focussed and more interlinked components that develop positive synergies at the local level, suggesting that even in community-driven development projects, stronger and interlinked drivers could more easily determine a virtuous transformative cycle.

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Appendix

Table 1: Matching covariates used in propensity score

Indicator	Matching justification
Number of rooms per adult	Wealth indicators
Binary: Roof qualtiy	
Binary: Floor quality	
Binary: Access to electricity	
Binary: Has own sanitary services	
Binary: Has piped water	
Binary: Uses gas for cooking	
Ratio of land owned to total land cultivated	Productive potential
Dependency ratio, age <14 : >14	Willingness to provide labor
Number of adult household members	
Binary: household has at least one employed member >=10 years old	Demographics that influence self-selection
Ethnicity of head of household	
Age of head of household	
Binary: head of household is female	
Years of education of head of household	
Binary: respondent voted in the last electoral process	Trust in government and community
Binary: at least one household member participated in a community group at baseline	Social capital
Altitude of community	Community-level productive capacity

Figure 1: Common support between treatment and control groups

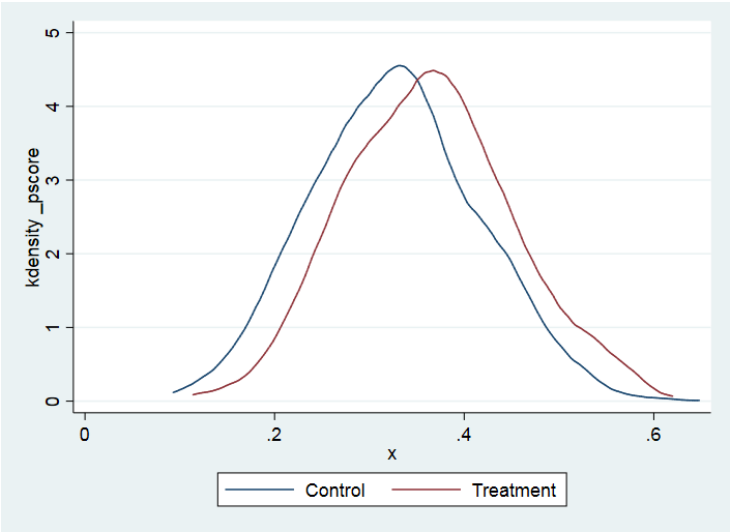

Figure 2: Bias reduction before and after matching

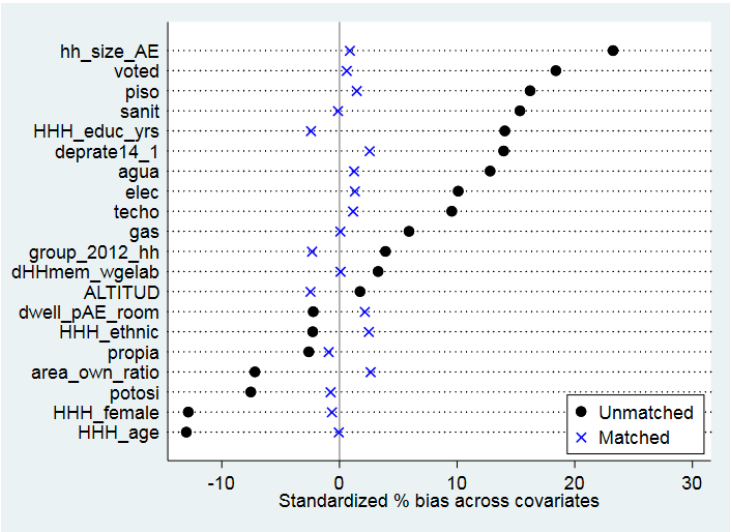

Figure 3: Covariates balance densities in treatment and control groups before and after matching

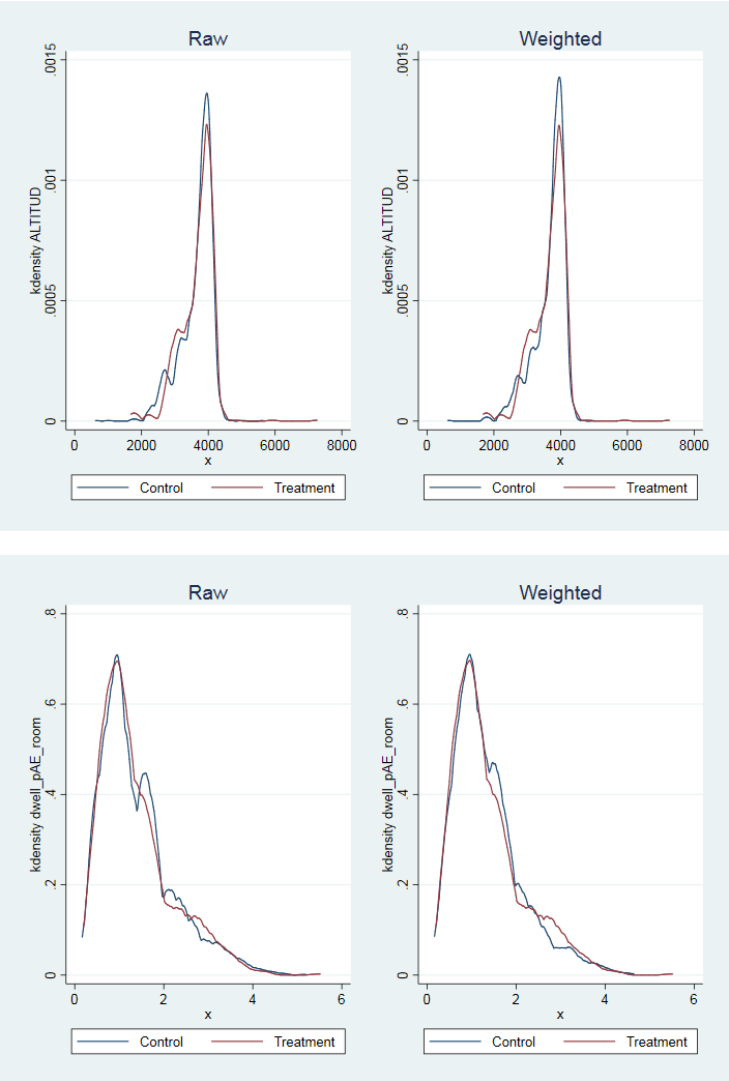

Table 2: Indicators used in the analysis

Indicator	Notes on construction
Economic mobility	
Total net household income	Constructed using RIGA methodology (Carletto et al., 2007). This includes income from crops, livestock, family enterprises, wage employment, and other sources, net of all costs.
Net agricultural income	Constructed using RIGA methodology, including only crops, livestock, and their sub-products.
Income diversification	Total number of income sources (as per RIGA methodology) .
Durable goods index	Using multiple correspondence analysis for a set of binary indicators indicating ownership of various durable goods.
Agricultural goods index	Using principal component analysis for a count of various agricultural goods.
Overall asset index	Using polychoric factor analysis combining binary and count variables for durable and agricultural assets used to compute the above asset indices.
Household is below asset-based poverty line	Binary indicator, with poverty line set at 40^{th} or 60^{th} percentile of the control group's asset index.
Household is below monetary-based poverty line	Binary indicator, with extreme poverty line for rural areas in Bolivia set to around 544 USD per year (INE, 2012).
Food diversity, food security, and resilience	
Household Dietary Diversity Score (HDDS)	Using past week as reference period and based on twelve food groups (FAO, 2011).
Food Insecurity Experience Scale score for adults	Constructed for adults aged 18 and above (Ballard et al., 2013).
Food Insecurity Experience Scale score for children	Constructed for children aged under 18 (Ballard et al., 2013).
Index for household's ability to recover from shocks	Constructed using a set of variables indicating whether the household experienced any of a range of economic or climatic shocks. The index calculates a severity score from the number and perceived severity of these shocks experienced by household since project baseline, and compares this to the household's self-reported ability to recover. Logically, the sample is restricted to those households that experienced any shocks since baseline.
Agricultural production and market capacity	
Net income from crops	Constructed using RIGA methodology.
Crop revenues	Including sales of crops and crop sub-products.
Gross crop margins	Revenues net of production costs.
Crop diversification	Calculated using the Gini-Simpson index.
Harvest-to-seed ratio	Constructed for the most common crop grown in the sample (i.e. potatoes).
Household uses improved seeds	Binary indicator where 1 = uses improved seeds for the most common crop grown in the sample (i.e. potatoes).
Livestock productivity and care	
Net income from livestock	Constructed using RIGA methodology.
Livestock revenues	Including sales of livestock and livestock sub-products.
Gross livestock margins	Revenues net of production costs.
Livestock diversification	Calculated using the Gini-Simpson index.
Number of tropical livestock units (TLUs) owned	Computed for animals of large and medium size; namely, cattle, sheep, goats and camelids.
Number of improved TLUs owned	As above.

Total value of TLUs owned	In US Dollars.
Reproduction rate for cattle	Calculated from a subsample of respondents who provided information for birth rates. Thus, the measure of reproduction included in the study may not be a measure representative of all project beneficiaries.
Reproduction rate for sheep	As above.
Household used livestock reproduction strategies	Binary, with reference period of previous 12 months.
Household experienced livestock disease	Binary, with reference period of previous 12 months.
Household produces livestock sub-products	Binary, with reference period of previous 12 months.
Household uses livestock protection	Binary, with reference period of previous 12 months.
Household cultivates forage crops	Binary, with reference period of previous 12 months.
Social capital, gender, and financial inclusion	
Household has at least one household member belonging to a group	Binary.
Household has a member who is a leader in a community group	Binary.
Household has a member who actively participates in a community group	Binary.
Number of groups in which the household currently participates	Binary.
Household is part of a group that interacts outside the community	Binary.
Household has social networks inside the community	Binary, where 1 = household can give or receive support from members of the community.
Household has social networks outside the community	Binary, where 1 = household can give or receive support from members of another community.
Number of times respondent has stayed with non-family outside of community	Reference period of previous 12 months.
Community identified a need for improvement	For infrastructure not related to project inputs.
Community took action to address identified need	For households responding "yes" to above indicator
Community mobilized external resources in taking action	For households responding "yes" to above indicator
Community has at least one group with increased participation	Reference period since baseline.
Household has a female member who is a leader in a community group	Binary.
Household has a female member who participates in community group	Binary.
Household member has ID documents	Binary.
Household has at least one member with a bank account	Binary.
Household has at least one member with voluntary savings	Binary.

Additional note: For indicators involving the value of crops and livestock (such as income measures or total value of livestock), the worth of each unit was imputed using the local median of the sales price for the unit from the corresponding region of that household – either at the municipality, province, or department level. Median prices for crops were used from the smallest local region possible which had at least 15 observations of price. For livestock, a minimum of 20 observations was used in most cases, but prices were imputed in cases of fewer observations if they were reasonably comparable to prices found in secondary data.

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