Capacity Building for Rural Enterprise Development for Small Producers in the Atlantic North Autonomous Region, Nicaragua

Project Effectiveness Review
Livelihoods Support

Oxfam GB
Livelihoods Support Global Outcome Indicator

December 2012

Photo credit: Annie Bungeroth

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Executive Summary

Under Oxfam Great Britain's (OGB) Global Performance Framework (GPF), certain mature projects are being selected at random each year to undergo a rigorous assessment of their effectiveness. In the 2011/12 financial year, a project supporting rural enterprise development in Nicaragua (NICA71/NICB16) was selected for evaluation against OGB's global indicator for livelihoods support:

- **Percentage of households demonstrating greater income, as measured by household expenditure per capita.**

The NICA71/NICB16 project (usually known by its Spanish acronym of "PRODER") supports producers in three value chains – dairy products, cocoa, and wooden furniture – in three municipalities in the Atlantic North Autonomous Region of Nicaragua. The support has focused on capacity building with producers to enable them to improve the quality of their production, facilitate their access to markets, and increase their negotiating power. Another important dimension of the project has been the provision of productive infrastructure for producer cooperatives in each value chain. However, these facilities were still under construction at the time of the effectiveness review, so their impact could not be assessed.

In January 2012, with the support of an external consultant, a team of enumerators carried out a household survey with 386 dairy and cocoa producers in the Municipality of Siuna. The enumerators interviewed almost all the households supported by the PRODER project, as well as a larger number of producers from neighbouring communities who have not benefited from PRODER or similar projects. The survey was designed to capture data relevant to Oxfam GB's global indicator for livelihoods, as well as on production of the value-chain products and on other intended outcomes of the project. At the analysis stage, the statistical tools of propensity-score matching and multivariable regression were used to control for measured differences between the supported and comparison producers.

Overall, the results provide some evidence that the PRODER project has led to increased household income among supported households in the dairy-producing areas. These households also experienced greater asset accumulation, suggesting that their higher household incomes have been sustained for some time. However, the mechanism for this apparent positive effect does not appear to be that envisaged in the project's design. In particular, while the project seems to have encouraged more of the supported producers to sell dairy products, there is no evidence that they obtained higher prices for these products.

Among the supported producers in the cocoa-producing areas, the project does not appear to have impacted overall household income or asset wealth. This is despite the fact that these households received more revenue from the sale of cocoa than the comparison households. However, there is some evidence that the project successfully encouraged household investment in planting cocoa, much of which had not fully matured at the time of the effectiveness review was carried out. Consequently, it is possible that this component of the project will translate into improvements in household wellbeing at a later time.

Finally, a surprisingly large proportion of the supported producers reported having received training on gender equity during the lifetime of the PRODER project, and these producers expressed significantly better attitudes to women's economic roles than comparison producers who did not receive such training.

Considerations to enable to programme team to learn from this effectiveness review include:

- Investigate why efforts to realise higher prices for value-chain products have apparently not so far been successful.
- Further assess what impact this project has had on women's position in the household, and learn what can be applied from this approach in other projects.

1 Introduction and purpose

This report documents the findings of the project effectiveness review, focusing on outcomes related to livelihoods support.

Oxfam GB has developed a Global Performance Framework (GPF) as part of its effort to better understand and communicate its effectiveness and enhance learning across the organisation. This framework requires programme/project teams to annually report generic output data across six thematic indicator areas. In addition, modest samples of sufficiently mature projects (e.g. those closing during a given financial year) associated with each thematic indicator area are being randomly selected each year and rigorously evaluated. One key focus is on the extent they have promoted change in relation to relevant OGB global outcome indicators.

The following global outcome indicator was endorsed for the livelihoods support thematic area:

- **Proportion of households demonstrating greater income, as measured by household expenditure per capita.**

The conceptual underpinnings of this indicator are presented in Section 3.0 below. The effectiveness review for the project "Capacity Building for Rural Enterprise Development" (NICA71/NICB16), which took place in Nicaragua in January 2012, was part of an effort to assess progress against this indicator.

This report presents the findings emerging from the evaluation process. Section 2 provides brief background information on the project and the context in which the support is being provided, while Section 3 explains the project's intervention logic. Section 4, Section 5, and Section 6 follow by presenting the conceptual frameworks underlying the indicators, the impact evaluation design being pursued, and the methods of data collection and analysis, respectively. Section 7 is the longest section of this document. Its subsections include those related to basic descriptive statistics, intervention exposure, and finally the overall differences between the targeted producers and the comparison producers. Section 8 concludes.

2 The Project: Capacity Building for Rural Enterprise Development for Small Producers in the Atlantic North Autonomous Region, Nicaragua

Oxfam GB's project in support of rural enterprise development for small producers started in 2008 in three municipalities of the Atlantic Autonomous Region (RAAN) in Nicaragua. This project, usually referred to by its Spanish acronym as "PRODER", promotes sustainable livelihoods and small enterprise development in three value chains: dairy and cocoa products in the Municipality of Siuna, cocoa products in the Municipality of Bonanza, and furniture manufacturers in the Municipality of Rosita. The project is implemented by a different partner organisation in each municipality.

PRODER aims to improve productive capacity for the relevant value-chain products and also to enable producers to improve their participation in markets. Dairy production is one of the main productive activities in the Siuna area, but prior to the project, the quality of the products brought to the market was low. Demand for cocoa has been increasing over several years, but

The PRODER project supports producers of three value-chain products: dairy products, cocoa, and wooden furniture.

again the quality being supplied was low, and producers were not organised so had no negotiating power with traders. The manufacture of furniture in the area has been a marginal activity with little returns for either the carpenters or the suppliers of the timber – despite the abundant forest in the region which should give it a competitive advantage over other parts of the country.

During the initial three years, the project's interventions have focused on providing producers with technical training and support in increasing the quality and productivity of the value-chain products, and also on facilitating better access to markets. Under the former strand, partner organisation staff have held regular training workshops and have used demonstration plots to demonstrate improved techniques for production of the value-chain products. Interventions focussed on the marketing side of the project have included providing information about standards demanded by buyers (particularly in the case of cocoa), facilitating access to producers' fairs, and "apprenticeship visits" or international exchanges for groups of producers to learn from experience in other countries.

Producers have also been encouraged to move further along the value chain by processing some of their own products. In two communities, for instance, this has involved groups of cocoa farmers establishing cooperative enterprises to produce artisanal chocolate, which is sold at retail outlets in the region. During 2011 and 2012, the project invested in physical infrastructure to support value-chain activities in each area. This has included the construction of collection and storage facilities for dairy-producing cooperatives and a carpenters' workshop and drying area for timber. However, these infrastructure facilities were not yet in use at the time of the effectiveness review, so their impact could not be evaluated. Complementing all of these activities has been the establishment or strengthening of producers' cooperatives in communities, both to facilitate the organisation and reinforcement of training, allowing members to gain from economies of scale in storage, processing and marketing their products.

In the Municipality of Siuna specifically, PRODER has built on a long-term relationship which Oxfam GB has with the 14 communities included in the project. These 14 communities were originally identified by Oxfam GB as some of those which were worst affected by Hurricane Mitch in October/November 1998, and rehabilitation work was carried out. From 2003 to 2007 Oxfam GB (funded by DFID) carried out a food security project in the same communities. This project focused on encouraging greater crop diversification and the use of agroforestry by households in the area. Dairy and cocoa production was also covered to some extent by this earlier project, but these were not areas of focus.

3 Intervention logic of the support provided

Figure 3.1 illustrates a simple 'theory of change', showing the steps by which the project's key interventions are intended to result in improvements in household income and reduction in poverty. This model separates the activities of the PRODER project into, firstly (in the lower right-hand bubble), the training and technical support on production of the value-chain activities themselves, and secondly (the lower left-hand bubble), the interventions intended to improve the capacity of producers to market their products. Both forms of support have been provided both through direct training of producers,

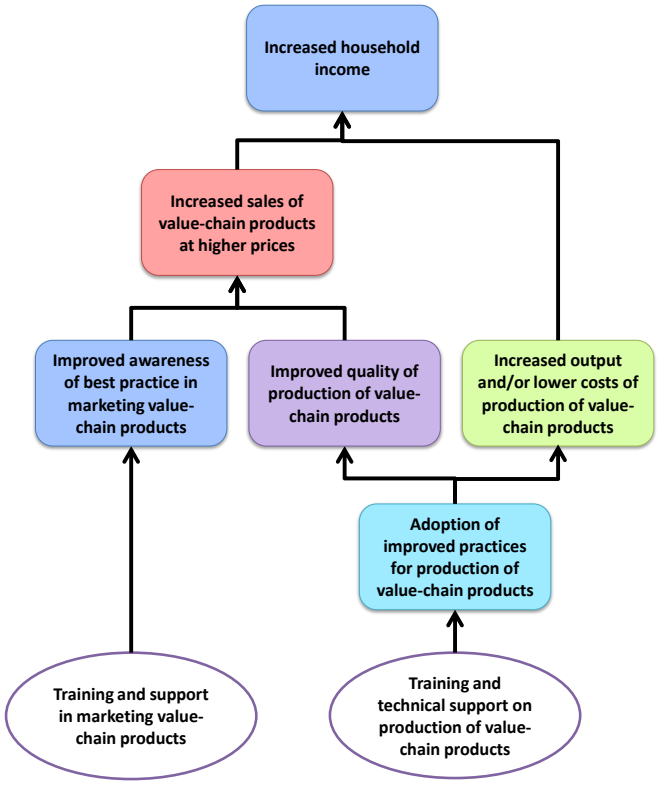
and through building the capacity of the local cooperatives to support the producers themselves.

Project activities include technical support in production of value-chain products, as well as support in enabling producers to bring their products to market.

The technical support activities are intended to result in improvements in quality or efficiency of production. Increases in efficiency are then to translate directly into greater net income for the household for each unit of the product which they sell. On the other hand, improvements in quality of production is intended to have a similar effect to improvements in marketing capacity, in increasing either the volume of sales or the prices which producers are receiving. The distinction between these two strands will be important when assessing the effect of the project in Section 7.

Figure 3.1

Intervention logic:
Production and marketing of value-chain products



Additionally, the PRODER project encourages women to be involved in these value-chain activities and in the leadership of the cooperatives. A small number of representatives from the cooperatives participated in a series of workshops on gender issues during 2011. These activities are intended to strengthen women's economic empowerment, evidence for which will also be examined in this effectiveness review.

4 Impact Assessment Design

4.1 Limitations in Pursuing the Gold Standard

The core challenge in evaluating the impact of a social programme is to credibly estimate its net effect on its participants. A programme's net effect is typically defined as the average gain participants realise in outcome (e.g. income) from their participation. In other words:

Impact = average post-programme outcome of participants – what the average post-programme outcome of these same participants would have been had they never participated

This formula seems straightforward enough. However, *directly* obtaining data on the latter part of the equation – commonly referred to as the counterfactual – is logically impossible. This is because a person, household, community, etc. cannot *simultaneously* both participate and not participate in a programme. The counterfactual state of a programme's participants can therefore never be observed directly; it can only be estimated.

The randomised experiment is regarded by many as the most credible way of estimating the counterfactual, particularly when the number of units (e.g. people, households, or, in some cases, communities) that are being targeted is large. The random assignment of a sufficiently large number of such units to intervention and control groups should ensure that the statistical attributes of the two resulting groups are similar in terms of a) their pre-programmes outcomes (e.g. both groups have the same average incomes); and b) their observed characteristics (e.g. education levels) and unobserved characteristics (e.g. motivation) that affect the outcome variables of interest. In other words, randomisation works to ensure that the *potential outcomes* of both groups are the same. As a result – provided that threats such differential attrition and intervention spill-over are minimal – any observed outcome differences observed at follow-up between the groups can be attributed to the programme.

However, implementing an ideal evaluation design like this is only possible if it is integrated into the project design from the start, since it requires the introduction of some random element that influences participation. To evaluate an ongoing or completed programme – as in this project effectiveness review – or one where randomisation is judged to be impractical, it is therefore necessary to apply alternative techniques to estimate the counterfactual as rigorously as possible.

4.2 Alternative Evaluation Design Pursued

The evaluation design involved comparing the Oxfam supported producers with non-supported producers, while statistically controlling for observed differences between them.

There are several evaluation designs when the comparison group is non-equivalent that can – particularly when certain assumptions are made – identify reasonably precise intervention effect estimates. One solution is offered by matching: find units in an external comparison group that possess the same characteristics, e.g. ethnicity, age, and sex, as those of the intervention group and match them on these characteristics. If matching is done properly, the observed characteristics of the matched comparison group will be identical to those of the intervention group. The problem, however, with conventional matching methods is that with large numbers of characteristics on which to match, it is difficult to find comparators with similar combinations of characteristics for each of the units in the intervention group. The end result, typically, is that only a few units from the intervention and comparison groups get matched up, thereby, not only significantly reducing the size of the sample but also limiting the extent to which the findings can be generalised to all programme participants. (This is referred to as the "curse of dimensionality" in the literature.)

Fortunately, matching on the basis of the propensity score – the conditional probability of being assigned to the programme group, given particular background variables or observed characteristics – offers a way out. The way propensity score matching (PSM) works is a follows: Units from both the intervention and comparison groups are pooled together. A statistical probability model is estimated, typically through logit or probit regression.

This is used to estimate programme participation probabilities for all units in the pooled sample. Intervention and comparison units are then matched within certain ranges of their conditional probability scores. Tests are further carried out to assess whether the distributions of characteristics are similar in both groups after matching. If not, the matching bandwidth or calliper is repeatedly narrowed until the observed characteristics of the groups are statistically similar. Provided that a) the dataset in question is rich and of good quality; b) the groups possess many units with common characteristics (i.e. there is a large area of common support); and c) there are no unobserved differences lurking among the groups, particularly those associated with the outcomes of interest, PSM can produce good intervention effect estimates.

Multivariable regression is another approach that is also used to control for measured differences between intervention and comparison groups. It operates differently from PSM in that it seeks to isolate the variation in the outcome variable explained by being in the intervention group *net of other explanatory variables* (key factors that explain variability in outcome) included the model. In this way, multivariable regression controls for measured differences between the intervention and comparison group. The validity of both PSM and multivariable regression are founded heavily on the "selection on observables" assumption, and therefore treatment effect estimates can be biased if there are unmeasured (or improperly measured) but relevant differences existing between the groups. Both PSM and multivariable regression were employed during data analysis, and efforts were made to capture key explanatory variables believed to be relevant in terms of the assessed outcomes, including details about the composition of the household, and their livelihood activities at baseline.

4.2 Reconstruction of Baseline Data

Several of the questions asked for information about the household's situation in 2007 to reconstruct baseline data.

For propensity-score matching or multivariate regression to work effectively, individual-level data are needed on differences in key characteristics between the intervention and comparison groups. Ideally, baseline data would be available for the outcomes of interest. In the case of this project, a baseline survey had been conducted to provide indicative figures on the beneficiary population. However, the original dataset was not available and (crucially) no comparison households had been surveyed. For these reasons, the baseline data were not used as an input into this effectiveness review.

Instead, the project effectiveness review attempted to reconstruct baseline data by asking to respondents to recall certain information about their household's situation in the year 2007, before the project activities commenced. The year 2007 was chosen as the year of Hurricane Felix, the most destructive hurricane of recent years, which all people in the area could remember clearly. In order to maximise the accuracy of the recalled data, respondents were asked to visualise their household's situation just before Hurricane Felix struck. They were only asked to recall information which they could reasonably be expected to recall with clarity, such as the condition of the house, the ownership of assets and livestock, and the variety of crops produced.

4.3 Selection of comparison group

A key factor in ensuring the validity of any non-randomised, "large *n*" impact evaluation design is to employ an appropriate comparison group. This is

particularly true for ex-post, cross-sectional designs. If a comparison group differs from the intervention group with respect any factors determining the outcome variable it will likely result in misleading conclusions about programme impact. Identifying a plausible comparison group is therefore critically important and is often not an easy task.

Since this project was being implemented via local producers' cooperatives in various localities, the ideal situation would have been to identify similar cooperatives in nearby areas which were similar in structure to those included in the Oxfam project, but which had not received significant levels of external support. However, discussions with partner organisation staff revealed that there were few independent cooperatives or producers' groups in these areas. Those which did exist – dairy cooperatives in the Municipality of Siuna – were in fact receiving intensive support, mostly from Oxfam's partner organisation.

Comparison producers where identified by attempting to replicate the project's initial targeting process.

As the next best alternative, the team decided to identify comparison respondents by replicating, as best as possible, the process by which producers were initially identified to participate in the local cooperatives. Here, partner organisation staff made contact with local community leaders and ask them to list all the dairy producers and/or cocoa producers in their locality, as appropriate. This was achieved successfully in all the areas included in the survey, though in fact community leaders tended to list only the largest producers of each value-chain product in their locality. As such, they and other local informants had to be prompted during the field work stage to identify further (usually smaller-scale) producers of the appropriate value-chain product. The consequence of this is that in each comparison locality all or almost all of the producers of each value-chain product were surveyed.

4.4 Selection of geographic areas and value chains

As discussed in Section 2, the project under review supports producers working in three value chains – dairy products, cocoa and timber – in the municipalities of Siuna, Rosita and Bonanza.

In the case of the cocoa value chain activities in the Municipality of Bonanza, local partner organisation staff advised that there were few if any producers of cocoa in that area who were not included in the Oxfam project. This meant that identifying a comparison group would be very challenging. For that reason and because of security concerns about working in Bonanza, the project activities in this municipality were excluded from the effectiveness review.

In the case of the timber value chain in the Municipality of Rosita, the project had supported 23 carpenters who construct furniture. However, only nine of these 23 direct beneficiaries were proprietors of their own businesses – the others, as workshop employees, were thought to have less potential for benefitting fully from the project. (The aim is that eventually the providers of timber should also benefit indirectly from the project's interventions, but it was considered too early to expect impact at this level.) Given that the small number of beneficiaries, a decision was taken to exclude this value chain from the effectiveness review.

This left the dairy and cocoa value-chain interventions in the Municipality of Siuna as suitable for evaluation in the project effectiveness review. These project activities are implemented by the local office of the *Unión Nacional de Agricultores y Ganaderos* (National Union of Agriculturalists and Livestock Producers, UNAG). Of the five dairy producers' cooperatives, two were

located in an area which was considered inaccessible for security reasons, so these were also excluded from the effectiveness review. Of the three cocoa producer cooperatives, comparable cocoa producing localities could be identified for only two of them; the third was therefore excluded from the effectiveness review. Table 4.1 summarises the cooperatives and the comparison localities which were included in the effectiveness review.

Table 4.1: Supported cooperatives and selection of comparison areas

Value-chain area	Cooperative	Localities	Comparison localities
Dairy	COOMUNSOL	Yaoya, Caño Seco, San Pablo, Coperna, San Martín, Santa Fe, Dorado	Madriguera Lívico Uli
	COACAM	Dorado, San Pablo, Monte de Oro	La Bomba Azadín
	COOMAUTOM	Negro Was, Mongallo, Salto Verde	El Bambú
Cocoa	COOMCOR	Rosa Grande	Las Quebradas El Ocote
	COOMUSASC	Carao Hormiguero	San José Hormiguero

5 Outcome indicators

5.1 Livelihoods outcome indicator

Respondents were asked to estimate the value of all food consumed in the household during the seven days prior to the survey, as well as other recent expenditures.

Measuring household wealth or socioeconomic position in low income countries is not straightforward, particularly in rural areas where respondents tend to be self-employed. Self-reported measures of total income are unreliable, given the wide variety of endeavours such populations engage in to generate income.[1] However, given that there is a widely recognised and strong association between household income and consumption,[2] one popular proxy measure used by the World Bank and other international institutions involves the aggregation of both household consumption and expenditure data.[3]

To capture data on this indicator, a household survey is administered that contains a consumption and expenditure module. The respondents are asked what types of food they consumed over the previous seven day period, as well as the particular quantity. The quantity is transformed into a monetary value, i.e. either how much they paid for the food item in question or, if the food item was from their own production, how much they would have paid if it was bought from the local market. The respondents are also asked how much they spent on particular regular non-food items and services from a list such as soap, toothpaste, and minibus fares over the past four weeks. Finally, they are asked for any household expenditure on non-regular non-food items such as school and hospital fees, clothes, and home repair over the last 12 months. For non-food items that are gender divisible, data are collected in a gender-disaggregated fashion, thereby enabling intra-household consumption inequality to be measured as well. The household expenditure

[1] Morris, Saul, Calogero Carletto, John Hoddinott, and Luc J. M, Christianensen. (1999) *Validity of Rapid Estimates of Household Wealth and Income for Health Surveys in Rural Africa: FCND Discussion Paper No. 72*. Washington: International Food Policy Research Institute.
[2] See Gujarati, Damodar N. (2003) *Basic Econometrics: Fourth Edition*. New York: McGraw Hill.
[3] Deaton, A and S. Zaidi. 2002. "Guidelines for constructing consumption aggregates for welfare analysis," Working Paper No. 135. The World Bank, Washington, D.C.

measure is calculated by converting each of the expenditure types into a per-day figure and adding them together.

While dividing the above equation by household size as the overall denominator is recommended in the literature, using a more nuanced calculation is deemed important to avoid underestimating the wealth status of larger sized households relative to their smaller counterparts. The formula used for calculating household size is

where *A* is number of adults in the household; *K* is the number of children; is the consumption of a child relative to an adult; and stands for the extent of economies of scale. This evaluation follows the common practice of setting equal to 0.33 and equal to 0.9,[4] but the findings are not sensitive to reasonable changes in these parameters.

The expenditure variable is normally then converted to a logarithmic scale, to both improve the model fit in regression analysis and reduce the influence of outliers. The resulting variable can remain continuous, and the average per capita consumption and expenditure can be calculated for the sample in question. It can also be transformed into a binary variable, so that the proportion of households living above a certain monetary figure can be calculated. For the Oxfam GB global indicator for livelihoods, the median expenditure level of the comparison group is used as the benchmark for creating the binary variable.

5.2 Other outcome measures

As reviewed in Section 3 above, the support provided to the targeted households is intended to bring about a number of other outcomes, in addition to strengthening livelihoods. Given this, data were collected on a number of additional outcome measures. These include those relating to household ownership of assets, agricultural production, household food security and change in use of water and sanitation facilities.

Household expenditure data were supplemented by several self-reported measures of household well-being.

Self-reported income change
Respondents were asked to make a judgement whether overall their income had increased, remained the same or decreased since 2007.

Ability to meet basic needs
Respondents were presented with the following four descriptions of household economic situations, and asked which matched their own situation most closely:

- *Doing well*: able to meet household needs by your own efforts, and making some extra for stores, savings, and investment.
- *Breaking even*: Able to meet household needs but with nothing extra to save or invest.
- *Struggling*: Managing to meet household needs, but depleting productive assets and/or sometimes receiving support.
- *Unable to meet household needs by your own efforts*: dependent on support from relatives living outside of your household or the community, government and/or some other organisation – could not survive without this outside support.

[4] Ibid.

Household food security

Household food security was measured using six questions adapted from the Household Food Insecurity Access Scale (HFIAS) developed by USAID's Food and Nutrition Technical Assistance (FANTA) Programme.[5] Respondents were asked whether any of the following were true for them or other members of their household in the four weeks before the date of the survey:

- Did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?
- Did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?
- Did you or any household member have to eat fewer meals in a day because there was not enough food?
- Was there ever no food to eat of any kind in your house because of lack of resources to get food?
- Did you or any household member go to sleep at night hungry because there was not enough food?
- Did you or any household member go a whole day and night without eating anything because there was not enough food?

For each question which was answered positively, the respondent was then asked how frequently this situation occurred during the four weeks. A score was generated based on the frequency of these events.

Household ownership of assets

The collected data also permits analysis of how household asset ownership has changed since 2007.

Household consumption and food security tend to provide good indications of the household's current economic situation, but in low-income contexts they tend to be influenced strongly by current or very recent income patterns. These measures may not, therefore, fully reflect any long-term economic benefits from participation in a project. In order to provide a better measure of more long-term improvements in wealth status, the survey also asked households about their ownership of livestock, household assets, and about the condition of their homes. The full list of assets and other wealth indicators which were collected in the survey is shown in Table 5.1.

Respondents were asked about their ownership of these assets both at the time of the survey and in 2007. Survey piloting confirmed that respondents were able to recall this information from 2007 with a reasonable level of confidence.

Principal component analysis (PCA) was used to create a weighted index of asset ownership for 2007, and a further index of changes in asset ownership since 2007. PCA is a data reduction technique that narrows in on the variation in household asset ownership, which is assumed to represent wealth status. The more an asset is correlated with this variation, the more weight it is given. Hence, each household's weighted score is determined by both a) the number of assets its owns; and b) the particular weight assigned to each asset. This enables the relative wealth status of the households to be compared.

[5] http://www.fantaproject.org/publications/hfias_intro.shtml

Table 5.1: List of assets and other wealth indicators used to derive asset index

Livestock	***Agricultural equipment***	***Household goods***	***Vehicles***
Cattle	Machete	Watch or clock	Bicycle
Sheep	Axe	Table	Boat
Pigs	Spade	Bed	Motorcycle
Donkeys	Grass chopper	Mattress	Car or motor vehicle
Horses	Plough	Lamp (electric or gas)	
Poultry	Chainsaw	Iron (electric or coal)	***Condition of house***
	Cart	Sewing machine	Number of rooms
	Silo	Jewellery	Material used for walls
Property	Milking bucket	Mobile phone	Material used for roof
Ownership of house	Thermal milk flask	Radio	Material used for floor
Ownership of land	Hand pump	CD player	Fuel used for cooking
where the house is	Electric pump	Sound system	Type of toilet
f farmland		Television	Electricity connection
nd owned		DVD player	
or		Generator	
		Solar panel	
		Fan	
		Refrigerator	
		Blender	

A short component in the survey examined respondents' attitudes to women's roles.

Agricultural production and sales

Respondents were asked for details on their production and sales of dairy and cocoa products in the 12 months prior to the survey, as well as basic information on their production and sales of dairy and cocoa products in 2007. To provide context on the importance of these value-chain activities within the surveyed households, respondents were also asked about the range of other crops they had cultivated and sold, both in 2007 and in the 12 months prior to the survey.

Other productive activities

In order to provide a fuller picture of the diversification of income sources within their household, respondents were also asked about the economic activities which each member of their household engages in. They were also asked to estimate the proportionate contribution of each activity to total household income, both currently and in 2007. This was facilitated by showing respondents a sheet with images of various sources of income, and asking them to allocate 20 stones between the sources according to their situation.

Attitudes to women's roles

Although evaluating success of the women's economic leadership activities was not a focus of this effectiveness review, a series of questions was included in the survey to give some indication of whether there was impact on this area. In particular, respondents were asked to state the extent of their agreement or disagreement with each of these statements:

- The only really satisfying role for a woman is as a wife and mother.
- Women are as important as men in ensuring that the basic material needs of families are met.

- Girls should be encouraged to be ambitious in terms becoming economically independent when they reach womanhood.
- Women are not suited for work of great stress and responsibility.
- Women's livelihood work is equally as important as their domestic work.
- A man should be responsible for providing money for his wife's personal use even if she is capable of earning it herself.
- Women's most important job is to look after the comforts of men and children.
- Households in our community would be much poorer if women stopped doing livelihood work.
- A situation where a woman spends the majority of her day away from the home to make money is not right.
- If a child falls ill, it is the mother's duty rather than the father's to take time away from productive activities to look after him or her.
- The saying "a woman's place is to take care of the home" is generally correct.
- A woman can be a good wife and mother even if she is involved in demanding livelihood activities.
- Women should worry less about their rights and more about becoming good wives and mothers.
- In general, women are equally capable of contributing to economic well-being than are men.
- If a woman gets too involved in livelihood activities, her family will likely suffer.

As is apparent, some of these statements are presented in a positive sense and some in a negative sense. During data analysis, the responses to the negative phrases were inverted, and points were awarded according to the extent of agreement or disagreement with each phrase. Rather than simply using the raw scores as the bases of the gender attitudes measure, principal factor analysis was carried out on the 10 items to generate a factor index. This technique focuses on the variation in the data that is common in the responses, so reducing the amount of "noise" in the data. This increases precision to identify significant differences in attitudes. One index was created for the responses given by male respondents, and one for the responses of female respondents.

5.3 Measuring project exposure and adoption of improved production techniques

To assess progress along the steps in the intervention logic models described in Section 3, it was necessary also to measure the extent to which the respondents were exposed to different types of support targeted at the households. As such, the respondents were asked which forms of support they had received during the three years prior to the survey, and whether each of these forms of support had been provided by a local cooperative or by a state body. They were also asked which of the techniques recommended by UNAG for the improving production of dairy and cocoa products they had implemented during the past year.

6 Methods of Data Collection and Analysis

6.1 Data Collection

The effectiveness review team designed a household questionnaire to capture data on both the outcome variables presented in Section 5 above, as well as other key characteristics of the targeted and comparison producers. The questionnaire was tested in a pilot community during the training workshop for the enumerators. Eighteen potential enumerators participated in a two-day training workshop. Based on their performance in this exercise, 15 enumerators were selected to carry out the field work.

Membership lists were provided by the implementing partner organisation, UNAG, for the three dairy producers' cooperatives and the two cocoa producers' cooperatives. After excluding a small number of cooperative members who were living in areas which could not be visited for security or logistical reasons, 165 cooperative members remained: 109 from dairy producers' cooperatives, and 56 from cocoa producers' cooperatives. It was judged that any sample of these cooperative members would have been too small to allow detailed analysis of outcomes. The team therefore attempted to survey *all* of the 165 cooperative members. In the event, the survey team found that in many cases multiple members of a cooperative came from the same household. Since most of the outcomes being assessed are at the household level, clearly only one interview could be conducted in each household. For that reason, the number of interviews conducted was smaller than expected: 97 households were surveyed in the dairy producers' cooperatives, and only 30 households in the cocoa producers' cooperatives.

The statistical techniques used made it advantageous to interview more comparison producers than supported producers.

Since the unmatched comparison data are given less weight in PSM than the data from intervention sites, it is advantageous to have larger sample sizes for the comparison group. To that end, the enumerators were given a target of 221 comparison interviews to conduct, split between the dairy and cocoa-producing areas in the same proportion as the project participants. As described in Section 4.3, comparison respondents were selected by asking community leaders and other key informants to identify dairy or cocoa producers in their localities, as appropriate. The field staff normally surveyed all the dairy or cocoa producers which they could identify within each locality. In fact the targets for the numbers of comparison respondents were exceeded: 259 comparison respondents were interviewed.

6.2 Data Analysis

OGB created a data-entry interface in Adobe Acrobat Pro, and the consultant supervised three data-entry clerks to enter the data. The data were imported into Stata for analysis, the results of which are presented in the following sections. The analyses involved group mean comparisons using *t*-tests, propensity-score matching (PSM) with Stata's *psmatch2* module, and various regression approaches. Kernel and nearest-neighbour matching without replacement were the main methods used in implementing PSM. Variables used in the matching process were identified by using backwards stepwise regression to identify those variables that were correlated with being a member of the intervention group, at *p*-values of 0.25 or less. Covariate balance was checked following the implementation of each matching procedure, to ensure that all covariates were balanced at *p*-values greater than 0.25. Bootstrapped standard errors enabled the generation of

confidence intervals to assess the statistical significance of the effect sizes. The covariates, as presented in Table 7.1 below, were included in the various regression approaches undertaken, i.e. regression with robust standard errors, robust regression (to reduce the influence of outliers), and regression with control functions (to attempt to control for unobserved differences between the intervention and comparison groups).

6.3 Main Problems and Constraints Encountered

Three difficulties encountered in the course of the data-collection process provide challenges in data analysis:

- *Total number of supported households interviewed was lower than expected.* As discussed in Section 6.1 above, the number of households that had been supported by the project in the five cooperatives included in the effectiveness review was smaller than expected. In total, the number of supported households which were available to be surveyed was 127. Of these, 97 were in the dairy value-chain areas and only 30 in the cocoa value-chain areas. The particularly small number of supported cocoa value-chain households would normally make it difficult to derive statistical estimates for impact. However, it should be remembered that the supported households which were interviewed make up almost the entire beneficiary group, rather than a *sample* of the supported households. This means that differences in outcomes found between the supported households and comparison households can be considered as real differences, without considering the statistical significance of these differences. However, when presenting the results in Section 7 below, statistical significance tests will be reported anyway. These tests aid in the interpretation of the *practical* significance of the identified outcome differences: the greater the statistical significance of these tests, the more we may have confidence that the difference is not simply due to random variation and measurement error.

  Final sample sizes for supported households were smaller than expected, mostly due to multiple members of supported cooperatives belonging to the same household.

  In any case, it should be noted that only five of the respondents reported having household members engaged in the manufacture of artisanal chocolates in Rosa Grande. This very small number meant that no attempt was made to analyse the impact of this activity in isolation from the general supported cocoa-producing households.

- *Significant baseline differences between supported and comparison households.* While the comparison communities and the specific producers in those communities were selected to be as comparable as possible to the supported households, they were found to be significantly different in several respects, on the basis of their household composition and recalled baseline data. Details of these differences are presented in Section 7.1. These observable differences were controlled for during data analysis, but the possibility remains that there are also unobserved differences which cannot be fully controlled for. The outcome effect estimates presented in Section 7.3 must therefore be interpreted cautiously.

- *Low maturity of some project activities.* In the case of the cocoa value-chain it appears that sufficient time has not yet passed to expect to see significant impact from the project activities. Cocoa planted in response to the project activities may not yet have reached maturity, and so cannot yet

generate income for the household. Of the 30 supported households in the cocoa-producing areas, eight did not produce any cocoa at all during 2011, but all but two of those had planted some cocoa in 2011.

7 Results

7.1 General Characteristics

Table 7.1 presents mean statistics for general household characteristics obtained through the administration of the questionnaire among the sampled producers from both the intervention and comparison groups. The stars beside the difference estimates indicate differences between the two groups that are statistically significant at a 90 percent confidence level or greater.

As is evident, there are several statistically significant differences between the groups:

- *Household size* is significantly greater among the supported producers than among the comparison households in the cocoa-producing area. This difference is mostly due to the supported households having a greater number of children than the comparison households.
- *Asset wealth in 2007:* In the dairy-producing areas, supported households were significantly wealthier in 2007 than the comparison households.
- *Baseline production of value-chain products:* The supported dairy producers were much more likely to have been producing at commercial levels in 2007 than the comparison dairy producers: 61 per cent of the supported dairy households sold some dairy products in 2007, but only 41 per cent of the comparison households. The divergence in baseline conditions in the cocoa-producing areas is even greater: 47 per cent of the supported households were producing cocoa in 2007, but only seven per cent of the comparison households.
- *Other sources of income in 2007:* As a corollary of the differences in baseline production of the value-chain products, comparison households derived a larger share of their income from other crops in 2007 than did supported households. Interestingly, though, there is no significant difference in the diversity of crops grown by these groups of households in 2007.

The supported households and comparison households were found to differ in a number of important respects.

Since these baseline characteristics are likely to have some affect on a household's income and productive activities, it will be very important to control for them when making assessments of differences on outcome measures between supported and comparison households in Section 7.3. Unfortunately some of these differences, particularly in the baseline production of value-chain products, considerably reduce the statistical power available to make estimates of differences in the outcome measures.

Table 7.1:

Descriptive statistics for intervention and comparison respondents

	Intervention mean	Comparison mean	Overall		Dairy value-chain area		Cocoa value-chain area	
			Difference	*t*-statistic	Difference	*t*-statistic	Difference	*t*-statistic
Household size	5.307	4.969	0.338	1.51	0.044	0.16	1.011**	2.60
Number of adults	2.795	2.803	-0.008	-0.06	-0.168	-1.04	0.381	1.56
Number of children	2.512	2.166	0.346**	2.12	0.212	1.04	0.630**	2.16
Number of productive adults	2.630	2.656	-0.026	-0.22	-0.143	-0.96	0.286	1.27
Number of unproductive adults	0.165	0.147	0.019	0.36	-0.025	-0.36	0.095	1.13
Household head female	0.094	0.112	-0.017	-0.52	-0.004	-0.09	-0.072	-1.22
Household head > 60 years old	0.126	0.136	-0.010	-0.26	-0.015	-0.34	0.002	0.03
Household head < 18 years old	0.000	0.000	0.000	.	0.000	.	0.000	.
Age of household head	43.331	44.395	-1.065	-0.72	-3.094*	-1.74	2.049	0.72
Only one adult in household	0.039	0.058	-0.019	-0.77	-0.021	-0.70	-0.019	-0.43
All household members > 60 years old	0.008	0.004	0.004	0.51	0.003	0.29	0.000	.
HH head has some primary education	0.363	0.283	0.080	1.56	0.059	0.95	0.149	1.53
HH head has some secondary education	0.097	0.048	0.049*	1.79	0.029	0.80	0.079*	1.94
Some HH member has formal employment	0.181	0.178	0.003	0.08	0.013	0.24	-0.098	-1.53
Number of members of the cooperative	1.425	0.266	1.159***	16.29	1.089***	13.28	1.475***	10.56
Number of years of membership	4.683	10.581	-5.899***	-5.40	-2.680**	-2.16	-7.471***	-3.47
Asset index 2007	0.701	-0.364	1.065***	3.69	1.095***	2.81	0.017	0.05
Asset poorest third in 2007	0.250	0.377	-0.127**	-2.40	-0.140**	-2.38	0.038	0.37
Asset middle third in 2007	0.308	0.346	-0.038	-0.71	-0.023	-0.36	-0.042	-0.41
Asset wealthiest third in 2007	0.442	0.277	0.165***	3.14	0.163**	2.41	0.003	0.04
Distance from the community to Siuna	14.984	15.857	-0.873	-0.92	3.354***	6.59	-0.902	-0.64
Distance from house to nearest shop	17.307	20.549	-3.242	-1.27	-0.323	-0.12	-8.802	-1.51
Distance from house to nearest water source	2.126	4.803	-2.677***	-4.45	-3.699***	-4.74	-0.666	-0.70
Total acres owned in 2007	42.008	38.441	3.567	0.62	-7.068	-0.89	5.047	1.00
Acres farmed in 2007	5.707	4.170	1.537**	2.28	1.406	1.43	1.042*	1.78
Produced any dairy products in 2007	0.677	0.533	0.144***	2.72	0.084	1.42	0.033	0.34
Sold any dairy products in 2007	0.480	0.301	0.179***	3.49	0.201***	3.12	-0.100	-1.38
Produced cocoa in 2007	0.134	0.054	0.080***	2.73	-0.010	-0.42	0.396***	5.96
Acres of cocoa farmed in 2007	0.946	0.118	0.828***	3.49	0.012	0.19	3.551***	5.35
Total number of crops produced in 2007	5.039	5.058	-0.019	-0.08	-0.162	-0.55	0.504	1.12
Total number of crops sold in 2007	2.205	2.541	-0.336	-1.56	-0.520**	-2.00	0.684*	1.78
Proportion of household income in 2007 from:								
Sale of dairy products	0.192	0.140	0.053**	2.10	0.060*	1.81	-0.068**	-2.14
Sale of livestock	0.169	0.139	0.030	1.51	0.025	0.96	-0.043	-1.63
Sale of cocoa	0.065	0.030	0.035**	2.28	-0.016	-1.60	0.207***	5.52
Sale of other crops	0.274	0.408	-0.134***	-4.26	-0.101***	-3.01	-0.047	-0.81
Renting out livestock	0.004	0.003	0.001	0.45	0.004	1.26	-0.004	-0.72
Commerce/small business	0.046	0.031	0.015	1.16	0.005	0.31	0.028	1.36
Pensions	0.002	0.013	-0.012	-1.39	-0.022*	-1.69	0.000	.
Casual labour	0.050	0.062	-0.012	-0.77	-0.019	-1.28	0.035	0.97
Formal employment	0.068	0.043	0.025	1.53	0.043*	1.97	-0.032	-1.27
Other work	0.117	0.118	-0.001	-0.05	0.022	0.76	-0.066*	-1.94
Renting out land	0.010	0.008	0.001	0.18	0.004	0.49	-0.008	-0.73
Remittances and transfers	0.002	0.000	0.002***	2.73	0.003**	2.34	0.000	.
Observations	**127**	**259**	**386**		**242**		**144**	

* $p<0.1$, ** $p<0.05$, *** $p<0.01$

7.2 Intervention exposure

The respondents were asked a number of questions about the support they have received from their cooperative and from other organisations in the previous three years. Figure 7.1 and Table 7.1 show the proportion of supported producers and comparison producers who reported having received the various types of support.

Many more of the supported households reported receiving various forms of support during the past three years than the comparison households.

It is clear that a higher proportion of the supported producers have received support than the comparison producers in most of these dimensions. Table 7.2 shows that the differences are all highly statistically significant in the case of the dairy producers, and most of the differences are also significant in the case of the cocoa producers. Not surprisingly, few of the supported cocoa producers reported receiving support which was aimed at dairy producers, including training on dairy production techniques and livestock rearing, veterinary services and the international exchanges.

It should be noted that these figures demonstrate only the proportion of members who have had *access* to each service during the past three years, and do not provide information about the intensity of provision or quality of each service.

Figure 7.1: Proportion of surveyed households receiving support from external organisations

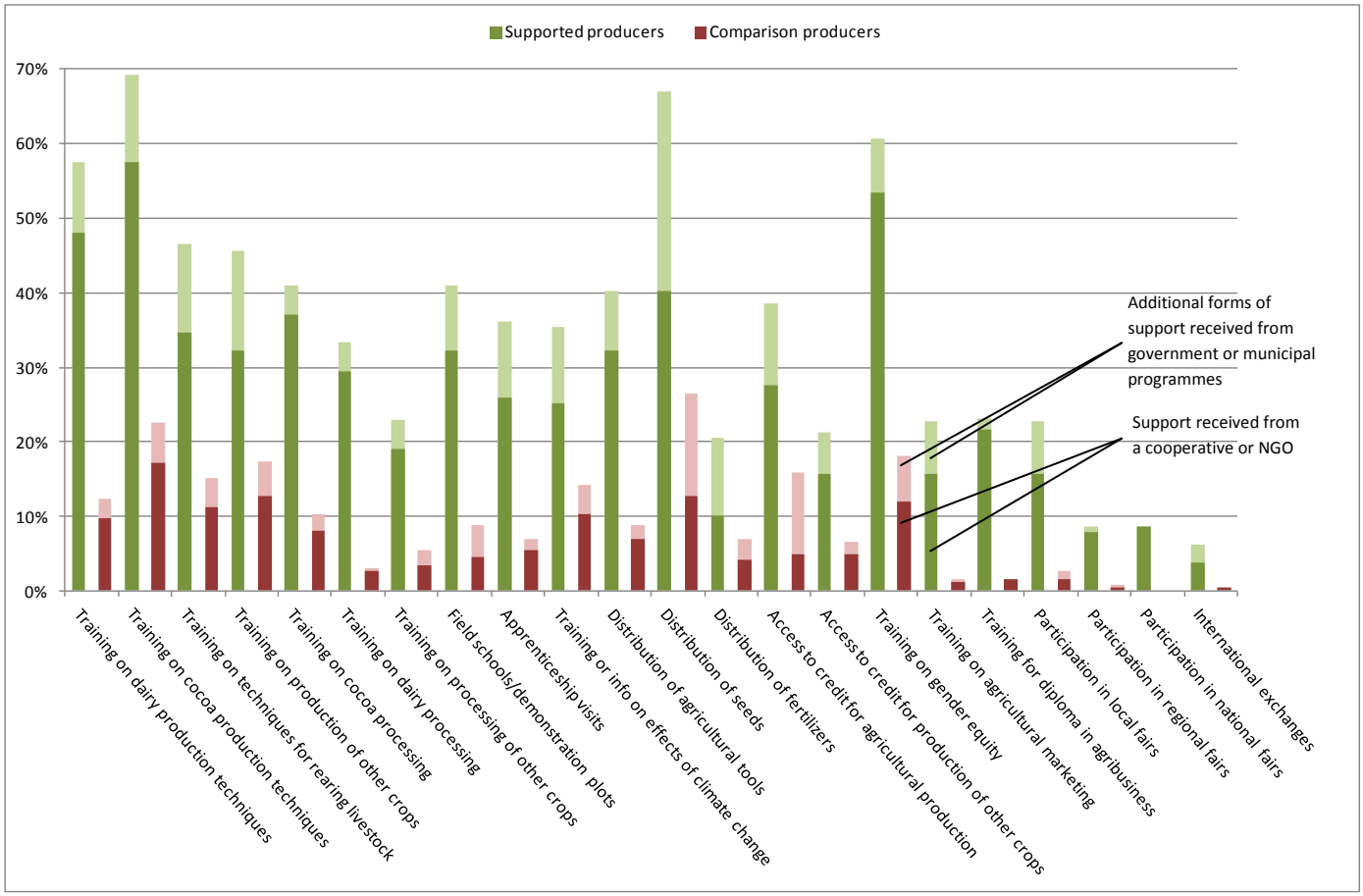


Table 7.2: Differences in support received from a cooperative or NGO in the 12 months previous to the survey

	Intervention mean	Comparison mean	Overall		Dairy value-chain area		Cocoa value-chain area	
			Difference	*t*-statistic	Difference	*t*-statistic	Difference	*t*-statistic
Training on dairy production techniques	0.480	0.097	0.384***	9.42	0.457***	8.52	0.081	1.55
Training on cocoa production techniques	0.575	0.171	0.404***	8.88	0.342***	6.32	0.681***	8.39
Training on techniques for rearing livestock	0.346	0.112	0.234***	5.75	0.275***	5.25	0.095	1.40
Training on production of other crops	0.323	0.128	0.195***	4.68	0.153***	3.04	0.335***	4.30
Training on cocoa processing	0.370	0.081	0.289***	7.48	0.216***	5.18	0.602***	8.04
Training on dairy processing	0.294	0.027	0.267***	8.37	0.299***	6.86	0.149***	3.50
Training on processing of other crops	0.190	0.035	0.156***	5.29	0.167***	4.68	0.147***	2.64
Field schools/demonstration plots	0.323	0.046	0.277***	7.99	0.182***	4.29	0.565***	9.86
Apprenticeship visits	0.260	0.054	0.206***	6.07	0.206***	4.64	0.189***	3.45
Training or info on effects of climate change	0.252	0.104	0.148***	3.85	0.189***	3.98	0.044	0.63
Distribution of agricultural tools	0.323	0.069	0.253***	6.87	0.230***	4.73	0.289***	4.97
Distribution of seeds	0.402	0.128	0.274***	6.42	0.297***	5.41	0.161**	2.30
Distribution of fertilizers	0.102	0.042	0.060**	2.30	0.076**	2.49	0.039	0.74
Access to credit for agricultural production	0.276	0.050	0.225***	6.64	0.227***	5.38	0.239***	3.86
Access to veterinary services	0.157	0.050	0.107***	3.59	0.123***	2.81	-0.009	-0.51
Training on gender equity	0.535	0.120	0.416***	9.80	0.378***	7.12	0.544***	7.26
Training on agricultural marketing	0.157	0.012	0.146***	5.93	0.141***	4.35	0.158***	4.04
Training for diploma in agribusiness	0.216	0.015	0.201***	7.18	0.155***	4.62	0.349***	6.78
Participation in local fairs	0.157	0.015	0.142***	5.64	0.103***	3.32	0.258***	5.72
Participation in regional fairs	0.079	0.004	0.075***	4.24	0.045**	2.20	0.167***	4.74
Participation in national fairs	0.087	0.000	0.087***	4.94	0.062***	3.08	0.167***	4.74
International exchanges	0.039	0.004	0.036***	2.67	0.041**	2.49	0.025	1.02
Observations	**127**	**259**	**386**		**242**		**144**	

* $p<0.1$, ** $p<0.05$, *** $p<0.01$

7.3 Evidence of Impact on Outcome Measures

7.3.1 Production and Sales of Value-Chain Products

Supported households were more likely to report applying improved agricultural techniques than comparison households.

Since it is clear from the preceding section that the intended beneficiaries of the project have received support on most or all of the intended dimensions, the next stage is to evaluate what impact this support has had on their production of the value-chain products.

The first step on the theory of change described in Section 2 is for producers to adopt the improved production techniques UNAG is promoting. The survey asked about adoption of five techniques for dairy farming, as well as eight agricultural techniques which are of use for farming cocoa and other crops.

The results for the number of techniques each household reported using during 2011 are shown in Table 7.3. The upper section of the table shows the raw unadjusted differences in the values. The second section uses two different forms of propensity-score matching (PSM), and the third section uses three different regression models, to generate estimates of the difference between supported and comparison households in the outcome measure, after controlling for demographic and baseline differences.

The first column of Table 7.3 shows that, although adoption of the improved dairy practices is also higher among the supported dairy producers than the comparison producers, the difference is small: the average supported dairy producer applies only 0.1 more improved dairy techniques than the average comparison producer. These differences would not have been statistically

significant if the data were drawn from a random sample, so it cannot be claimed with confidence that they represent an impact of the project.

On the other hand, the second and third columns show that the adoption of the improved agricultural techniques was higher among the supported producers than among the comparison producers. This is the case both when considering the cocoa group specifically (second column) and when including the dairy producers as well (third column). On average the supported producers applied approximately one more improved agricultural technique than the comparison producers.

Table 7.3: Number of improved techniques for production of value-chain products employed by the household

	Techniques for dairy production	Techniques for agricultural production (cocoa value-chain area only)	Techniques for agricultural production (cocoa and dairy value-chain areas)
Unadjusted:			
Sample mean	1.959	3.958	4.160
Intervention mean	2.093	5.033	4.960
Comparison mean	1.869	3.675	3.765
Unadjusted difference	0.224	1.358***	1.196***
	(1.42)	(4.03)	(6.44)
Observations:	242	144	381
PSM (ATT)			
Post-matching difference	0.014	1.118**	0.932***
(kernel)	(0.08)	(2.53)	(3.90)
Observations:	217	129	344
Post-matching difference	0.082	1.318***	1.112***
(no replacement)	(0.44)	(2.79)	(4.86)
Observations:	217	129	344
Multivariable Regression:			
MVR coefficient (fixed	0.100	1.299***	0.965***
effects; robust SE)	(0.62)	(3.11)	(4.80)
Observations:	212	118	329
MVR coefficient (robust	0.076	1.400***	1.037***
regression)	(0.47)	(3.24)	(4.95)
Observations:	212	118	329
MVR coefficient with control	0.099	1.276***	0.967***
functions (robust SE)	(0.62)	(3.01)	(4.77)
Observations:	212	118	329

t statistics in parentheses
* $p<0.1$, ** $p<0.05$, *** $p<0.01$
PSM estimates bootstrapped 1000 repetitions.
Coefficients for covariates used are not presented.

These improved techniques are intended to enable producers to increase their productivity – i.e. to produce a greater quantity or higher quality of the value-chain outputs for a given level of inputs. The survey did not collect data on all agricultural and dairy-related inputs, so we do not have detailed information on costs of production. However, in the case of cocoa there is data on the acreage from which cocoa was harvested in 2011, which enables calculation of the average yield for each household. The results for yield are shown in Table 7.4. There is no detectable difference between the supported and comparison producers in this respect. Of course, this does not, in itself, imply a failure of the production techniques promoted under this project – it is possible that productivity of inputs other than land has increased.

Table 7.4: Yield for cocoa produced by the household in 2011 (quintals per manzana)

Unadjusted:	
Sample mean	7.849
Intervention mean	6.168
Comparison mean	8.937
Unadjusted difference	-2.769*
	(-1.90)
Observations:	56
PSM (ATT)	
Post-matching difference (kernel)	-0.911
	(-0.36)
Observations:	52
Post-matching difference (no replacement)	-1.890
	(-0.88)
Observations:	52
Multivariable Regression:	
MVR coefficient (fixed effects; robust standard errors)	0.117
	(0.05)
Observations:	46
MVR coefficient (robust regression)	-0.991
	(-0.36)
Observations:	48
MVR coefficient with control functions (robust SE)	-3.302
	(-1.42)
Observations:	48

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
PSM estimates bootstrapped 1000 repetitions.
Coefficients for covariates used are not presented.

Despite their wider application of modern agricultural techniques, cocoa yield is no higher among supported producers than comparison producers.

The emphasis on improving production techniques is only one of the two strands mapped out in the theory of change shown in Figure 3.1: the other strand seeks to build producers' marketing skills and negotiating power. Both of these strands are expected to result in producers increasing their sales and/or realising a better price for their production. Impact on these steps in the theory of change can be evaluated directly from the sales data collected in the survey.

To this end, Table 7.5 shows the differences in sales of milk (for those in the dairy-producing areas) and cocoa (for those in the cocoa-producing areas) between the supported producers and the comparison producers. (For dairy producers, the data in Table 7.5 show sales of milk only – other dairy products were sold by too few respondents to allow for meaningful analysis.) Columns (1) and (4) show the differences in the proportion of households in the dairy and cocoa producing areas who sold any milk and cocoa respectively during 2011. Note that, in generating these estimates, the PSM and regression models control for whether each household sold milk or produced cocoa (as appropriate) at baseline in 2007. In both value chains, a higher proportion of supported producers appear to have made sales of their respective value-chain products than the comparison producers, even after controlling for baseline differences. The estimates of the size of this difference, however, vary widely between the various statistical tests.

Table 7.5: Quantity of value-chain products sold by the household in 2011

	(1) Household sold any milk	(2) Quantity of milk sold (litres)	(3) Quantity of milk sold (logarithm of litres)	(4) Household sold any cocoa	(5) Quantity of cocoa sold (*quintals*)	(6) Quantity of cocoa sold (logarithm of *quintals*)
Unadjusted:						
Sample mean	0.444	4328	8.709	0.389	4.839	1.979
Intervention mean	0.604	6135	8.859	0.733	9.617	1.858
Comparison mean	0.338	3132	8.560	0.298	3.582	2.057
Unadjusted difference	0.266***	3003***	0.299	0.435***	6.035***	-0.199
	(4.20)	(2.86)	(1.35)	(4.63)	(2.98)	(-0.62)
Observations:	241	241	107	144	144	56
PSM (ATT)						
Post-matching difference	0.113	1719	0.196	0.404***	2.096	-0.293
(kernel)	(1.55)	(1.54)	(0.80)	(3.03)	(1.14)	(-0.55)
Observations:	216	216	90	129	129	48
Post-matching difference	0.167**	1980	0.319	0.227	-0.695	-0.766*
(no replacement)	(2.19)	(1.53)	(1.17)	(1.52)	(-0.28)	(-1.73)
Observations:	216	216	90	129	129	48
Multivariable Regression:						
MVR/probit coefficient	0.392*	1313	0.352	0.688**	2.078	-0.097
(fixed effects; robust SE)	(1.77)	(1.27)	(1.60)	(2.09)	(0.83)	(-0.20)
Observations:	211	211	93	118	118	52
MVR coefficient (robust		662**	0.353**		0.598**	-0.123
regression)	–	(2.01)	(2.13)	–	(2.56)	(-0.27)
Observations:		211	93		118	52
MVR/probit coefficient	0.374*	1367	0.346	0.630*	1.765	-0.114
with control functions	(1.68)	(1.31)	(1.39)	(1.93)	(0.71)	(-0.27)
(robust SE)						
Observations:	211	211	93	118	118	52

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
PSM estimates bootstrapped 1000 repetitions.
Coefficients for covariates used are not presented.

A significantly larger proportion of the supported producers brought the value-chain products to market in 2011 than did comparison producers.

Columns (2) and (5) of Table 7.5 show the differences between the supported and comparison households in the *quantities* of the value-chain products sold during 2011. From the top section of the table, it is clear that, in both value-chain areas, the quantity sold by an average household is much greater among the supported households than among the comparison households. These differences in the dairy value-chain area remain positive even when the various statistical tests are used to control for baseline differences. It is particularly interesting that the estimate derived through rigorous regression is the only one which is statistically significant. Robust regression works by reducing the weight given to outliers, which in this case means households with reported sales that are much greater than the norm. When these outliers are given less weight through robust regression, the estimate of the size of the difference in quantity sold between supported and comparison households is smaller, but it becomes statistically significant. This suggests that the other regression and PSM estimates are influenced by a small number of extreme values; the estimate derived from the robust regression model, although smaller, may be a more accurate reflection of the difference for a "typical" household.[6] This estimate is statistically significant at the 95 per cent level, which gives more confidence that it reflects a real difference between the supported and comparison producers.

[6] In fact excluding one single outlying observation (with sales of approximately double the next largest observation) from the analysis results in estimates which are statistically significant at least at the 10 per cent level in each of the regression models, and significant at the 5 per cent level in the PSM models.

In the cocoa value-chain area, column (5) shows a similar pattern to that described in the dairy value-chain area, except that there is greater variation in the point estimates derived from the various statistical models (the estimate from the no-replacement PSM model being negative). This variation between the tests probably reflects the small sample size, particularly among supported cocoa-producing households. Again when robust regression is used to reduce the weighting on outliers, the estimate of the difference is statistically significant; this model may reflect the experience of a typical household better than the other tests.

Of course it is partly to be expected that the volume of sales of the value-chain products are higher for the average supported household than the average comparison household, since we have already found (in columns (1) and (4)) that more of the supported households made sales at all. It is also of interest to know whether, of those households who made any sales, supported households sold larger quantities. The results of the relevant tests are shown in columns (3) and (6), which evaluate differences in the logarithm of the quantity of sales. As well as reducing the influence of outliers, using the logarithm has the effect of excluding all those households who did not make any sales of the relevant value-chain product. This necessarily reduces the sample size available for analysis. But even so, in the case of the dairy value chain (column (3)) it does appear that there is a consistent positive difference in estimates for the quantity sold. The estimates of this difference vary between 20 per cent and 35 per cent, with the robust regression estimate (again the only one which is statistically significant) at the upper end of this scale. In the cocoa value-chain area (column (6)) the estimates imply that supported households make lower sales than comparison households. However, the small number of observations means that these estimates vary widely, so should not be treated with a high level of confidence.

There are no detectable differences between the supported and comparison households in the prices received for sales of their value-chain products.

The next important factor to consider is whether supported producers have been able to realise high prices than the comparison producers when making sales of the value-chain products. Table 7.6 examines the approximate average price realised for sales of milk and cocoa during 2011. Of course, it is only possible to do this analysis with those households which reported some sales, so the sample sizes are again small. In any case, there are no clear patterns to be observed in Table 7.6: estimates of the price differential between the prices received by supported and comparison producers for each of the three products considered vary around zero.

Table 7.6: Approximate average price realised for sales of value-chain products (calculated using the selling price from the last sale)

	Milk (córdobas per litre)	***Cuajada* (córdobas per pound)**	**Cocoa (córdobas per quintal)**
Unadjusted:			
Sample mean	5.48	12.04	1224
Intervention mean	5.43	11.47	1297
Comparison mean	5.56	12.37	1178
Unadjusted difference	-0.13	-0.90	119
	(-0.49)	(-1.31)	(0.74)
Observations:	107	47	56
PSM (ATT)			
Post-matching difference	-0.02	-1.64**	148
(kernel)	(-0.07)	(-1.99)	(0.57)
Observations:	90	44	48
Post-matching difference	-0.10	-1.56*	274
(no replacement)	(-0.34)	(-1.77)	(1.20)
Observations:	90	44	48
Multivariable Regression:			
MVR coefficient (fixed	-0.17	-0.19	-90
effects; robust SE)	(-0.59)	(-0.15)	(-0.40)
Observations:	93	43	52
MVR coefficient (robust	-0.14	-1.08	79
regression)	(-0.42)	(-1.05)	(0.68)
Observations:	93	43	52
MVR coefficient with control	-0.20	-0.21	-130
functions (robust SE)	(-0.65)	(-0.17)	(-0.53)
Observations:	93	43	46

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
PSM estimates bootstrapped 1000 repetitions.
Coefficients for covariates used are not presented.

Supported households on average generated higher total revenue from sales of the value-chain products than comparison households.

Combining the two dimensions examined in tables 7.5 and 7.6, Table 7.7 now summarises the data on the total household revenue received from sales of the value-chain products during 2011. (Note that the first two columns include revenue generated by the sale of all dairy products, not only milk.) As observed in Table 7.5, a greater proportion of the supported producers made sales of the value-chain products in 2011 than the comparison producers. We would therefore expect to see higher revenue from these value-chain products among the supported producers, even if (as suggested by Table 7.6) there is little or no difference in the sale price. The results presented in Table 7.7 confirm that this is the case. Although the estimates of the difference in absolute values of revenue vary, the estimates of the difference in the logarithms are all clearly positive, and some are statistically significant.[7] Not surprisingly (given the results found already), the difference in revenue between the supported and comparison households is much larger in the cocoa-producing areas than in the dairy-producing areas.

[7] In this case all households are included in the analysis of the values even after taking logarithms. Households that reported no sales are deemed to have made sales of one córdoba during the year; although very close to zero in reality, this enables a logarithmic value to be calculated.

Table 7.7: Approximate total revenue from sales of value-chain products in 2011

	Dairy products (córdobas)	Dairy products (logarithm of 1 + sales in córdobas	Cocoa (córdobas)	Cocoa (logarithm of 1 + sales in córdobas)
Unadjusted:				
Sample mean	30,090	5.695	4,963	3.496
Intervention mean	36,406	7.195	9,514	6.541
Comparison mean	25,880	4.694	3,766	2.695
Unadjusted difference	10,526	2.501***	5,748***	3.846***
	(1.36)	(3.74)	(2.80)	(4.49)
Observations:	240	240	144	144
PSM (ATT)				
Post-matching difference	1,914	0.974	3,081	3.431***
(kernel)	(0.21)	(1.40)	(1.28)	(3.10)
Observations:	216	216	129	129
Post-matching difference	4,295	1.352*	-299	1.749
(no replacement)	(0.45)	(1.79)	(-0.10)	(1.34)
Observations:	216	216	129	129
Multivariable Regression:				
MVR coefficient (fixed	-478	0.742	1,122	1.866*
effects; robust SE)	(-0.06)	(1.40)	(0.37)	(1.73)
Observations:	211	211	118	118
MVR coefficient (robust	3,639	0.118	667**	2.131*
regression)	(1.62)	(1.54)	(2.10)	(1.71)
Observations:	211	211	118	118
MVR coefficient with control	-252	0.722	809	1.782
functions (robust SE)	(-0.03)	(1.34)	(0.27)	(1.66)
Observations:	211	211	118	118

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
PSM estimates bootstrapped 1000 repetitions.
Coefficients for covariates used are not presented.

Supported cocoa producers had planted an average of half a manzana *with cocoa more than comparison producers during 2011.*

It is important to recall that the figures shown in Table 7.7 refer only to *revenue* from the value-chain products. These figures do not take into account costs of production or opportunity costs of the household members' time used for producing and marketing the value-chain products, so the effect on *net* household income cannot be known with certainty. The full effect will become clearer by investigating household expenditure in Section 7.3.3.

One final indicator of the project's success in promoting production of the value-chain products is whether supported households are investing in increasing their production. Table 7.8 shows the differences in a simple measure of investment for each value-chain product: in the dairy-producing areas, the net number of cattle added to the herd during 2011, and in the cocoa-producing areas, the number of *manzanas* planted with cocoa during 2011. In the dairy-producing areas, overall changes in the number of cattle are negative, showing that, on average, households have reduced their herd sizes during 2011. There is no clear evidence on whether supported producers have differed from comparison producers in this respect. However, in the cocoa-producing areas, there is a clear and significant difference: supported producers report having planted on average approximately half a *manzana* more with cocoa during 2011 than have comparison producers.

Table 7.8: Investment in value-chain products during 2011

	Net number of cattle added to herd in 2011 (dairy value-chain area)	Number of *manzanas* of cocoa planted in 2011 (cocoa value-chain area)
Unadjusted:		
Sample mean	-2.803	0.797
Intervention mean	-4.495	1.267
Comparison mean	-3.214	0.673
Unadjusted difference	-1.281	0.593***
	(-0.98)	(3.94)
Observations:	242	144
PSM (ATT)		
Post-matching difference	-0.795	0.457*
(kernel)	(-0.56)	(1.78)
Observations:	217	129
Post-matching difference (no	-1.635	0.557**
replacement)	(-1.05)	(2.40)
Observations:	217	129
Multivariable Regression:		
MVR coefficient (fixed	0.063	0.506***
effects; robust SE)	(0.05)	(2.67)
Observations:	212	118
MVR coefficient (robust	-0.878*	0.410**
regression)	(-1.83)	(2.25)
Observations:	212	118
MVR coefficient with control	0.002	0.495**
functions (robust SE)	(0.00)	(2.60)
Observations:	212	118

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
PSM estimates bootstrapped 1000 repetitions.
Coefficients for covariates used are not presented.

7.3.2 Diversification of Agricultural Production

Promoting crop diversification is not a key objective of PRODER, but supported households appear to have increased the number of crops grown anyway.

As noted in Section 2, the predecessor project to PRODER (which was implemented from 2003 to 2008) specifically aimed to promote crop diversification among producers in the Municipality of Siuna. Many of the households supported under PRODER also participated in this earlier project. The activities of the earlier project cannot be evaluated in this effectiveness review, partly because the baseline year for the survey was 2007, after most of the activities from the earlier project had been completed. However, since Oxfam GB has continued to have a relationship with these producers under the current project, and that the forms of support provided (as confirmed in Table 7.2) have been more wide-ranging than simply focussing on the value-chain products, it is likely that there may have been further consolidation of the earlier messages on diversification. It is therefore reasonable to investigate whether diversification has increased among supported producers during the lifetime of the current project.

To that end, Table 7.9 shows the total number of crops farmed by households in 2011. Supported producers are seen to be growing a significantly larger number of crops than comparison producers, particularly in the cocoa value-chain areas. The right-hand column of Table 7.9 shows that the difference in diversification in the cocoa value-chain area is not simply a result of increased cultivation of cocoa: supported households cultivated, on average, approximately one crop type more than comparison producers even when cocoa is excluded. The difference in crop diversity in the dairy value-chain

area is smaller but still evident. Note that these are the results after controlling for differences in the number of crops produced in 2007. That is, there appears to have been *further* impact on diversification since 2007.

Table 7.9: Number of crops cultivated by the household in 2011

	Overall	Dairy value-chain area	Cocoa value-chain area	Cocoa value-chain area (excluding cocoa itself)
Unadjusted:				
Sample mean	5.259	4.955	5.771	5.396
Intervention mean	5.535	5.165	6.733	6.000
Comparison mean	5.124	4.814	5.518	5.237
Unadjusted difference	0.412*	0.351	1.216***	0.763*
	(1.79)	(1.30)	(2.79)	(1.84)
Observations:	386	242	144	144
PSM (ATT)				
Post-matching difference (kernel)	0.710**	0.508	1.489**	1.070*
	(2.32)	(1.52)	(2.22)	(1.71)
Observations:	346	217	129	129
Post-matching difference (no replacement)	0.477	0.435	1.091	0.864
	(1.57)	(1.29)	(1.48)	(1.27)
Observations:	346	217	129	129
Multivariable Regression:				
MVR coefficient (fixed effects; robust SE)	0.645***	0.481**	1.304***	1.072***
	(3.32)	(2.09)	(3.53)	(3.32)
Observations:	330	212	118	118
MVR coefficient (robust regression)	0.491***	0.241	1.329***	1.160***
	(2.78)	(1.21)	(3.33)	(3.14)
Observations:	330	212	118	118
MVR coefficient with control functions (robust SE)	0.649***	0.486**	1.303***	1.076***
	(3.31)	(2.10)	(3.45)	(3.26)
Observations:	330	212	118	118

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
PSM estimates bootstrapped 1000 repetitions.
Coefficients for covariates used are not presented.

Despite the more diverse crop portfolio of the supported producers, on average, they brought no more crop types to market than did the comparison producers.

Table 7.10 shows that the number of crop types which were *sold* by the household during 2011 does not clearly differ between supported and comparison producers. The fact that a wider range of crop types are being grown may, however, provide a wider diet for the household and perhaps another potential source of income in times of stress.

Table 7.10: Number of crops sold by the household in 2011

	Overall	Dairy value-chain area	Cocoa value-chain area	Cocoa value-chain area (excluding cocoa itself)
Unadjusted:				
Sample mean	2.440	1.847	3.438	3.181
Intervention mean	2.181	1.732	3.633	3.067
Comparison mean	2.568	1.924	3.386	3.211
Unadjusted difference	-0.386*	-0.192	0.247	-0.144
	(-1.82)	(-0.83)	(0.63)	(-0.40)
Observations:	386	242	144	144
PSM (ATT)				
Post-matching difference	0.051	0.002	0.239	-0.094
(kernel)	(0.21)	(0.01)	(0.44)	(-0.21)
Observations:	346	217	129	129
Post-matching difference (no	-0.196	-0.129	0.318	0.091
replacement)	(-0.75)	(-0.50)	(0.55)	(0.19)
Observations:	346	217	129	129
Multivariable Regression:				
MVR coefficient (fixed	0.091	0.130	0.433	0.191
effects; robust SE)	(0.52)	(0.63)	(1.33)	(0.70)
Observations:	330	212	118	118
MVR coefficient (robust	0.001	0.091	0.378	0.136
regression)	(0.01)	(0.46)	(1.03)	(0.41)
Observations:	330	212	118	118
MVR coefficient with control	0.117	0.107	0.362	0.155
functions (robust SE)	(0.67)	(0.51)	(1.13)	(0.57)
Observations:	330	212	118	118

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
PSM estimates bootstrapped 1000 repetitions.
Coefficients for covariates used are not presented.

7.3.3 Household Income and Wellbeing

Various measures were collected in the survey which can be used to evaluate household income and wellbeing. The simplest measure is that respondents were asked whether their household income had increased, decreased or stayed roughly the same since the year 2007. Table 7.11 shows that significantly more of the supported households reported that their household income had increased since 2007 than did the comparison households. Although the estimates of the size of this difference vary widely between the different statistical models, the difference is clearly positive for both value changes.

The survey also asked respondents about the ability of their household to meet its basic needs from current income, without relying on savings, selling assets, or external support. Table 7.12 shows that nearly a third of respondents responded positively to this question overall, although the proportion was much larger in the dairy-producing areas than the cocoa-producing areas. In contrast to the results of the income change question shown in Table 7.11 above, supported producers were no more likely to respond positively to this question.

Table 7.11: Proportion of respondents reporting that their overall household income had increased since 2007

	Overall	Dairy value-chain area	Cocoa value-chain area
Unadjusted:			
Sample mean	0.302	0.349	0.224
Intervention mean	0.441	0.464	0.367
Comparison mean	0.233	0.271	0.186
Unadjusted difference	0.207***	0.193***	0.181**
	(4.25)	(3.13)	(2.13)
Observations:	384	241	143
PSM (ATT)			
Post-matching difference (kernel)	0.175***	0.164**	0.218*
	(2.63)	(2.23)	(1.68)
Observations:	345	216	129
Post-matching difference (no replacement)	0.224***	0.188**	0.318**
	(3.45)	(2.51)	(2.37)
Observations:	345	216	129
Multivariable Regression:			
Probit (fixed effects; robust SE)	0.562***	0.530***	0.949**
	(3.46)	(2.72)	(2.03)
Observations:	329	211	100
Probit with control functions (robust SE)	0.549***	0.534***	0.868*
	(3.38)	(2.71)	(1.76)
Observations:	329	211	100

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
PSM estimates bootstrapped 1000 repetitions.
Coefficients for covariates used are not presented.

A greater proportion of supported producers than comparison producers reported that their household income has increased since 2007.

Table 7.12: Proportion of respondents reporting that their household is able to meet its basic needs and save for the future from household income

	Overall	Dairy value-chain area	Cocoa value-chain area
Unadjusted:			
Sample mean	0.311	0.347	0.250
Intervention mean	0.315	0.351	0.200
Comparison mean	0.309	0.345	0.263
Unadjusted difference	0.006	0.006	-0.063
	(0.12)	(0.09)	(-0.71)
Observations:	386	242	144
PSM (ATT)			
Post-matching difference (kernel)	-0.027	-0.050	0.061
	(-0.41)	(-0.67)	(0.61)
Observations:	346	217	129
Post-matching difference (no replacement)	0.009	-0.035	0.045
	(0.14)	(-0.47)	(0.39)
Observations:	346	217	129
Multivariable Regression:			
Probit (fixed effects; robust SE)	-0.133	-0.119	-0.077
	(-0.80)	(-0.59)	(-0.22)
Observations:	330	212	118
Probit with control functions (robust SE)	-0.128	-0.162	-0.054
	(-0.76)	(-0.77)	(-0.15)
Observations:	330	212	118

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
PSM estimates bootstrapped 1000 repetitions.
Coefficients for covariates used are not presented.

A more sophisticated indicator of household income is household expenditure. The survey asked all respondents to estimate the value of all the food items which members of their household have eaten in the past seven days, as well as all the other expenditures which members of the household had made recently (in the past month for types of expenditure which are typically made regularly, and in the past 12 months for other types of expenditure which tend to be less frequent). These expenditure details were aggregated and converted into a per-person per-day figure. Since the consumption figures have a large range with a few extreme figures, they were transformed by taking logarithms, in order to reduce the influence of extreme figures on the results. The results after this transformation are shown in Table 7.13.

Data on household expenditure show that supported households in the dairy-producing areas appear to be better off than the comparison households.

Table 7.13 shows that reported household expenditure was between 12 and 16 per cent higher among the supported households than the comparison households in the dairy value-chain area. On the other hand, there is no clear difference in expenditure between households in the cocoa value-chain area. This pattern is even clearer when the figures are disaggregated to consider food expenditure in isolation (figures are not shown here). This increases confidence in the results because food expenditure is, generally speaking, easier to estimate and, therefore, was probably measured more accurately in the survey than other types of household expenditure.

It may be surprising that supported households in the dairy-producing area appear to have increased their household income but not households in the cocoa-producing area. In Table 7.7 above, we found evidence that supported households in the cocoa-producing area had derived much higher revenue from cocoa than the corresponding comparison households, but a smaller effect in the dairy value chain. However, increased revenue does not necessarily result in increased net income. For example, it is quite possible that adoption of the improved techniques for cocoa production involves higher costs of production in return for the increased revenue, so that the effect on *net* household income may be small. As household members devote more time to cocoa production, they may also engage less in other livelihoods activities, so reducing income from other activities. Alternatively, even if cocoa adds significantly to net household income, the additional income generated may be being invested back into productive activities. There is some evidence in favour of this from Table 7.8, showing that supported households in the cocoa-producing areas had been investing in planting cocoa at a significantly higher rate than comparison households. If this is the case, it is possible that the situation observed here is temporary. To elaborate, once cocoa-producing households reach an optimal level of investment, they may be able to benefit from the additional net income by increasing their household consumption. This would also help to explain the result found for the more subjective measure of income change in Table 7.11 above – cocoa-producing households may perceive that their income has increased, even if this has not yet translated into increased household expenditure.

Table 7.14 uses this aggregate spending data to analyse success against the Oxfam GB global indicator for livelihoods. In each value chain, the median level of expenditure of the comparison group is taken as the benchmark. A clear majority of the supported producers in both value chains are above this benchmark.

Table 7.13: Value of household consumption expenditure (natural logarithm of córdobas per person per day)

	Overall	Dairy value-chain area	Cocoa value-chain area
Unadjusted:			
Sample mean	4.265	4.360	4.106
Intervention mean	4.387	4.492	4.049
Comparison mean	4.206	4.272	4.121
Unadjusted difference	0.182***	0.220***	-0.073
	(3.17)	(3.16)	(-0.73)
Observations:	386	242	144
PSM (ATT)			
Post-matching difference (kernel)	0.067	0.120	-0.138
	(0.93)	(1.60)	(-1.00)
Observations:	346	217	129
Post-matching difference (no replacement)	0.172***	0.155*	0.072
	(2.62)	(1.92)	(0.57)
Observations:	346	217	129
Multivariable Regression:			
MVR coefficient (fixed effects; robust SE)	0.107*	0.151**	0.002
	(1.92)	(2.27)	(0.02)
Observations:	330	212	118
MVR coefficient (robust regression)	0.109*	0.161**	0.000
	(1.96)	(2.34)	(0.00)
Observations:	330	212	118
MVR coefficient with control functions (robust SE)	0.104*	0.147**	-0.003
	(1.85)	(2.19)	(-0.02)
Observations:	330	212	118

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
PSM estimates bootstrapped 1000 repetitions.
Coefficients for covariates used are not presented.

The majority of supported households in both value-chain areas have income above the benchmark defined by the global indicator for livelihoods.

Table 7.14: Proportion of households with per capita per day consumption greater than the median of the comparison group

	Overall	Dairy value-chain area	Cocoa value-chain area
Unadjusted:			
Sample mean	0.547	0.562	0.521
Intervention mean	0.638	0.649	0.600
Comparison mean	0.502	0.503	0.500
Unadjusted difference	0.136**	0.146**	0.100
	(2.53)	(2.26)	(0.97)
Observations:	386	242	144
PSM (ATT)			
Post-matching difference (kernel)	0.083	0.067	0.143
	(1.25)	(0.91)	(1.00)
Observations:	346	217	129
Post-matching difference (no replacement)	0.159**	0.118	0.273**
	(2.31)	(1.48)	(2.03)
Observations:	346	217	129
Multivariable Regression:			
Probit (fixed effects; robust standard errors)	0.279*	0.172	0.830**
	(1.69)	(0.86)	(2.34)
Observations:	328	210	118
Probit with control functions (robust SE)	0.287*	0.171	0.866**
	(1.71)	(0.86)	(2.28)
Observations:	328	210	118

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
PSM estimates bootstrapped 1000 repetitions.
Coefficients for covariates used are not presented.

7.3.4 Food security

Table 7.15 uses an alternative measure to test for impact on household wellbeing – the score derived from the survey questions on food security. Note that in this table, higher figures represent a *worse* food security situation. In general, reported levels of food security are good, with the majority of households reporting no problems at all with access to sufficient food for their families during the four weeks prior to the survey.

Table 7.15 shows that the reported levels of food security are in fact worse among the supported households than among the comparison households. However, few of the estimates are statistically significant, so should be treated with caution. The generally high levels of food security suggest that these results should not be taken to imply that the supported households are worse off than comparison households in this respect.

Table 7.15: Food security score (first principal component – higher numbers represent lower food security)

	Overall	Dairy value-chain area	Cocoa value-chain area
Unadjusted:			
Sample mean	0.000	0.000	0.000
Intervention mean	0.171	0.047	0.573
Comparison mean	-0.086	-0.033	-0.151
Unadjusted difference	0.257	0.080	0.723*
	(1.26)	(0.32)	(1.91)
Observations:	379	235	144
PSM (ATT)			
Post-matching difference (kernel)	0.327	0.299	0.434
	(1.53)	(1.17)	(0.97)
Observations:	339	210	129
Post-matching difference (no replacement)	0.246	0.085	0.451
	(1.04)	(0.30)	(0.86)
Observations:	339	210	129
Multivariable Regression:			
MVR coefficient (fixed effects; robust SE)	0.384*	0.375	0.642*
	(1.82)	(1.62)	(1.69)
Observations:	324	206	118
MVR coefficient (robust regression)	0.000	–	0.257
	(0.01)		(1.27)
Observations:	324		118
MVR coefficient with control functions (robust SE)	0.375*	0.385	0.672*
	(1.75)	(1.64)	(1.76)
Observations:	324	206	118

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
PSM estimates bootstrapped 1000 repetitions.
Coefficients for covariates used are not presented.

Levels of food security reported by households were good, with little observable difference between supported and comparison households.

7.3.5 Asset wealth

One weakness with using current household expenditure as a measure of the success of PRODER's effect on livelihoods is that expenditure is likely to be highly dependent on recent income levels among households and, consequently, may not reflect longer-term changes in wellbeing. A better measure to assess long-term improvements in household wellbeing is to examine differentials in the assets owned by households. As described in Section 5.2, the survey asked about ownership of a series of assets and other

wealth indicators, both in 2007 and on the date of the survey. These observations were then used to create an index of the change in ownership of each asset. The effects on the resulting index of changes in asset ownership are shown in Table 7.16. In this table, higher positive numbers represent an increase in assets and other wealth indicators compared to the rest of the sample.

Table 7.16: Change in asset index between 2007 and date of survey

There is good evidence that supported dairy-producing households have increased their asset wealth since 2007 more than the appropriate comparison households.

	Overall	Dairy value-chain area	Cocoa value-chain area
Unadjusted:			
Sample mean	0.000	0.000	0.000
Intervention mean	0.714	0.872	0.234
Comparison mean	-0.371	-0.615	-0.068
Unadjusted difference	1.085***	1.487***	0.302
	(4.16)	(4.63)	(0.64)
Observations:	354	220	134
PSM (ATT)			
Post-matching difference (kernel)	1.006***	1.226***	0.168
	(3.30)	(3.35)	(0.32)
Observations:	339	213	126
Post-matching difference (no replacement)	1.068***	1.204***	0.547
	(3.21)	(3.25)	(0.98)
Observations:	339	213	126
Multivariable Regression:			
MVR coefficient (fixed effects; robust standard errors)	0.835***	1.093***	-0.104
	(3.00)	(3.26)	(-0.22)
Observations:	324	209	115
MVR coefficient (robust regression)	0.669***	0.847***	-0.033
	(3.26)	(3.09)	(-0.19)
Observations:	324	209	115
MVR coefficient with control functions (robust SE)	0.874***	1.094***	-0.068
	(3.20)	(3.23)	(-0.14)
Observations:	324	209	115

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
PSM estimates bootstrapped 1000 repetitions.
Coefficients for covariates used are not presented.

These results show a large and strongly significant increase in wealth among the supported households in the dairy value-chain area, compared to the appropriate comparison households. This result should be treated with caution because of the baseline differences between the two groups using this same indicator which were found in Section 7.1 (Table 7.1). The results in Table 7.16, as in all the other tables of outcome measures in this report, have controlled for these baseline differences as far as possible – but it is always possible that the baseline differences could have lead to further changes in asset wealth in ways which are not accounted for by the statistical models. However, the differences found in Table 7.16 are greater in magnitude than the differences found at baseline. On balance it does appear justified to conclude that there is some positive impact from the project on asset wealth among the dairy producers. In any case, there is no clear effect on the asset wealth of supported households in the cocoa-producing areas.

7.3.6 Gender balance in household expenditure

For items of household expenditure which can be identified as benefiting a specific individual (including expenditure on health, education, transport, and leisure activities), respondents were asked to specify the amounts which were spent separately on males and on females within the household. The logarithm of the ratios is shown in Table 7.17. The fact that all of the estimates are positive shows that, on average, more was spent on males than females in these households. There are, however, no consistent differences in this ratio between households supported by the project and comparison households.

Household expenditure is generally biased towards males, with no significant differences between the supported and comparison households.

Table 7.17: Ratio of household expenditure on goods and services for males to females (natural logarithm)

	Overall	Dairy value-chain area	Cocoa value-chain area
Unadjusted:			
Sample mean	0.374	0.333	0.448
Intervention mean	0.334	0.357	0.235
Comparison mean	0.393	0.316	0.494
Unadjusted difference	-0.059	0.041	-0.259
	(-0.50)	(0.30)	(-1.02)
Observations:	318	206	112
PSM (ATT)			
Post-matching difference	-0.058	-0.046	-0.112
(kernel)	(-0.42)	(-0.30)	(-0.44)
Observations:	288	184	104
Post-matching difference (no	0.049	-0.086	0.300
replacement)	(0.35)	(-0.51)	(0.96)
Observations:	288	184	104
Multivariable Regression:			
MVR coefficient (fixed	-0.077	0.016	-0.165
effects; robust SE)	(-0.54)	(0.10)	(-0.62)
Observations:	271	180	91
MVR coefficient (robust	-0.033	0.041	-0.075
regression)	(-0.26)	(0.28)	(-0.29)
Observations:	271	180	91
MVR coefficient with control	-0.083	0.007	-0.045
functions (robust SE)	(-0.58)	(0.04)	(-0.17)
Observations:	271	180	91

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
PSM estimates bootstrapped 1000 repetitions.
Coefficients for covariates used are not presented.

7.3.7 Attitudes to gender roles

As described in Section 5.2, all respondents were asked to state their level of agreement or disagreement with a series of 15 statements on the economic roles of women, and an overall score was constructed using factor analysis. These scores range between –1 and 1, with a positive score representing more positive attitudes to women's roles. Zero represents the attitudes of the average respondent.

The results are shown in Table 7.18 for male and female respondents respectively. The results of the PSM models provide some evidence for positive impact of the project on attitudes, particularly among female producers.

Recall from Section 7.1 that a majority of the supported households (61 per cent) reported having received some form of gender training within the last 3 years. It is of interest to know whether the positive effects of the project on gender attitudes is particularly concentrated on those who reported receiving gender training. Table 7.19 investigates this, by adding a dummy variable to the first multivariate regression model which is positive when the respondent was *both* supported by the project *and* reported having received gender training. The right-hand column of Table 7.19 confirms that there is a strong difference in attitudes between those who report having received gender training and those who do not. In fact, while there is a strong positive effect on gender attitudes among those supported producers who report having received gender training, there is no effect on the supported producers who did not receive gender training.

Table 7.18: Attitudes to gender roles among respondents (scores constructed by factor analysis)

Supported producers (both male and female) who report having received gender training during the lifetime of the project expressed better attitudes to women's economic roles than did the comparison producers.

	Male respondents	Female respondents
Unadjusted:		
Sample mean	0.000	0.000
Intervention mean	0.254	0.357
Comparison mean	-0.130	-0.154
Unadjusted difference	0.385***	0.511***
	(3.52)	(3.12)
Observations:	245	126
PSM (ATT)		
Post-matching difference (kernel)	0.273*	0.483**
	(1.71)	(2.29)
Observations:	221	116
Post-matching difference (no replacement)	0.242	0.367*
	(1.61)	(1.69)
Observations:	221	116
Multivariable Regression:		
MVR coefficient (fixed effects; robust standard errors)	0.245*	0.421*
	(1.90)	(1.91)
Observations:	218	101
MVR coefficient (robust regression)	0.200	0.407*
	(1.60)	(1.84)
Observations:	218	101
MVR coefficient with control functions (robust SE)	0.236*	0.267
	(1.83)	(1.09)
Observations:	218	101

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
PSM estimates bootstrapped 1000 repetitions.
Coefficients for covariates used are not presented.

These results are surprising, since the PRODER project has not in fact carried out gender training on a large scale. A small number of representatives from the supported producers' cooperatives have participated in a series of training workshops on gender issues during 2011. The large numbers of respondents reporting having received gender training in the past 3 years may have had messages from these cooperatives representatives or may be referring to informal training through contact with UNAG and Oxfam staff. It is clear, anyway, that messages about gender equity encouraged by UNAG and Oxfam have reached the majority of supported producers, and that those people have been receptive to these messages.

Table 7.19: Results of gender training interaction test for attitudes to gender roles measured, regressed on intervention × gender training interaction variable (scores constructed by factor analysis)

	Original intervention coefficient	Intervention coefficient with intervention × gender training interaction variable	Coefficient on intervention × gender training interaction variable
Male respondents	0.245* (1.90)	-0.025 (-0.16)	0.433** (2.11)
Female respondents	0.421* (1.91)	-0.116 (-0.50)	0.995*** (3.16)

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Coefficients for covariates not presented.

8 Conclusion and Programme Learning Considerations

8.1 Conclusions

Overall, this effectiveness review finds evidence that the project activities have lead to some increase in the living standards of the supported producers, at least in the dairy value chain. This improvement appears to have been made through encouraging more of the supported households to engage in sales of the value-chain products, compared to the comparison households which had similar characteristics at baseline in 2007. In addition, supported dairy-producing households are, on average, selling between 20 and 35 per cent more milk than are those comparison households who also make sales, and consequently are generating higher revenue. However, there is no evidence that supported producers have been able to realise higher prices when making sales than have the comparison producers. With reference to the theory of change mapped out in Section 3, these results provide no evidence that the strands of the project aimed at improving quality of production, or at increasing the marketing skills or negotiating power of producers, have yet been effective.

The impact on household income and wealth indicators is mostly limited to the supported dairy producers.

The results do suggest that supported dairy producers are producing more *efficiently* than comparison dairy producers: the higher quantities of milk (and perhaps of other dairy products) being sold by supported producers appears to have been translated into higher income and greater overall household wellbeing. A further indicator of success is that supported dairy producers have increased their household asset wealth at a greater rate than comparison producers since 2007, suggesting that the project has enabled them to make lasting improvements in their living conditions.

In contrast, the supported cocoa producers – despite having generated more revenue on average from the sale of cocoa during 2011 than the corresponding comparison producers – do not have higher overall household expenditure or asset wealth. This may reflect the fact that investments in growing cocoa have not yet fully matured: eight of the 30 supported households interviewed in the cocoa-producing areas had not harvested any cocoa at all during 2011, but it is likely that they have planted cocoa crops which will mature in the coming years. Indeed, 23 of those 30 supported

households had planted some cocoa during 2011. Even though the impact of cocoa cultivation on household wellbeing could not be evaluated through this effectiveness review, the fact that they have made this investment suggests that these supported households clearly believe from their experience so far that this is a valuable investment for their households.

There is also evidence that the project has had some impact on farming practice more widely. In particular, supported producers in both value chains are applying more of the improved agricultural techniques which are encouraged by UNAG. Supported producers are also cultivating a wider variety of crops than comparison producers, even after controlling for the effects of the earlier (2003–07) project which was specifically focused on diversification.

Interestingly, the survey found that the majority of supported producers reported that at least one member of their household had received gender training at some time in the past three years – and those who report having received this training show significantly better attitudes towards women's economic roles than comparison producers who had not received this training. What the respondents have reported as gender training is likely to have been in the form of contact with the few representatives from each cooperative who participated in a formal workshop on gender issues or from contact with UNAG and Oxfam staff in the course of other activities.

8.2 Programme Learning Considerations

- **Analyse why efforts to realise higher prices for value-chain products have apparently not been successful so far.**

Many of the activities carried out under the PRODER project have been aimed at improving the quality of value-chain products or facilitating producers' access to markets or improving their negotiating power. However, this effectiveness review has found that the prices which supported producers are realising in the market for their production are not systematically higher than the prices received by similar producers who have not benefited from the project. Instead, the impact of this project appears to have come about through encouraging more of the supported producers to engage in these value chains than they otherwise would have done.

It is not clear to what extent this represents a threat to the project's design. If a central objective is to increase the product quality and market power of the supported producers, then this will be a disappointing conclusion and may require new strategies to be adopted. Even without this, however, the project can be seen as successful for having enabled a portion of the supported producers to actively participate in these value chains, which apparently (at least in the case of the dairy value-chain) are bringing them net benefits.

Of course, it is also clear that one of the major project activities is the investment in infrastructure to support storage and processing of value-chain products. These infrastructure facilities were not yet in use at the time of the field work, and so their impact could not be assessed. It is possible that supported producers will see further boosts to their net income from the value-chain activities once these infrastructure facilities come into use. As such, it will be of interest to conduct a follow-up survey when the project closes in 2014, to further examine impact at that date.

- **Further investigate what impact this project has had on women's position in the household, and learn what can be applied from this approach to gender in other projects.**

The effectiveness review did not attempt to analyse effects on women's empowerment in detail, since the implementation team did not see this as a major emphasis of the project. However, it is interesting that the small section on attitudes to women's economic roles included in the survey does provide some evidence that the project has had an impact in this area. Even though the formalised gender training was carried out with only a small number of representatives from the producers' cooperatives, more than 60 per cent of the supported producers believe themselves to have received some form of gender training during the lifetime of the project, and expressed more positive attitudes towards women's economic roles. It would be of interest to conduct further research to investigate whether these apparent changes in attitudes have resulted in appreciable improvements in women's position in their households and in their communities. If so, there may well be potential for other projects to learn from the approach adopted in this project.