Sustainable Livelihood Development and Ethnic Minority Diversity in Lao Cai Province

Project Effectiveness Review

Full Technical Report

Oxfam GB
Livelihoods Outcome Indicator

October, 2012

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Photo: Nguyen Thi Hoang

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Executive summary

Under Oxfam Great Britain's (OGB) Global Performance Framework (GPF), sufficiently mature projects are being randomly selected each year and their effectiveness rigorously assessed. The Sustainable Livelihood Development and Ethnic Minority Diversity in Lao Cai Province project (RVNA64) was randomly selected for an Effectiveness Review under the livelihoods thematic area. This project was implemented from 2007 to 2011. Its focus was to mobilise poor, ethnic minority farmers, the H'mong, Dao, and Tay in particular, into farmer groups and provide them with training and agricultural extension support. The project also comprised of a number of policy influencing components, but this effectiveness review did not examine the effectiveness of this work.

Given that the bulk of the project's direct livelihood work was concentrated in Sapa district, data were only collected from the villages it targeted in this district. Here, the project established and supported 13 farmers groups, comprising of 271 households. Oxfam both directly supported the farmer groups and did so indirectly through the Sa Pa District Farmers' Union and the Department of Economic Development under the Ministry of Agriculture and Rural Development.

To assess the effectiveness of the project, primarily in relation to improving agricultural production and household food security and income, a quasi-experimental impact evaluation design was implemented. This involved administering surveys to 553 households in 16 villages – eight targeted by the project and eight purposely matched comparison villages. To reduce bias, Propensity Score Matching (PSM) and Multivariable Regression (MVR) were used in the statistical comparison of the treatment groups. The effectiveness of the project in relation to a number of key outcomes was assessed through this process. These outcomes included those related to the adoption of preferred agricultural practices, service access and use, agricultural productivity and profits, household expenditure and wealth status, household food security and gender attitudes. The household expenditure data, in particular, informs Oxfam GB's global livelihoods outcome indicator:

- % of households demonstrating greater income, as measured by daily consumption expenditure per capita.

There is some evidence that the project succeeded in encouraging a small proportion of households belonging to its farmer groups to adopt a number of preferred agricultural practices, e.g. improved methods for rice seeding preparation and planting of both rice seedlings and maize seeds. These households were also more likely to report having better access to farming extension and, to a lesser extent, credit services. However, there is no evidence that this translated into improvements in agricultural production and/or profits and, in turn, either household food security or income. There is also no evidence that it improved gender attitudes in general and attitudes towards violence against women in particular.

While the findings of this effectiveness review are not positive, they do provide the basis for learning and critical reflection. Oxfam in general and the Vietnam country team and partners in particular are encouraged to consider the following:

- Present the findings of this review to relevant Oxfam staff/interns, district partners and the farmer groups to further explore possible reasons why there is no evidence of project impact.
- Check to ensure that programmes and projects are designed to do more than simply support the roll-out of government plans and/or policy.
- Ensure that dietary diversification considerations are substantively mainstreamed in future food security projects in Sapa district and possibly elsewhere.
- Explore possibilities for adopting a more comprehensive value-chain approach to bolster both household income and food security.

1.0 Introduction and Purpose

Oxfam GB has put in place a Global Performance Framework (GPF) as part of its effort to better understand and communicate its effectiveness, as well as enhance learning across the organisation. This framework requires project/ programme teams to annually report output data across six thematic indicator areas. In addition, modest samples of mature projects (e.g. those closing during a given financial year) under 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 global outcome indicator for the livelihoods thematic area is based on the extent to which targeted households demonstrate greater household income, as measured by household expenditure per capita. This indicator is explained further in Section 4.0 below, and the work that took place in Vietnam in July 2012 was part of an effort to capture data on it. The project randomly selected for the effectiveness review is entitled Sustainable Livelihood Development and Ethnic Minority Diversity in Lao Cai Province (RVNA64). This project was implemented from 2007 to 2011. Its focus was to mobilise poor ethnic minority farmers, the H'mong, Dao, and Tay in particular, into farmers' groups and provide them with training and agricultural extension support. According to project documents, this was intended to:

The review focused on assessing the effectiveness of a project that aimed to improve the livelihoods of three ethnic minority groups in the north of Vietnam

- Provide better access to and control over agricultural extension services, irrigation and market information that lead to empowerment and improvement in the lives of ethnic minority communities;
- Achieve equal opportunities for sustainable livelihood with respect to ethnic minority tradition, culture and local knowledge;
- Empower ethnic minority farmers to participate in decision making processes and raise their voices to positively impact their lives.

Given that the bulk of the project's direct livelihood work was concentrated in Sapa district (see Figure 1.1), data were only collected from the villages it targeted in this district. Here, the project established and supported 13 farmers groups, comprising of 271 households. Oxfam both directly supported the farmer groups and did so indirectly through the Sa Pa District Farmers' Union and the Department of Economic Development under the Ministry of Agriculture and Rural Development.

This report presents the findings resulting from a process where data were collected and compared from both farmer group members and non-members targeted by the project and farmers residing in purposively matched comparison villages. However, before doing so, Section 2.0 reviews the intervention logic of the Sustainable Livelihood Development and Ethnic Minority Diversity in Lao Cai Province project. Section 3.0 and Section 4.0 follow by presenting the impact evaluation design that was used and the methods of data collection and analysis, respectively. Section 5.0 is the longest section of this document. Its subsections present basic descriptive statistics, data on intervention exposure and finally the overall differences between the treatment groups. Section 6.0 concludes with general conclusions and programme learning considerations.

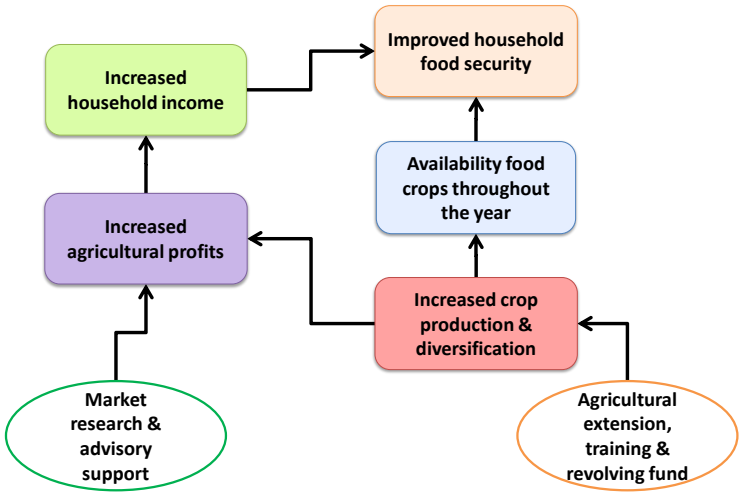
Figure 1.1: District where data collection took place

2 Intervention logic of the sustainable livelihood development and ethnic minority diversity in Lao Cai province

The primary aim of the project assessed under the Effectiveness Review was to improve household food security. Figure 2.1 presents the intervention logic of how the activities carried out under the project were to achieve this particular aim.

Several interventions were carried under the project out to increase both household food security and income

FIGURE 2.1:
Project Intervention Logic



As is evident from the diagram, training and agricultural support was provided to both increase crop production, and diversification. This was complemented through the setting up of a revolving fund to enable

farmers to access credit for agricultural investment purposes. Increased crop production and diversification was to both increase the availability of food throughout the year, thereby improving household food security. It was also to bolster agricultural profits and ultimately household income and, in turn, contribute to improved household food security.

3 Impact assessment design

3.1 Limitations in pursuing the 'gold standard'

A social programme's net effect is typically defined as the average gain participants realise in outcome (e.g. improved household food security) from their participation. In other words:

The Effectiveness Review attempted to ascertain what would have happened in the intervention villages had the project never been implemented

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 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 their a) pre-programmes outcomes (e.g. both groups have the same average incomes); and b) observed characteristics (e.g. education levels) and unobserved characteristics (e.g. motivation) relevant to 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 as 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 impact assessment design like this is only possible if it is integrated into the programme 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 Effectiveness Review – or one where randomisation is judged to be impractical, it is therefore necessary to apply alternative techniques to approximate the counterfactual as closely as possible.

3.2 Alternative evaluation design pursued

There are several evaluation designs when the comparison group is non-equivalent that can – particularly when certain assumptions are made – identify reasonably precise intervention effects. One solution is

offered by matching: Find units in an external comparison group that possess the same characteristics, e.g. ethnicity, age, and sex, relevant to the outcome variable as those of the intervention group and match them on the basis of these characteristics. If matching is done properly in this way, 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. This not only significantly reduces the size of the sample but also limits the extent the findings can be generalised to all programme participants. (This is referred to as the "curse of dimensionality" in the literature.)

In an attempt to mitigate bias, two statistical procedures were used – propensity score matching and multi-variable regression

Fortunately, matching on the basis of the propensity score – the conditional probability of being assigned to the programme group, given particular background variables or observable characteristics – offers a way out. The way propensity score matching (PSM) works is as 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 relevant to the outcome lurking among the groups, PSM is capable of identifying unbiased intervention effects.

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 in the model. 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 unmeasured (or improperly measured) but relevant differences exist between the groups.[1] Both PSM and multivariable regression were used to analyse the data collected under this effectiveness review, and efforts were made to capture key explanatory variables believed to be relevant in terms of the assessed outcomes, e.g. sex and age of household head, educations levels, etc. (see Section 4.0 below).

[1] One of the MVR procedures that were used attempted to control for possible unobserved differences between the groups. This is the Heckman Selection Model or 2-step Estimator. Here, efforts are made to directly control for the part of the error term associated with the participation equation that is correlated with both participation and non-participation. The effectiveness of this method, however, depends, in part, how well the drivers of participation are modelled.

While no baseline data were available, efforts were made, as explained below, to reconstruct it through respondent recall. This method does have limitations, e.g. memory failure, confusion between time periods, etc. However, for data that can be sensibly recalled, e.g. ownership of particular household assets, it can serve to enhance the validity of a cross-sectional impact evaluation design. The reconstructed baseline data were used in two ways: First, several of the variables included in the PSM and regression procedures were baseline variables constructed from recalled baseline data. One variable, for example, was related to the respondents' wealth status at baseline derived through the construction of a household wealth index based on asset ownership and other wealth indicators. This was done in an attempt to control for baseline wealth differences between the intervention and comparison groups.

The second way the reconstructed baseline data were used was to derive pseudo difference-in-difference (double difference) intervention effect estimates. With longitudinal or panel data, this is implemented by subtracting each unit's baseline measure of outcome from its end line measure of outcome (i.e. end line outcome status minus baseline outcome status). The intention here is to control for time invariant differences between the groups. Bearing in mind the limitations associated recalled baseline data, using PSM and/or regression and the double difference approaches together is considered to be a strong quasi-experimental impact evaluation design.

The evaluation design made two sets of comparisons: a) households in the intervention villages versus households in matched comparison villages; and b) households that belong to the project's farmer groups versus households in matched comparison villages

3.3 Intervention and comparison villages surveyed

A key factor in ensuring the validity of any non-randomised impact evaluation design is to use an appropriate comparison group. This is particularly true for ex-post, cross-sectional designs. Comparators who differ in relevant baseline characteristics and/or who are subjected to different external events and influences will likely result in misleading conclusions about programme impact. Identifying a plausible comparison group is therefore critically important and is, generally speaking, not an easy task in non-experimental work.

The challenge we confronted, then, was how to identify households that could be comparable with those the project directly targeted, i.e. the farmer group households. As mentioned above, 271 households were directly targeted by the project through the farmers groups (FGs) in the eight intervention villages. These households represent approximately 28 percent of the households residing in these villages.

One option could have been to compare FG households with non-FG households residing in the same eight intervention villages. However, this was ruled out for two reasons: First, it is unclear how the FG members became members. There were no clear targeting criteria, and their selection into the groups was likely not random. Given this, the FG and non-FG households in the eight intervention villages are likely to be different in both observable and unobservable ways unrelated to the project, thereby, making the comparison problematic. The second reason why this was ruled out was because these non-FG members

may have been indirectly affected by the project, e.g. through the diffusion of the improved agricultural practices that were promoted.

Given the above, households from neighbour villages were used for comparison purposes. In particular, each intervention village was matched with a comparison village located within the same commune, i.e. the administrative unit in Vietnam that is above the village and below the district. The selection criteria for village matching included: a) ethnicity; b) proximity to main district road and town; c) population size; and d) geographic terrain.

Comparing the FG members with households in these comparison villages is an improvement, but it is still not ideal. As mentioned above, the FG members represent a sub-set of the households in the comparison villages. Consequently, directly comparing them with the general set of households in the comparison villages may be biased. We can mitigate this by controlling for measured differences between the two groups using the statistical techniques discussed above.

However, further analyses can also be undertaken. One approach, for instance, involves simply comparing representative samples of all the households of the intervention villages with all the households of the comparison villages. If the impact of the project was large on the FG members, an average difference in outcome between all the intervention and comparison households should be observable, despite this being watered down by the non-FG households of the intervention villages. This type of analysis is called Intention to Treat (ITT) analysis.

Three different types of analyses were carried out to identify the effects of the project – Intention to Treat (ITT), Average Treatment Effect on the Treated (ATT), and Local Average Treatment Effect (LATE)

A similar problem occurs in the context of randomised control trials: It is often the case that some people assigned to be in the treatment group do not bother to participate. Given this, the people that do participate are not directly comparable with those assigned to the control group. In such cases, an alternative treatment effect estimate can still be derived. This is called the Local Average Treatment Effect (LATE). While difficult to interpret, this is defined as the effect of the intervention on those whose treatment status changed because of the randomised assignment process. In a situation where a) all those assigned to be in the control group do not take up the programme and b) there is partial take up of the programme among those assigned to be in the treatment group, this is equivalent to the effect of the programme on those that actually participated.

It is best to understand the intuition underlying LATE analysis through example. Let us assume that a comparison of all the households in the intervention and comparison villages reveals an average difference in household expenditure of $1.00 per day per capita. This ITT effect estimate would underestimate the impact of the project because 72 percent of the households in the intervention villages were not directly reached by the project. To derive LATE, we scale up the ITT estimate by the ratio of those that actually participated in the project:[2]

[2] See: Conning, J. & Deb, P. 2007. *Impact Evaluation for Land Property Rights Reforms*. Hunter College: Department of Economics.

If we assume that the households in the intervention and comparison villages used in the effectiveness review were generally the same before the project was implemented, LATE estimation can also be used to identify the project's effect on the farmer groups. One limitation, however, is that the sample size needed to carry out such analysis is typically larger than that used for the effectiveness review. Given this, coupled with the fact that the intervention villages were not selected at random, the results of such analysis should be interpreted cautiously.

A total of 553 households were interviewed – 282 from the intervention villages and 271 from the comparison villages

Following the above, efforts were made to identify three types of treatment effects in the analysis of data collected under the effectiveness review: a) Intention to Treat (ITT) resulting from a direct comparison of all the households in the intervention and comparison villages; b) Average Treatment Effect on the Treated (ATT) derived from comparing the farmer group members to households in the comparison villages; and c) quasi Local Average Treatment Effect (LATE) through adjusting the ITT effect estimate to take into account the proportion of households in the intervention villages that participated in the famer groups.

Initial plans were to use stratified proportionate sampling to randomly select 270 households belonging and not belonging to the project's farmers groups in the intervention villages and 270 households in the comparison villages. However, as displayed in Table 3.3.1, these targets were slightly exceeded.

Table 3.3.1: Intervention and comparison villages and sample sizes

Intervention Villages			***Matched Comparison Villages***	
Village Name	**FG members interviewed**	**Non-FG members interviewed**	**Village Name**	**HHs interviewed**
Giàng Tà Chải Mông	15	18	Tả Van Mông	30
Lếch Dao	28	17	Bản Kim	42
Lý Lao Chải	11	25	Lao Hàng Chải	36
Mã Tra	25	21	Giàng Tra	42
Sả Xéng	12	15	Lủ Khấu	27
Sa Pả	17	20	Suối Hồ	37
Suối Thầu	14	14	Tà Chải	27
Vù Lúng Sung	18	12	P. Sì Ngài	30
Totals	**140**	**142**		**271**

Thirteen enumerators belonging to the H'mong and Dao ethnic groups administered the questionnaire

4 Methods of Data Collection and Analysis

4.1 Data Collection

A household questionnaire was developed by Oxfam staff and translated by the Consultant to capture data on various outcome and intervention exposure measures associated with the project's theory of change presented in Section 2.0. Data for other key characteristics of the interviewed households were also obtained to implement the evaluation design described in Section 3.0. The questionnaire was pre-tested first by Oxfam local staff and then by the enumerators during a practice exercise and revised accordingly.

The 13 enumerators that administered the questionnaires were young H'mong and Dao adults, some of whom had not completed high school. It was difficult to identify potential enumerators with college/university education who could speak the dialect of the two ethnic groups, so the educational qualification standard for enumerators that is usually used for OGB's effectiveness reviews was relaxed. Fourteen prospective enumerators completed the two-day training course, which was led by the Consultant but also supported by OGB staff. The second day involved a practice run at administering the questionnaire, followed by critically reviewing the performance of the trainees. One trainee was subsequently disengaged.

Household lists were compiled in advance of visiting the surveyed villages, and they were randomly selected from these lists based on the sample quotas calculated based on the population sizes of the villages and the number of farmer group members. The farmer groups, in particular, were over-sampled to enable a reasonable level of precision in the point estimates computed for them. The work of the enumerators was closely monitored and scrutinised by the Consultant and OGB staff. OGB's Oxford-based adviser spent the first two days of the survey reviewing the completed questionnaire forms and monitoring the household-level interviews.

4.2 Data analysis

OGB developed data entry tools in Adobe Acrobat Pro, and the Consultant entered the data from the completed questionnaires. The data were imported into Stata for analysis, the results of which are presented in the following sections. Most of the analyses involved group mean comparisons using *t*-tests, as well as PSM with the *psmatch2* module and various multivariable regression approaches.

Kernel and nearest neighbour matching without replacement were used to implement PSM. Backwards stepwise regression was used to identify those variables correlated with either being in an intervention village or a famer group at *p*-values greater than 0.20. Covariate balance was checked following the implementation of each matching procedure, and efforts were made to ensure that the covariates were balanced across groups at *p*-values greater than 0.20. Boot-strapped standard errors enabled the generation of confidence intervals for statistical hypothesis testing. (See Appendix 1 for further details.)

All but the last four of the covariates presented in Table 5.1.1 below

were included in the various regression approaches undertaken, i.e. regression with robust standard errors (to address issues of heteroskedasticity), robust regression (to reduce the influence of outliers), and regression with control functions (to attempt to control for relevant unobserved differences between the intervention and comparison groups).

Given that the households belonging to the farmer groups were oversampled, sampling weights were used in the computation of all the intervention village point estimates, as well as the intention the treat (ITT) effect estimates, i.e. where the households in the intervention and comparison villages were directly compared.

4.3 Main problems and constraints encountered

Overall, despite the heavy rain experienced during the first days of the survey, coupled with the usual hardships encountered when undertaking such intensive work, the data collection process went well. There were initial fears that the relatively low educational levels of most of the enumerators would negatively impact the quality of the data. However, this fear was unfounded; overall, the enumerators performed at a level on par with more educated enumerators in other countries.

5 Results

5.1 General characteristics

Table 5.1.1 presents statistics for various household characteristics obtained through the administration of the questionnaires to the respondents from both the intervention and comparison villages. Four different comparisons were made: a) intervention village households versus comparison village households; b) farmer group households versus all other households in the dataset; c) famer group households versus non-farmer group households residing in the intervention villages; and d) farmer group members versus households in the intervention villages. The stars beside the number indicate differences between the groups that are statistically significant at a 95 percent confidence level or greater. As is evident, there are not too many significant differences. However, those that are particularly noteworthy include:

Several statistically significant measured differences between the various study groups were identified

- Households in the intervention villages are, on average, slightly closer to the commune centre, main district road, and Sapa town than are their counterparts in the comparison villages.
- The head of the households were more likely to be interviewed in the intervention villages but less likely to be literate.
- While households in the intervention villages were less likely to be rearing livestock at baseline, the members of the farmers groups were more likely to be doing so than non-members in these same villages. And the farmer group households are similar to the households in the comparison villages in this respect.
- Households in the comparison villages were more likely to have had electricity at baseline.
- The farmer group households were more likely to be wealthy at baseline than the non-farmer group households in the intervention villages but not wealthier than comparison village households.

Table 5.1.1: Descriptive statistics: Covariate comparison between treatment groups

	Sample Mean	Intervention Village Mean	Farmer Group Mean	Comparison Village Mean	Intervention vs. compare. village	*t*-stat.	Farmer group member vs. all others	*t*-stat.	Farmer group vs. non-farmer group	*t*-stat.	Farmer group vs. comparison village	*t*-stat.
Minutes walk to village centre	14.76	15.51	15.02	13.98	1.53	1.53	0.45	0.40	-0.68	-0.54	1.04	0.84
Minutes walk to commune centre	37.15	33.25	34.14	41.20	-7.95***	-3.59	-4.21	-1.69	1.23	0.46	-7.06*	-2.57
Minutes to Sapa town by motorbike	38.58	35.26	37.17	42.04	-6.78***	-3.51	-2.28	-1.04	2.66	1.07	-4.87*	-2.03
Km of home from main dist. road	8.01	7.36	8.19	8.69	-1.33*	-2.14	0.066	0.09	1.15	1.22	-0.50	-0.62
Respondent head of HH	0.69	0.74	0.72	0.64	0.10*	2.48	0.046	1.01	-0.025	-0.47	0.083	1.69
All adults in HH old	0.01	0.01	0.01	0.01	0.0031	0.31	0.0022	0.20	0.00020	0.01	0.0032	0.28
Male headed household	0.95	0.95	0.96	0.95	0.0062	0.32	0.015	0.73	0.014	0.56	0.016	0.73
Elderly headed HH	0.11	0.12	0.12	0.11	0.00073	0.03	0.0076	0.24	0.0088	0.23	0.0070	0.21
Number of adults in HH	3.22	3.30	3.40	3.14	0.16	1.17	0.22	1.43	0.13	0.71	0.26	1.67
Number of children in HH	2.90	2.92	2.71	2.89	0.033	0.26	-0.22	-1.61	-0.29	-1.75	-0.18	-1.27
HH size	6.13	6.22	6.11	6.03	0.20	0.97	-0.0018	-0.01	-0.16	-0.63	0.081	0.37
Head has primary education	0.25	0.22	0.25	0.28	-0.055	-1.43	-0.0042	-0.10	0.039	0.77	-0.027	-0.58
# of adults with primary education	0.99	1.00	1.09	0.98	0.017	0.16	0.11	0.95	0.12	0.85	0.10	0.84
Head is literate	0.40	0.35	0.41	0.45	-0.10*	-2.39	0.00036	0.01	0.083	1.45	-0.043	-0.83
Number of productive adults	3.22	3.30	3.40	3.14	0.16	1.14	0.22	1.45	0.14	0.75	0.26	1.67
Head farming at baseline	0.96	0.95	0.98	0.96	-0.015	-0.78	0.025	1.29	0.042	1.75	0.015	0.85
HH farming at baseline	0.99	0.99	0.99	1.00	-0.0054	-0.78	-0.0094	-1.14	-0.0072	-0.59	-0.011	-1.20
HH processing crops at baseline	0.00	0.00	0.00	0.00	0	.	0	.	0	.	0	.
HH rearing livestock at baseline	0.91	0.88	0.96	0.94	-0.063*	-2.34	0.056*	2.15	0.12***	3.46	0.023	1.02
HH livestock products at baseline	0.05	0.05	0.11	0.05	-0.0065	-0.37	0.066**	2.91	0.086**	2.99	0.055*	2.09
HH ran off-farm IGA at baseline	0.01	0.01	0.00	0.01	-0.00092	-0.10	-0.012	-1.31	-0.014	-1.41	-0.011	-1.25
HH did casual labor at baseline	0.23	0.23	0.20	0.23	0.0010	0.03	-0.037	-0.91	-0.046	-0.94	-0.032	-0.75
HH did unskilled work at baseline	0.01	0.01	0.01	0.01	-0.00062	-0.06	-0.00024	-0.02	0.00020	0.01	-0.00047	-0.04
HH did skilled work at baseline	0.03	0.03	0.03	0.03	0.0075	0.49	-0.00048	-0.03	-0.0066	-0.32	0.0027	0.16
Head is H'Mong	0.64	0.66	0.59	0.63	0.034	0.79	-0.063	-1.34	-0.10	-1.83	-0.042	-0.82
Head is Dao	0.35	0.33	0.41	0.37	-0.035	-0.83	0.068	1.45	0.11	1.96	0.045	0.89
Head belongs to other ethnic group	0.00	0.01	0.00	0.00	0.0014	0.22	-0.0048	-0.82	-0.0070	-0.99	-0.0037	-0.72
Head is Christian	0.14	0.16	0.16	0.11	0.052	1.69	0.036	1.07	0.0023	0.05	0.054	1.54
Head follows indigenous beliefs	0.75	0.73	0.77	0.77	-0.038	-0.98	0.018	0.44	0.053	1.02	0.00021	0.00
Head is atheist	0.11	0.10	0.06	0.12	-0.014	-0.49	-0.054	-1.82	-0.055	-1.61	-0.054	-1.73
HH had electricity at baseline	0.49	0.44	0.41	0.53	-0.088*	-1.98	-0.099*	-2.03	-0.051	-0.86	-0.12*	-2.40
Livestock index at baseline	-0.06	-0.14	0.22	0.03	-0.17	-1.39	0.30*	2.16	0.50**	2.99	0.19	1.28
Tool index at baseline	-0.06	-0.11	0.26	0.00	-0.12	-0.60	0.35	1.56	0.52	1.91	0.26	1.06
HH goods index at baseline	-0.07	-0.20	0.22	0.08	-0.28	-1.40	0.30	1.28	0.59*	2.15	0.14	0.56
HH home material index at baseline	-0.01	-0.08	-0.03	0.07	-0.15	-1.28	-0.042	-0.33	0.067	0.43	-0.099	-0.74
HH wealth index at baseline	-0.10	-0.27	0.37	0.08	-0.35	-1.27	0.50	1.59	0.89*	2.36	0.29	0.85
Kgs of trad. rice at baseline	4.26	4.37	4.37	4.14	0.24	0.36	0.15	0.22	-0.0054	-0.01	0.23	0.32
Kgs of hybrid rice at baseline	9.30	9.06	8.81	9.55	-0.50	-0.67	-0.61	-0.76	-0.34	-0.39	-0.75	-0.87
Kgs of trad. maize at baseline	4.36	4.45	4.55	4.27	0.17	0.48	0.23	0.58	0.14	0.31	0.28	0.65
Kgs of hybrid maize at baseline	1.39	1.22	1.37	1.57	-0.34	-1.56	-0.057	-0.24	0.21	0.77	-0.19	-0.76
N	**553**	**282**	**140**	**271**	**553**		**553**		**282**		**411**	

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; Sample weights used to compute sample and intervention village means and in intervention versus comparison village comparison

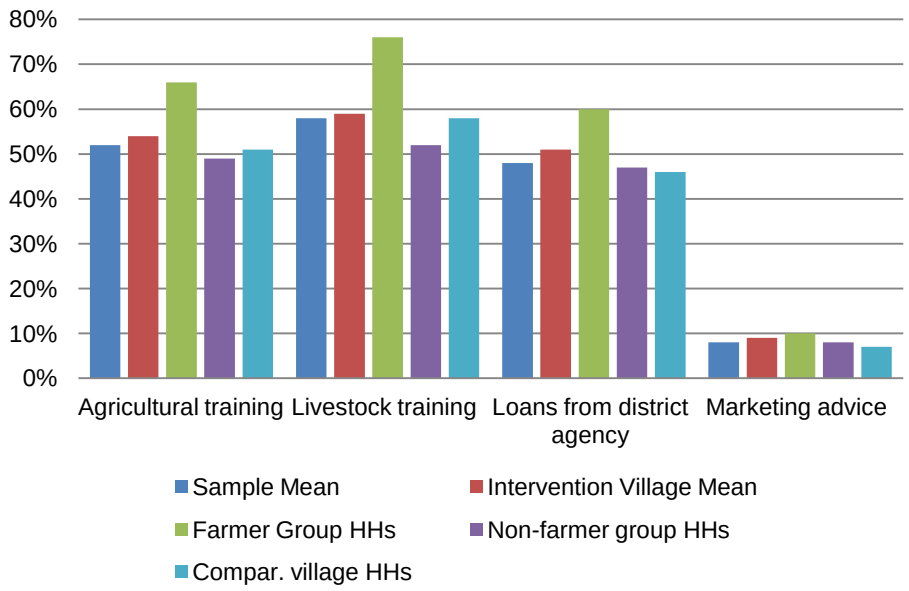
Given that there are differences between the various treatment groups, directly comparing them may very well result in biased estimations of the impacts of the project. Consequently, it was critical to control for these differences during the analysis of the data.

5.2 Receipt of external support

More households belonging to the farmer groups reported receipt of agriculture and livestock training, as well as loans from the district partner

The interviewed households were also asked whether they had received particular types of external support since the baseline period in 2007. These relate particularly to the types of support provided by the project but were not communicated as such to the respondents. The particular types of support are presented in Figure 5.2.1 and Table 5.2.1. The table, in particular, presents the results of a statistical comparison between the various study groups in relation to the receipt of this support.

Figure 5.2.1: Percentage of HHs reporting receipt of types of support provided through project



As presented in the bar chart and table, about half of all interviewed households reported receiving agricultural training and loans from Oxfam's district agency partner, while 58 and 8 per cent reported receipt of livestock training and marketing advice, respectively. More households belonging to the project's farmer groups reported receipt of agricultural and livestock training, as well as loans from the district partner agency. Table 5.2.1 reveals that these differences are statistically significant. Virtually no difference was found between the groups in relation to the receipt of marketing advice. The results are slightly different when the groups are compared in relation to the number of times they received the support, as revealed in Table 5.2.2. For instance, the difference between the intervention and comparison communities is now statistically significant for agricultural and livestock training. Moreover, while not consistently statistically significant, the farmer group households were more likely to report having had received marketing advice more times as well.

Table 5.2.1: Proportions of HHs reporting exposure to interventions similar to those of project

	Sample Mean	Intervention Village Mean	Farmer Group Mean	Non-farmer group Mean	Compar. village Mean	Inter. vs. compar. village	FG vs. all others	FG vs. NFG	FG vs. inter. village
Agricultural Training	0.52	0.54	0.66	0.49	0.51	0.023 (0.51)	0.16*** (3.33)	0.18** (3.07)	0.15** (2.96)
Livestock Training	0.58	0.59	0.76	0.52	0.58	0.0077 (0.17)	0.20*** (4.20)	0.24*** (4.24)	0.18*** (3.61)
Loans from district agency	0.48	0.51	0.60	0.47	0.46	0.050 (1.13)	0.14** (2.83)	0.13* (2.17)	0.14** (2.76)
Marketing advice	0.08	0.09	0.10	0.08	0.07	0.015 (0.62)	0.023 (0.83)	0.015 (0.45)	0.026 (0.91)
N	**553**	**282**	**140**	**142**	**271**	**553**	**553**	**282**	**411**

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Sample weights used to compute sample and intervention village means and in intervention versus comparison village comparison

Table 5.2.2: Number of times HHs reported receipt of interventions similar to those of project

	Sample Mean	Intervention Village Mean	Farmer Group Mean	Non-farmer group in intervention village Mean	Comparison village Mean	Intervention vs. Comparison village	Farmer group member vs. all others	Farmer group vs. non-farmer group	Farmer group vs. intervention village
# Agricultural Training	2.23	2.64	3.96	2.13	1.80	0.84* (2.49)	2.05*** (4.97)	1.84** (3.01)	2.17*** (4.83)
# Livestock Training	2.51	2.89	4.27	2.35	2.13	0.76* (2.37)	2.07*** (5.02)	1.92** (3.14)	2.15*** (4.68)
# loans from district agency	0.75	0.79	1.18	0.64	0.71	0.083 (0.93)	0.49*** (4.43)	0.54*** (3.56)	0.47*** (3.72)
# times marketing advice	0.17	0.17	0.34	0.11	0.17	0.0022 (0.04)	0.20* (2.15)	0.24 (1.81)	0.17 (1.58)
N	**553**	**282**	**140**	**142**	**271**	**553**	**553**	**282**	**411**

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Sample weights used to compute sample and intervention village means and in intervention versus comparison village comparison

5.3 Differences between the intervention and comparison households on uptake of practices promoted under the project

Several significant differences in agricultural practice were observed among the various treatment groups

The project, through training and agricultural extension support, encouraged members of the farmers groups to adopt very specific agricultural practices. These included those related to rice and maize planting, organic manure preparation, and livestock management and care. In the household questionnaire, the respondents were asked whether they had undertaken each specific practice, both since and before the project's baseline period. Given that the project was expected to generate its anticipated impacts largely through the adaption of these practices, it is critical to understand the extent they were actually adopted.

Table 5.3.1 presents the proportion of households that reported undertaking each specific practice, as well the quantity of both traditional and hybrid rice and maize seeds planted in the previous 12 months. As evident, there are some statistically significant differences between the groups. 30 per cent of households in the farmers groups, for instance, reported practicing the

method of rice seed planting promoted under the project, as compared with 14 and 21 per cent among comparison and non-farmer group households, respectively. Moreover, households in the farmers groups were more likely to report having undertaken the improved methods of rice and maize planting, as well as two out of the three livestock care practices. However, no significant difference in favour of the farmer groups was found in relation to organic manure preparation, livestock vaccination, backyard gardening, and planting of hybrid rice and maize varieties.

Table 5.3.1: Reported adoption of practices promoted under the project – post 2007

	Sample Mean	Inter. Village Mean	Farmer Group Mean	Non-farmer group Mean	Compar. village Mean	Intervention vs. Compar. village	Farmer group member vs. all others	Farmer group vs. non-farmer group	Farmer group vs. compar. village
Method for prep. of rice seedlings	0.19	0.24	0.30	0.21	0.14	0.096** (2.79)	0.14*** (3.50)	0.089 (1.71)	0.16*** (3.94)
Fertilizer application	0.29	0.33	0.38	0.31	0.26	0.071 (1.75)	0.10* (2.29)	0.069 (1.21)	0.12* (2.54)
Method to plant rice seedlings	0.72	0.75	0.80	0.73	0.69	0.058 (1.44)	0.093* (2.15)	0.068 (1.34)	0.11* (2.31)
Method planting maize seeds	0.36	0.36	0.45	0.33	0.35	0.0100 (0.24)	0.10* (2.20)	0.12* (2.06)	0.096 (1.89)
Prep. of organic manure	0.12	0.12	0.14	0.11	0.12	-0.0027 (-0.09)	0.017 (0.53)	0.023 (0.58)	0.014 (0.40)
Vaccination of livestock	0.80	0.76	0.85	0.73	0.85	-0.089* (-2.47)	0.044 (1.16)	0.12* (2.58)	0.0013 (0.03)
Cleaning of livestock shelter	0.21	0.22	0.35	0.18	0.19	0.036 (1.03)	0.17*** (4.11)	0.17*** (3.37)	0.16*** (3.67)
Fodder storage	0.49	0.50	0.64	0.45	0.48	0.021 (0.47)	0.17*** (3.53)	0.19** (3.29)	0.16** (3.10)
Backyard garden	0.69	0.65	0.74	0.62	0.72	-0.069 (-1.67)	0.055 (1.23)	0.12* (2.23)	0.020 (0.42)
Kgs of traditional rice seed	1.98	1.79	2.32	1.59	2.18	-0.38 (-1.14)	0.34 (0.79)	0.73 (1.36)	0.14 (0.27)
Kgs of hybrid rice seed	11.75	11.51	11.71	11.44	12.00	-0.49 (-0.73)	-0.099 (-0.14)	0.27 (0.34)	-0.29 (-0.39)
Kgs of traditional maize seed	3.00	2.93	2.54	3.08	3.08	-0.15 (-0.43)	-0.54 (-1.46)	-0.54 (-1.45)	-0.54 (-1.32)
Kgs of hybrid maize seed	2.19	2.19	2.63	2.01	2.20	-0.0098 (-0.05)	0.50* (2.09)	0.61* (2.18)	0.43 (1.63)
N	**553**	**282**	**140**	**142**	**271**	**553**	**553**	**282**	**411**

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Sample weights used for intervention versus comparison village comparison

It is possible that these differences in agricultural practices already existed even before the coming of the project. While there are limitations in making use of recalled baseline data, such data can be differenced from the post-baseline data to investigate the extent to which the practices changed over time. Table 5.3.2 presents the results. Here, the differences in fertiliser application and livestock shelter cleaning between the farmer group households and those in the intervention villages are no longer statistically significant.

There is evidence that the project was successful in encouraging some households to adopt several improved agricultural practices

However, it is now revealed that the farmer group households were more likely than households in the comparison villages to have switched from planting traditional maize seed to hybrid maize seed.

That being said, while the farmer group households are more likely to report having adopted several of the improved farming practices promoted under the project in comparison with both the non-farmer group households and households in the comparison villages, these differences are not large. In other words, if the project was successful in *significantly changing* farming practice, we would have expected the differences between the farmer groups and the other two treatment groups to be much greater.

Table 5.3.2: Reported adoption of practices promoted under the project – difference from baseline

	Sample Mean	Inter. Village Mean	Farmer Group Mean	Non-farmer group Mean	Compar. village Mean	Inter. vs. Comparison village	Farmer group member vs. all others	Farmer group vs. non-farmer group	Farmer group vs. compar. village
Method for prep. of rice seedlings	0.07	0.09	0.17	0.06	0.04	0.049*	0.12***	0.11**	0.13***
						(2.23)	(4.48)	(2.85)	(4.28)
Fertilizer application	0.06	0.06	0.09	0.04	0.06	0.0010	0.042	0.051	0.038
						(0.04)	(1.56)	(1.53)	(1.29)
Method to plant rice seedlings	0.19	0.23	0.24	0.23	0.14	0.097**	0.066	0.0033	0.099*
						(2.80)	(1.74)	(0.07)	(2.55)
Method planting maize seeds	0.11	0.13	0.18	0.11	0.09	0.039	0.079*	0.066	0.086*
						(1.38)	(2.47)	(1.57)	(2.49)
Prep. of organic manure	0.01	0.01	0.01	0.01	0.01	-0.00062	-0.00024	0.00020	-0.00047
						(-0.05)	(-0.02)	(0.01)	(-0.03)
Vaccination of livestock	0.17	0.17	0.18	0.17	0.17	0.0019	0.0091	0.0096	0.0088
						(0.06)	(0.23)	(0.20)	(0.20)
Cleaning of livestock shelter	0.06	0.06	0.06	0.06	0.07	-0.012	-0.0011	0.0079	-0.0058
						(-0.44)	(-0.04)	(0.23)	(-0.20)
Fodder storage	0.11	0.14	0.17	0.13	0.08	0.054	0.072*	0.045	0.087*
						(1.75)	(2.09)	(0.97)	(2.40)
Backyard garden	0.08	0.09	0.06	0.10	0.07	0.017	-0.023	-0.041	-0.013
						(0.60)	(-0.76)	(-1.10)	(-0.42)
Kgs of traditional rice seed	-2.27	-2.58	-2.05	-2.78	-1.96	-0.62	0.19	0.73	-0.092
						(-1.11)	(0.32)	(0.95)	(-0.16)
Kgs of hybrid rice seed	2.45	2.46	2.90	2.29	2.45	0.010	0.51	0.61	0.45
						(0.02)	(0.86)	(0.98)	(0.70)
Kgs of traditional maize seed	-1.36	-1.51	-2.01	-1.32	-1.19	-0.32	-0.77**	-0.68	-0.81*
						(-1.26)	(-2.67)	(-1.94)	(-2.58)
Kgs of hybrid maize seed	0.80	0.96	1.26	0.85	0.63	0.33	0.55**	0.41	0.63**
						(1.92)	(2.90)	(1.57)	(3.25)
N	**553**	**282**	**140**	**142**	**271**	**553**	**553**	**282**	**411**

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Sample weights used for intervention versus comparison village comparison

5.4 Differences between the intervention and comparison households on the outcome measures

This subsection presents the results of analyses that compared the respondents from the intervention and comparison villages in relation to outcome measures relevant to the theory of change presented in section 2.0.

Farmer group households reported having slightly better access to farming extension services than those in the comparison villages

5.4.1 Measures related to service access

The respondents were also asked the extent to which they had access to four different types of services: disaster preparedness information; farming extension; credit; and marketing information and support. If they reported having such access, they were then asked the extent they made use of the service and found it useful, as well as their perceptions on its timing and frequency. For each service, the households were given a score out of four, with higher points awarded the more positively the respondent answered the various questions. The results of comparing the various treatment groups are presented in Table 5.4.1.1 below.

Table 5.4.1: Service access, used and perceptions of quality 2012

	Intervention HHs versus Comparison HHs				*Farmer Group HHs versus Comparison HHs*			
	Disaster prepar. info.	**Farming extension services**	**Credit services**	**Market info.**	**Disaster prepar. info.**	**Farming extension services**	**Credit services**	**Market info.**
Unadjusted								
Sample mean	2.17	1.69	1.91	1.33	2.22	1.80	1.92	1.34
Intervention mean:	2.13	1.73	1.96	1.34	2.26	2.07	2.04	1.36
Comparison mean:	2.21	1.66	1.86	1.33	2.21	1.66	1.86	1.33
Unadjusted difference :	-0.0739	0.0688	0.0964	0.0119	0.0505	0.415***	0.183	0.0359
	(-0.69)	(0.77)	(1.08)	(0.17)	(0.40)	(3.61)	(1.63)	(0.41)
Observations:	**553**	**553**	**553**	**553**	**411**	**411**	**411**	**411**
PSM								
Post-matching difference:	0.0367	0.194	0.120	0.109	0.0263	0.375**	0.204	0.0681
(kernel)	(0.31)	(1.93)	(1.26)	(1.67)	(0.18)	(3.01)	(1.71)	(0.75)
Observations:	**551**	**551**	**551**	**551**	**402**	**402**	**402**	**402**
Post-matching difference:	-0.0506	0.194*	0.156	0.0844	0.0687	0.481***	0.214	0.0840
(no replacement)	(-0.45)	(1.99)	(1.67)	(1.11)	(0.45)	(3.73)	(1.63)	(0.82)
Observations:	**508**	**508**	**508**	**508**	**402**	**402**	**402**	**402**
Multivariable Regression								
MVR coefficient:	0.0290	0.0883	0.136	0.0906	-0.0104	0.342**	0.251*	0.0921
(robust standard errors)	(0.28)	(0.98)	(1.48)	(1.34)	(-0.08)	(2.92)	(2.12)	(1.04)
Observations:	**553**	**553**	**553**	**553**	411	411	411	411
MVR coefficient:	0.0260	0.0938	0.136	0.0933	-0.00546	0.339**	0.246*	0.105
(with control functions)	(0.25)	(1.04)	(1.47)	(1.36)	(-0.04)	(2.84)	(2.04)	(1.15)
Observations:	**553**	**553**	**553**	**553**	**408**	**408**	**408**	**408**
LATE Analysis								
ivreg2 coefficient					0.0901	0.299	0.462	0.299
(robust standard errors)					(0.27)	(1.03)	(1.53)	(1.35)
Observations:					**553**	**553**	**553**	**553**

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
PSM estimates bootstrapped 1000 repetitions
Coefficients for covariates used not presented
Sample weights used for intervention versus comparison village comparison

As is clear, there are no statistically significant differences between the households of the intervention and comparison villages when they are directly compared. However, there are some differences when the farmer group households are compared with the households in the comparison villages, particularly in relation to farming extension services and, to a lesser extent, credit services.

5.4.2 Agricultural Production

There is no evidence that the project was successful in bolstering agricultural production

Given that the core aim of the project was to improve household food security and income by bolstering agricultural production, many of the questions in the household survey were devoted to obtaining data on the latter. The respondents, in particular, were asked to report on the various crops they grew during the previous 12 months, including the quantity harvested, their market value, production expenses incurred, and revenue earned, if any. The questionnaire was designed in such a way so data related to the production and sales of rice and maize could be isolated. The households were also asked directly whether they had experienced an increase or decrease in agricultural production since the baseline period. If they reported in the affirmative, they were then asked to use stones to represent percentage of either increase or decrease. A comparison of the households residing in the intervention and comparison villages in relation to a number of production measures is presented in Table 5.4.2.1.

Table 5.4.2.1: Measures of agricultural production – intervention HHs versus comparison HHs

	Total number of crops harvested	Rice harvested (kg)	Cash value of rice harvested (VND 000)	Maize harvested (kg)	Cash value of maize harvested (VND 000)	Cash value of all crops harvested (VND 000)	Self-reported % increase in crop production
Unadjusted							
Sample mean	4.63	1764.62	10970.38	521.80	3173.78	18158.45	0.12
Intervention village mean:	4.55	1644.37	10672.30	535.53	3278.03	17078.02	0.13
Comparison village mean:	4.71	1889.75	11280.55	507.51	3065.30	19282.74	0.12
Unadjusted difference :	-0.158	-245.4	-608.3	28.02	212.7	-2204.7	0.0147
	(-0.65)	(-1.86)	(-0.36)	(0.64)	(0.74)	(-1.08)	(0.65)
Observations:	**553**	**553**	**553**	**553**	**553**	**553**	**553**
PSM							
Post-matching difference:	-.077199	-295.82***	-795.35	23.62	132.53	-1628.36	0.0250
(kernel)	(-0.46)	(-4.4259)	(-0.68)	(0.69)	(0.59)	(-1.22)	(1.02)
Observations:	**551**	**551**	**551**	**551**	**551**	**551**	**551**
Post-matching difference:	-.012794	1808.92	-593.42	34.16	171.68	-2539.6	0.0209
(no replacement)	(-0.05)	(-2.22)	(-0.35)	(0.75)	(0.60)	(-1.19)	(0.84)
Observations:	**508**	**508**	**508**	**508**	**508**	**508**	**508**
Multivariable Regression							
MVR coefficient :	0.191	-231.0	-154.4	56.73	315.6	-949.8	0.00676
(robust standard errors)	(1.20)	(-1.77)	(-0.08)	(1.26)	(1.03)	(-0.47)	(0.30)
Observations:	**553**	**553**	**553**	**553**	**553**	**553**	**553**
MVR coefficient:	0.155	-35.59	-320.3	-27.97	-159.3	-680.7	0.00198
(robust regression)	(1.26)	(-0.61)	(-0.83)	(-1.15)	(-1.00)	(-1.11)	(0.11)
Observations:	**553**	**553**	**553**	**553**	**553**	**553**	**553**
MVR coefficient:	0.196	-217.4	-64.56	56.81	305.6	-988.1	0.00514
(with control functions)	(1.22)	(-1.71)	(-0.03)	(1.24)	(0.98)	(-0.47)	(0.23)
Observations:	**553**	**553**	**553**	**553**	**553**	**553**	**553**

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
PSM estimates bootstrapped 1000 repetitions
Coefficients for covariates used not presented
Sample weights used for intervention versus comparison village comparison

Even when the farmer groups are analysed separately, there is no evidence of project impact

The statistics from the table reveal that there are no positive differences in favour of the intervention villages for any of the various measures. In fact, for the number of kilograms of rice harvested, four out of the five effect estimates are negative with a 10 percent level of confidence or greater. However, the robust regression estimate is not statistically significant, indicating that the apparently negative difference is due to the influence of outliers.

Does the picture change when the households belonging to the project's farmer groups are compared with households in the intervention villages? Table 5.4.2.2 presents the results. Unfortunately, there are, again, no positive and significant differences between the two groups. There is no evidence, then, that the project had a positive impact on any of these measures.

Table 5.4.2.2: Measures of agricultural production: farmer group HHs versus comparison HHs

	Total number of crops harvested	Rice harvested (kg)	Cash value of rice harvested (VND 000)	Maize harvested (kg)	Cash value of maize harvested (VND 000)	Cash value of all crops harvested (VND 000)	Self-reported % increase in crop production
Unadjusted							
Sample mean	4.85	1859.53	10871.68	529.07	3155.92	18640.75	0.14
Farmer Group mean:	5.13	1801.04	10080.23	570.80	3331.35	17398.04	0.18
Comparison village mean:	4.71	1889.75	11280.55	507.51	3065.30	19282.74	0.12
Unadjusted difference :	0.416	-88.71	-1200.3	63.29	266.1	-1884.7	0.0645
	(1.40)	(-0.62)	(-1.00)	(1.15)	(0.82)	(-1.03)	(1.77)
Observations:	**411**	**411**	**411**	**411**	**411**	**411**	**411**
PSM							
Post-matching difference:	0.124	-159.6	-1262.9	44.30	0.933	-1531.5	0.0629
(kernel)	(0.37)	(-1.05)	(-1.13)	(0.77)	(0.00)	(-0.89)	(1.58)
Observations:	**402**	**402**	**402**	**402**	**402**	**402**	**402**
Post-matching difference:	0.0611	-203.1	-1271.0	37.61	-79.70	-1535.3	0.0599
(no replacement)	(0.17)	(-1.23)	(-1.20)	(0.63)	(-0.22)	(-0.83)	(1.46)
Observations:	**402**	**402**	**402**	**402**	**402**	**402**	**402**
Multivariable Regression							
MVR coefficient :	0.242	-212.3	-1590.8	61.94	114.9	-1813.5	0.0370
(robust standard errors)	(1.28)	(-1.64)	(-1.67)	(1.33)	(0.40)	(-1.37)	(1.11)
Observations:	**411**	**411**	**411**	**411**	**411**	**411**	**411**
MVR coefficient:	0.0833	24.73	-268.9	-24.04	-263.6	-602.5	-0.00422
(robust regression)	(0.56)	(0.32)	(-0.53)	(-0.80)	(-1.35)	(-0.77)	(-0.19)
Observations:	**411**	**411**	**411**	**411**	**411**	**411**	**411**
MVR coefficient:	0.225	-181.3	-1496.4	66.65	71.46	-2087.2	0.0364
(with control functions)	(1.19)	(-1.50)	(-1.61)	(1.39)	(0.24)	(-1.55)	(1.13)
Observations:	**408**	**408**	**408**	**408**	**408**	**408**	**408**
LATE Analysis							
ivreg2 coefficient	0.634	-781.8	-550.6	187.5	1041.6	-3218.2	0.0212
(robust standard errors)	(1.22)	(-1.81)	(-0.09)	(1.27)	(1.03)	(-0.49)	(0.29)
Observations:	**553**	**553**	**553**	**553**	**553**	**553**	**553**

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
PSM estimates bootstrapped 1000 repetitions
Coefficients for covariates used not presented

Table 5.4.2.3 and Table 5.4.2.4 present the results of comparing the various treatment groups in relation to several additional measures. The first three were computed by factoring in the reported costs of production into the estimated cash value of rice, maize, and all the crops the household harvested. In addition, using the reported data on both production expenses and revenue from sales, profits earned through the sale of rice were also computed. This was also attempted for maize, but very few households reported selling this particular crop. Consequently, the treatment groups were not compared on this measure.

As is apparent from Table 5.4.2.3, there are again no positive differences in favour of the households in the intervention villages for any of the various measures used. In fact, the cash received through the sale of all crops is lower for the intervention households.

However, the size of this difference is significantly smaller in the case of the robust regression estimate, indicating outliers are again partly skewing the results.

Table 5.4.2.3: Measures of agricultural production con't – intervention HHs vs. comparison HHs

	Net Cash Value of Rice Harvested (VND 000)	Net Cash Value of Maize Harvested (VND 000)	Net Cash Value of all Crops Harvested (VND 000)	Rice Profit (VND*1000)	Cash Received from Sales of All Crops (VND 000)	Self-reported % increase in crop profits
Unadjusted:						
Sample mean	8477.05	2231.15	14472.13	260.22	2923.17	0.06
Intervention village mean:	7979.08	2314.86	13225.25	231.34	1994.21	0.05
Comparison village mean:	8995.24	2144.04	15769.63	290.27	3889.84	0.07
Unadjusted difference :	-1016.2	170.8	-2544.4	-58.93	-1895.6***	-0.0139
	(-0.60)	(0.69)	(-1.28)	(-0.45)	(-3.60)	(-0.95)
Observations:	**553**	**553**	**553**	**553**	**553**	**553**
PSM						
Post-matching difference:	-1234.9	52.15	-1912.5	16.17	-1241.2*	-0.0244
(kernel)	(-0.91)	(0.20)	(-1.14)	(0.12)	(-2.28)	(-1.63)
Observations:	**551**	**551**	**551**	**551**	**551**	**551**
Post-matching difference:	-1086.8	23.92	-2325.6	-16.97	-1609.0**	-0.00907
(no replacement)	(-0.68)	(0.10)	(-1.16)	(-0.11)	(-2.73)	(-0.57)
Observations:	**508**	**508**	**508**	**508**	**508**	**508**
Multivariable Regression						
MVR coefficient :	-475.1	184.5	-1307.5	-4.500	-1626.5**	-0.0153
(robust standard errors)	(-0.26)	(0.70)	(-0.65)	(-0.03)	(-3.07)	(-1.03)
Observations:	**553**	**553**	**553**	**553**	**553**	**553**
MVR coefficient:	-122.7	-207.0	-730.4	n/a	-158.9	n/a
(robust regression)	(-0.34)	(-1.43)	(-1.28)		(-1.48)	
Observations:	**553**	**553**	**553**		**553**	
MVR coefficient:	-377.8	175.5	-1334.4	-2.684	-1635.1**	-0.0146
(with control functions)	(-0.20)	(0.66)	(-0.64)	(-0.02)	(-3.08)	(-0.97)
Observations:	**553**	**553**	**553**	**553**	**553**	**553**

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
PSM estimates bootstrapped 1000 repetitions
Coefficients for covariates used not presented
Sample weights used for intervention versus comparison village comparison

Again, it is of interest to narrow in on the farmer groups. Table 5.4.2.4 compares households belonging to the farmer groups with the households in the comparison villages. Unfortunately, there are no positive differences favouring the farmer group households for any of the six measures. While not consistently statistically significant, the comparison households, again, preformed better in relation to crop sales measure.

Table 5.4.2.4: Measures of agricultural production con't – farmer group HHs vs. comparison HHs

	Net Cash Value of Rice Harvested (VND 000)	Net Cash Value of Maize Harvested (VND 000)	Net Cash Value of all Crops Harvested (VND 000)	Rice Profit (VND 000)	Cash Received from Sales of All Crops (VND 000)	Self-reported % increase in crop profits
Unadjusted						
Sample mean	8517.32	2186.44	15028.79	300.06	3479.88	0.06
Farmer Group mean:	7592.21	2268.51	13594.73	319.00	2686.30	0.06
Comparison village mean:	8995.24	2144.04	15769.63	290.27	3889.84	0.07
Unadjusted difference :	-1403.0	124.5	-2174.9	28.73	-1203.5	-0.00853
	(-1.22)	(0.46)	(-1.27)	(0.18)	(-1.83)	(-0.46)
Observations:	**411**	**411**	**411**	**411**	**411**	**411**
PSM						
Post-matching difference:	-1477.3	-95.28	-1776.0	21.18	-934.6	-0.0112
(kernel)	(-1.41)	(-0.33)	(-1.18)	(0.10)	(-1.06)	(-0.56)
Observations:	**402**	**402**	**402**	**402**	**402**	**402**
Post-matching difference:	-1385.6	-135.9	-1701.3	4.005	-1249.5	-0.00573
(no replacement)	(-1.40)	(-0.45)	(-1.01)	(0.02)	(-1.34)	(-0.26)
Observations:	**402**	**402**	**402**	**402**	**402**	**402**
Multivariable Regression						
	-1767.4	-42.24	-2087.6	75.86	-924.4	-0.0178
s)	(-1.90)	(-0.16)	(-1.65)	(0.40)	(-1.28)	(-0.96)
	411	**411**	**411**	**411**	**411**	**411**
	-242.7	-315.7	-867.6	n/a	-285.4	n/a
	(-0.52)	(-1.79)	(-1.20)		(-1.77)	
	411	**411**	**411**		**411**	
	-1694.8	-79.66	-2363.4	71.76	-1013.5	-0.0181
)	(-1.87)	(-0.30)	(-1.84)	(0.37)	(-1.36)	(-0.96)
	408	**408**	**408**	**408**	**408**	**408**
	-1611.0	604.8	-4401.8	-18.67	-5438.9**	-0.0517
s)	(-0.27)	(0.70)	(-0.67)	(-0.04)	(-2.97)	(-1.06)
	553	**553**	**553**	**553**	**553**	**553**

Respondents were asked to recall the types and quantities of food consumed during the previous week, as well as how much they spent on various non-food items

es
p < 0.001
PSM estimates bootstrapped 1000 repetitions
Coefficients for covariates used not presented

OGB's global livelihood indicator is informed by household consumption and expenditure data

5.4.3 Household Consumption Expenditure

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.[3] However, given that there is a widely recognised and strong association between household income and consumption,[4] one popular proxy measure used by the World Bank and other international institutions involves the aggregation of household consumption/expenditure data.[5] It is through these data that the percentages of households living on more than USD $1.25 per day per capita are estimated.

Such consumption expenditure data form the basis of Oxfam GB's global indicator for livelihoods:

[3] 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.
[4] See Gujarati, Damodar N. (2003) *Basic Econometrics: Fourth Edition*. New York: McGraw Hill.
[5] Deaton, A and S. Zaidi. (2002) "Guidelines for constructing consumption aggregates for welfare analysis," Working Paper No. 135. The World Bank, Washington, D.C.

There is no evidence that the project increased household consumption expenditure

- % of supported households demonstrating greater income, as measured by daily consumption and expenditure per capita.

The collected consumption expenditure data can be analysed as a continuous variable. However, the way it is used to inform Oxfam GB's global livelihoods indicator is as follows: If the household is above the typical household in the comparison group (as defined by the median value of this group), it is coded with 1 and 0 if otherwise. When the intervention and comparison households are subsequently compared, this approach offers a way of both a) assessing the extent to which the intervention households have higher consumption expenditure, on average, than the comparison households and b) enabling the relative comparisons of the intervention and comparison households to be aggregated with the results from other effectiveness reviews.

To capture the consumption expenditure data, several modules were incorporated into the household survey. The respondents were asked what types of food they consumed over the previous seven day period, as well as the particular quantities. The quantities of each food item consumed were then converted into a monetary value. This was done by asking the respondent how much was paid for the food item in question or, if the food item was from the household's own production, how much it would be worth if it was purchased from the local market. The respondents were also asked how much they spent on particular non-food items and services from a list, such as soap, toothpaste, and minibus fares over the past four weeks. Finally, they were asked for any household expenditure on particular non-food items such as school and hospital fees, clothes, and home repair over the last 12 months.

The basic per capita measure is calculated as follows for each household:

(((expenditure_food_item_1 + expenditure_food_item_2 +… + expenditure_food_item_n)/7) + ((expenditure_regular_item_1 + expenditure_regular_item_2 + … + expenditure_regular_item_n)/30) + ((expenditure_non-regular_item_1 + expenditure_non-regular_item_2 + … + expenditure_non-regular_item_n)/365))/household size

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 (e.g. > £1.00), so that the proportion of households living above a certain monetary figure can be calculated. Placing the continuous version of the variable on a natural logarithmic scale is also possible, which can improve model fit in regression analysis and reduce the influence of outliers.

While dividing the above equation by household size as the overall denominator is recommended in the literature, it is considered important to avoid underestimating expenditure for larger sized households relative to their smaller counterparts. A recommended formula for calculating household size is: HH_size where *A* is number of adults in the household; *K* is the number of children; is the cost of a child relative to an adult; and controls the extent of economies of scale. For low income countries, is recommend that be set at .25 or .33 and be set at .9.[6]

[6] Ibid.

Table 5.4.3.1 presents the results of a comparison of seven measures constructed from the consumption/expenditure data. Given that a primary aim of the programme was to improve food security, the results for the food consumption data are also presented in isolation. The unadjusted results for the global indicator and three variations of the household expenditure data are modestly statistically significant but in favour of the households in the comparison villages. However, after controlling for observable differences between the two groups, the magnitude of the differences decrease for most of the statistical adjustment procedures and are no longer statistically significant with a 10 percent level of confidence or greater. Nevertheless, it is clear that households in the intervention villages are, on average, no better off in relation to household consumption/expenditure than are their counterparts in the comparison villages.

Table 5.4.3.1: Household consumption and expenditure – intervention HHs vs. comparison HHs

	Global livelihood outcome indicator	HH expenditure per day per capita (VND)	HH expenditure per day per capita USD (PPP)	HH expenditure per day per capita (logarithmic scale)	Food consumption per day per capita (VND)	Food consumption per day per capita USD (PPP)	Food consumption per day per capita (logarithmic scale)
Unadjusted							
Sample mean	0.46	44969.56	5.40	10.56	30113.28	3.62	10.16
Intervention village mean:	0.42	42571.14	5.11	10.51	29868.57	3.59	10.14
Comparison village mean:	0.50	47474.58	5.70	10.61	30367.92	3.65	10.19
Unadjusted difference :	-0.0750	-4903.4	-0.589	-0.102*	-499.4	-0.0600	-0.0469
	(-1.70)	(-1.83)	(-1.83)	(-2.15)	(-0.27)	(-0.27)	(-1.03)
Observations:	**552**	**552**	**552**	**552**	**553**	**553**	**553**
PSM							
Post-matching difference:	-.0216048	-2644.05	-0.317643	-0.03427	773.59	0.092935	0.02203
(kernel)	(-0.71)	(-1.42)	(-1.42)	(-1.05)	(0.53)	(0.53)	(0.66)
Observations:	**550**	**550**	**550**	**550**	**551**	**551**	**551**
Post-matching difference:	-.0183368	-4940.4	-0.593511	-.09811	-369.82	-0.044427	-0.03694
(no replacement)	(-0.40)	(-1.83)	(-1.83)	(-2.10)	(-0.19)	(-0.19)	(-0.82)
Observations:	**507**	**507**	**507**	**507**	**508**	**508**	**508**
Multivariable Regression							
MVR coefficient :	-.0387154	-2930.9	-0.352	-0.0606	814.2	0.0978	-0.00117
(robust standard errors)	(-0.79)	(-1.03)	(-1.03)	(-1.26)	(0.40)	(0.40)	(-0.02)
Observations:	**552**	**552**	**552**	**552**	**553**	**553**	**553**
MVR coefficient:	n/a	-168.8	-0.0203	-0.0279	615.0	0.0739	0.0221
(robust reg.)		(-0.12)	(-0.12)	(-0.67)	(0.62)	(0.62)	(0.55)
Observations:		**552**	**552**	**552**	**553**	**553**	**553**
MVR coefficient:	-.0323187	-2877.3	-0.346	-0.0589	790.8	0.0950	-0.0000672
(with control functions)	(-0.73)	(-1.01)	(-1.01)	(-1.22)	(0.38)	(0.38)	(-0.00)
Observations:	**552**	**552**	**552**	**552**	**553**	**553**	**553**

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
PSM estimates bootstrapped 1000 repetitions
Coefficients for covariates used not presented
Sample weights used for intervention versus comparison village comparison
Probit regression used for global indicator
PPP = Purchase Power Parity

Again, it is of interest to see whether the results change when the households belonging to the farmer groups are compared with the households in the comparison villages. The results are presented in Table 5.4.3.2. Unfortunately, again, there are no significant differences between the two groups. There is, therefore, no evidence that the project has increased household expenditure and, by extension, household income.

Table 5.4.3.2: HH consumption and expenditure – farmer group HHs vs. comparison HHs

	Global livelihood outcome indicator	HH expenditure per day per capita (VND)	HH expenditure per day per capita USD (PPP)	HH expenditure per day per capita (logarithmic scale)	Food consump. per day per capita (VND)	Food consump. per day per capita USD (PPP)	Food consump. per day per capita (logarithmic scale)
Unadjusted							
Sample mean	0.50	46850.12	5.63	10.60	31573.17	3.79	10.20
Farmer group mean:	0.49	45645.81	5.48	10.58	33906.19	4.07	10.23
Comparison village mean:	0.50	47474.58	5.70	10.61	30367.92	3.65	10.19
Unadjusted difference :	-0.0358	-1828.8	-0.220	-0.0325	3538.3	0.425	0.0462
	(-0.27)	(-0.56)	(-0.56)	(-0.60)	(1.28)	(1.28)	(0.82)
Observations:	**410**	**410**	**410**	**410**	**411**	**411**	**411**
PSM							
Post-matching difference:	-0.00986	-3558.6	-0.428	-0.0307	2008.8	0.241	0.0510
(kernel)	(-0.17)	(-0.92)	(-0.93)	(-0.45)	(0.68)	(0.63)	(0.76)
Observations:	**401**	**401**	**401**	**401**	**402**	**402**	**402**
Post-matching difference:	-0.0153	-4425.9	-0.532	-0.0447	2163.5	0.260	0.0508
(no replacement)	(-0.24)	(-1.09)	(-1.08)	(-0.66)	(0.68)	(0.69)	(0.79)
Observations:	**401**	**401**	**401**	**401**	**402**	**402**	**402**
Multivariable Regression							
MVR coefficient :	-.0289058	-3560.5	-0.428	-0.0429	2240.5	0.269	0.0450
(robust standard errors)	(-0.49)	(-1.05)	(-1.05)	(-0.79)	(0.80)	(0.80)	(0.81)
Observations:	**410**	**410**	**410**	**410**	**411**	**411**	**411**
MVR coefficient:	n/a	-312.7	-0.0376	-0.0416	940.5	0.113	0.0271
(robust reg.)		(-0.17)	(-0.17)	(-0.77)	(0.75)	(0.75)	(0.53)
Observations:		**410**	**410**	**410**	**411**	**411**	**411**
MVR coefficient:	-.0328442	-3534.9	-0.425	-0.0422	2051.9	0.247	0.0440
(with control functions)	(-0.55)	(-1.03)	(-1.03)	(-0.75)	(0.72)	(0.72)	(0.76)
Observations:	**407**	**407**	**407**	**407**	**408**	**408**	**408**
LATE Analysis							
ivreg2 coefficient:	-0.107	-9782.0	-1.175	-0.202	2705.5	0.325	-0.00448
(robust standard errors)	(-0.75)	(-1.04)	(-1.04)	(-1.28)	(0.40)	(0.40)	(-0.03)
Observations:	**552**	**552**	**552**	**552**	**553**	**553**	**553**

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
PSM estimates bootstrapped 1000 repetitions
Coefficients for covariates used not presented
Sample weights used for intervention versus comparison village comparison
Probit regression used for global indicator
PPP = Purchase Power Parity

5.4.4 Household Food Security

The Household Food Insecurity Access Scale (HFIAS) was one of the main methods used to assess household food security

In addition to data on food consumption, the questionnaire comprised of two additional modules related to household food security. One module was the Household Food Insecurity Access Scale (HFIAS) developed by USAID's Food and Nutrition Technical Assistance (FANTA) Programme.[7] This module involves asking the respondents the following questions using a four week recall period:

1. 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?
2. Did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?
3. Did you or any household member have to eat fewer meals in a day because there was not enough food?

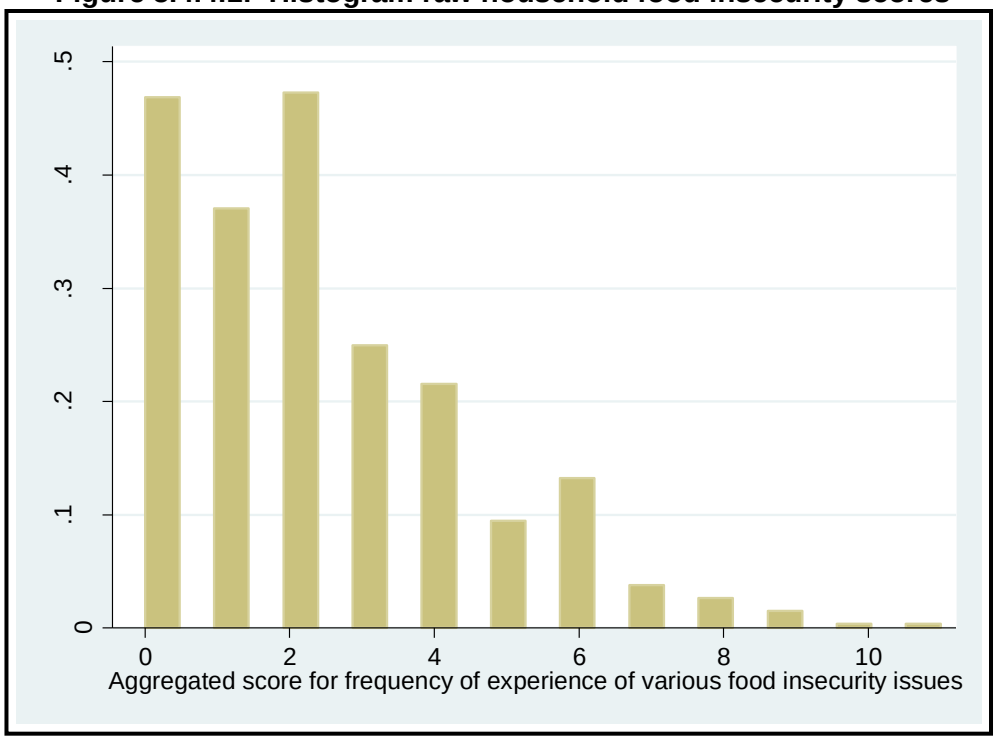
[7] http://www.fantaproject.org/publications/hfias_intro.shtml

4. Was there ever no food to eat of any kind in your house because of lack of resources to get food?
5. Did you or any household member go to sleep at night hungry because there was not enough food?
6. Did you or any household member go a whole day and night without eating anything because there was not enough food?

If the question was answered in the affirmative, the respondent was then asked how frequently the situation occurred during the previous four weeks. Scores were given based on their particular responses, with a score of 1 for once or twice, 2 for three to 10 times, and 3 for over 10 times. Consequently, the higher the household's score, the more food insecure it is considered to be. Figure 5.4.4.1 presents a histogram of the resulting raw scores, revealing that there is some variability in reported household food security.

A good number of households reported having at least some food security problems

Figure 5.4.4.1: Histogram raw household food insecurity scores



The data obtained through HFIAS was also used to create two binary measures of household food security – one for households reporting at least some food security problems and another for households reporting more severe food security. For the first binary measure, a household was coded with 1 if the responded reported any of the following at least "sometimes" (three to 10 times) in the past four weeks:

- No food of any kind in the home
- Cut down the size or number of meals regularly consumed
- Went to bed hungry or went for a whole day and night without eating.

A household was further coded as reporting severe food insecurity if the respondent reported either:

- Having had to cut down the number of meals consumed or had no food of any kind in the home more than 10 times in the past four weeks
- Going to bed hungry or not eating anything in the past 24 hours three to 10 times in the past four weeks

A module was also administered to obtain data on the number of days various food types were consumed in the household, including:

Dietary diversity was assessed by obtaining data on the number of days various food items were consumed in the previous week

- Rice.
- Other grains like maize, bread, millet, sorghum, wheat or any other grains.
- Pumpkins, carrots, squash, or sweet potatoes that are yellow or orange inside.
- Potatoes, white yams, manioc, cassava or any other foods made from roots /tubers.
- Dark, green, leafy vegetables such as cassava leaves, bean leaves, kale, spinach, pepper leaves, taro leaves, and amaranth leaves.
- Other types of vegetables.
- Ripe papayas, mangoes, and other fruits rich in vitamin A.
- Other fruits like bananas, apples, etc.
- Meats such as beef, pork, lamb, goat, chicken, duck, other birds, etc.
- Eggs.
- Fish whether fresh or dried or shellfish.
- Legume such as beans, peas, and lentils.
- Milk products such as milk, cheese, yogurt, or any other milk products.
- Nuts and seeds (groundnuts, local varieties).

The collected data were analysed as both a raw overall score, with the number of times each food item was reported being consumed simply added together, and as a binary variable. The mean number of days each food item was reported to have been consumed are presented in Figure 5.4.4.2. As apparent, the average household reported eating rice on nearly a daily basis, with the other food items coming in at a distant second. Given the low number of non-rice items consumed, the binary variable that was created is quite modest, as far as good nutrition standards go. In particular, a household was coded as 1 if it reported consuming the following in the past seven days and 0 otherwise:

- orange vegetables OR fruit rich in vitamin A at least once
- dark vegetables more than once
- other vegetable/fruit at least 1 time
- a protein source at least 3 times

The results for the various household food security measures are presented in Table 5.4.4.1 and Table 5.4.4.2 below. For the measures constructed from the data obtained through the HFIAS module, there are no statistically significant differences between the various treatment groups. The case is different for the food diversity measures. Both the intervention households in general and the farmer group households in particular are actually worse off than the households in the comparison villages.

Figure 5.4.4.2: Number of times various food items consumed in previous week

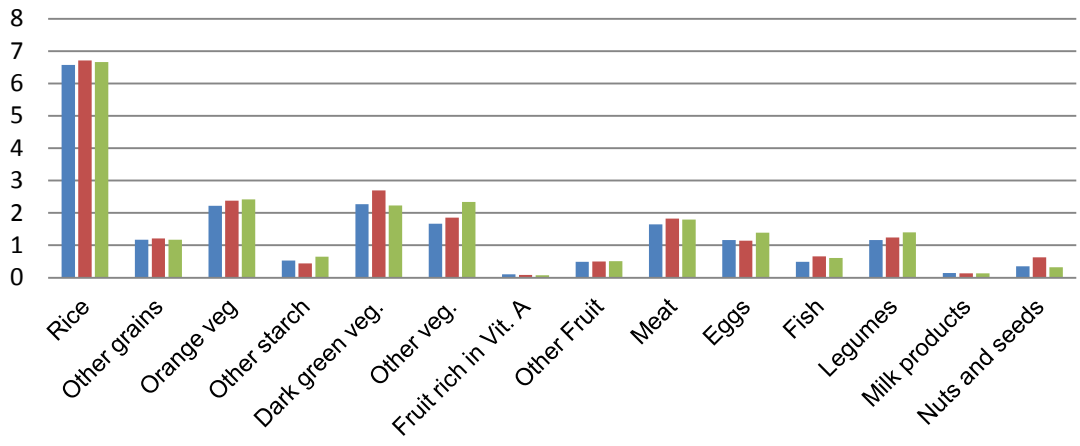


Table 5.4.4.1: Household food security – intervention HHs vs. comparison HHs

	Food Insecurity Raw Score	% HHs with moderate food insecurity or greater	% of HHs indicating severe food insecurity	HH raw food diversity score	HH food diversity score (binary)
Unadjusted					
Sample mean	2.37	0.53	0.19	20.81	0.43
Intervention village mean:	2.44	0.55	0.20	19.97	0.36
Comparison village mean:	2.30	0.51	0.18	21.69	0.51
Unadjusted difference :	0.139	0.0387	0.0198	-1.721**	-0.154***
	(0.74)	(0.87)	(0.57)	(-3.08)	(-3.54)
Observations:	**553**	**553**	**553**	**553**	**553**
PSM (ATT)					
Post-matching difference:	.225963	.058967	.0108045	-0.963	-0.0894
(kernel)	(1.71)	(1.95)	(0.44)	(-1.55)	(-1.94)
Observations:	**551**	**551**	**551**	**551**	**551**
Post-matching difference:	.068001	.0013201	-.0026401	-1.329*	-0.173***
(no replacement)	(0.35)	(0.03)	(-0.08)	(-2.32)	(-3.75)
Observations:	**508**	**508**	**508**	**508**	**508**
Multivariable Regression					
MVR coefficient :	0.139	0.0409935	0.0236388	-1.294*	-0.173479***
(robust standard errors)	(0.85)	(0.76)	(0.95)	(-2.14)	(-3.47)
Observations:	**553**	**540**	**544**	**553**	**553**
MVR coefficient:	0.110	n/a	n/a	-1.070*	n/a
(robust reg.)	(0.78)			(-2.14)	
Observations:	**553**			**553**	
MVR coefficient:	0.149	0.0399622	0.0267811	-1.275*	-0.1751972***
(with control functions)	(0.92)	(0.74)	(1.12)	(-2.11)	(-3.52)
Observations:	**553**	**540**	**544**	**553**	**553**

t statistics in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
PSM estimates bootstrapped 1000 repetitions
Coefficients for covariates used not presented
Sample weights used for intervention versus comparison village comparison
Probit regression used for binary outcome variables

Table 5.4.4.2: Household food security – farmer group HHs vs. comparison HHs

	Food Insecurity Raw Score	% HHs with moderate food insecurity or greater	% of HHs indicating severe food insecurity	HH raw food diversity score	HH food diversity score binary
Unadjusted					
Sample mean	2.27	0.52	0.19	21.63	0.48
Farmer group mean:	2.22	0.52	0.21	21.51	0.41
Comparison village mean:	2.30	0.51	0.18	21.69	0.51
Unadjusted difference :	-0.0775	0.0214	0.135	-0.183	-0.10
	(-0.35)	(0.16)	(0.91)	(-0.28)	(-1.90)
Observations:	**411**	**411**	**411**	**411**	**411**
PSM					
Post-matching difference:	0.153	0.0672	0.0578	-0.717	-0.115*
(kernel)	(0.61)	(1.18)	(1.29)	(-0.99)	(-2.05)
Observations:	**402**	**402**	**402**	**402**	**402**
Post-matching difference:	0.252	0.0763	0.0687	-0.427	-0.115
(no replacement)	(0.95)	(1.21)	(1.35)	(-0.54)	(-1.91)
Observations:	**402**	**402**	**402**	**402**	**402**
Multivariable Regression					
MVR coefficient :	0.0484	.0340115	.055676	-0.754	-.1527198*
(robust standard errors)	(0.25)	(0.55)	(1.79)	(-1.18)	(-2.54)
Observations:	**411**	**402**	**405**	**411**	**411**
MVR coefficient	-0.117	n/a	n/a	-0.677	n/a
(robust reg.)	(-0.73)			(-1.11)	
Observations:	**411**			**411**	
MVR coefficient :	0.0287	.022355	.0457178	-0.615	-.1418014*
(with control functions)	(0.15)	(0.36)	(1.49)	(-0.96)	(-2.29)
Observations:	**408**	**402**	**405**	**408**	**388**
LATE Analysis					
ivreg2 coefficient	0.238	0.0593	0.0256	-2.226*	-0.274***
(robust standard errors)	(0.80)	(0.83)	(0.43)	(-2.04)	(-3.42)
Observations:	**553**	**553**	**553**	**553**	**553**

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
PSM estimates bootstrapped 1000 repetitions
Coefficients for covariates used not presented
Probit regression used for binary outcome variables

5.4.5 Other outcome measures

Efforts were further made to compare the treatment groups in relation to several additional measures. These include: a composite household wealth index, perceived ability to meet household needs, and gender attitudes.

Household wealth status was measured by accessing data on asset ownership and other wealth indicators

For the household wealth index, data were collected on household asset possession and other relevant wealth indicators. The respondent was first asked whether their household had/owned each item. For non-binary items, a follow-up question was asked on the precise number possessed/owned. The respondent was then asked whether their household possessed/owned the item in the baseline period and then the precise number, if relevant. This was done to ascertain household wealth status at baseline. The number of non-binary items owned/possessed for each household was subsequently divided into three quantiles for each time period. Principal Component Analysis (PCA) was then run on these quantiled variables, as well as the binary items, to construct asset indices for each time period. In addition, each wealth indicator was differenced by time period, and PCA was run on the resulting difference. This created an index of changes in household poverty status over time.

Table 5.4.5.1: Inter-item correlations of HH Wealth Indicators used to construct Wealth Index for 2012

Item	Obs	Sign	item-test correlation	item-rest correlation	average inter item covariance	alpha
1. buffalo	553	+	0.399	0.3509	0.0495896	0.8951
2. goat	553	+	0.1431	0.0997	0.0513125	0.8977
3. ox or cow	553	+	0.1317	0.0948	0.0514109	0.8974
4. pig	553	+	0.4286	0.3792	0.049287	0.8948
5. horse	553	+	0.1013	0.0873	0.0516799	0.8969
6. poultry	553	+	0.4673	0.4224	0.0491508	0.8942
7. ox plow	553	+	0.337	0.2807	0.0498299	0.8963
8. gas or electric generator	553	+	0.1128	0.1071	0.0517518	0.8969
9. hydro generator	553	+	0.0779	0.0418	0.0516475	0.8978
10. plowing machine	553	+	0.3057	0.2601	0.0503412	0.8961
11. hoe	553	+	0.5118	0.4717	0.0490069	0.8935
12. hand rice thrasher	553	+	0.3265	0.2929	0.0505678	0.8956
13. sickle	553	+	0.5297	0.4901	0.048865	0.8933
14. mechanical rice thrasher	553	+	0.2561	0.2399	0.05134	0.8963
15. axe	553	+	0.2827	0.2341	0.0504216	0.8965
16. hand rice de-husker	553	+	0.2675	0.2293	0.0507442	0.8963
17. hand grinder	553	+	0.3591	0.3289	0.0505225	0.8954
18. mechanical rice de-husker	553	+	0.5451	0.5061	0.0487527	0.8931
19. mechanical grinder	553	+	0.5381	0.506	0.0492877	0.8934
20. hand sprayer	553	+	0.4993	0.4714	0.0498537	0.8941
21. shovel	553	+	0.4346	0.3895	0.0494204	0.8946
22. mechanical sprayer	553	+	0.1204	0.1064	0.0516482	0.8968
23. water pump	553	+	0.1101	0.1002	0.0517069	0.8969
24. hammer	553	+	0.4261	0.3916	0.0499664	0.8947
25. looming machine	553	+	0.0477	0.0147	0.0517678	0.8979
26. saw	553	+	0.4339	0.3955	0.0497268	0.8945
27. curved knife	553	+	0.6284	0.5921	0.048007	0.8918
28. black smith tools	553	+	0.3285	0.2976	0.0506449	0.8956
29. sewing machine	553	+	0.3578	0.3358	0.0508522	0.8956
30. chisel	553	+	0.4051	0.3582	0.0495882	0.895
31. TV	553	+	0.5538	0.5281	0.0496364	0.8936
32. sofa set	553	+	0.3557	0.3315	0.0507731	0.8955
33. satellite dish	553	+	0.5308	0.5052	0.0498077	0.8939
34. dinning set	553	+	0.5578	0.5152	0.0483707	0.8928
35. CD player	553	+	0.3459	0.2889	0.0497365	0.8963
36. fridge	553	+	0.2425	0.2261	0.0513677	0.8963
37. radio	553	+	0.3153	0.2772	0.0504894	0.8958
38. gas cooker	553	+	0.3185	0.2953	0.0509473	0.8958
39. mobile phone	553	+	0.647	0.6134	0.0480141	0.8916
40. electric cooker	553	+	0.1163	0.1035	0.0516678	0.8968
41. motor cycle	553	+	0.5642	0.5285	0.0487952	0.8929
42. rice cooker	553	+	0.4472	0.4031	0.0493645	0.8944
43. IPOD	553	+	0.0799	0.0658	0.0517155	0.897
44. fan	553	+	0.5636	0.5211	0.0483159	0.8927
45. wardrobe	553	+	0.5673	0.5297	0.0486252	0.8928
46. heater	553	-	0.0274	0.0192	0.0518062	0.897
47. store bought bed	553	+	0.4852	0.4395	0.0489387	0.8939
48. TV cabinet	553	+	0.57	0.5312	0.0485042	0.8927
49. mattress	553	+	0.5864	0.554	0.0488313	0.8927
50. gold jewelry	553	+	0.1703	0.1509	0.0514732	0.8966
51. silver jewelry	553	+	0.4514	0.4025	0.0491019	0.8945
52. thermos	553	+	0.466	0.4312	0.0496823	0.8942
53. cemented pig pen	553	+	0.3634	0.3082	0.0496417	0.8959
54. tea set	553	+	0.2739	0.2332	0.0506536	0.8963
55. livestock shelter	553	+	0.361	0.3295	0.0504647	0.8953
56. cupboard	553	+	0.3942	0.3446	0.0495742	0.8952
57. cooking fuel score	553	+	0.091	0.0793	0.0517151	0.8969
58. toilet type score	553	+	0.2596	0.2071	0.0504999	0.897
59. floor type score	553	+	0.4877	0.432	0.0484095	0.8942
60. wall type score	553	+	0.3685	0.3458	0.0507831	0.8955
61. roof type score	553	+	0.1069	0.0955	0.0516957	0.8969
62. electricity	553	+	0.17	0.145	0.0513899	0.8967
Test scale					**0.050153**	**0.8968**

Table 5.4.5.1 presents the list of assets and other wealth indicators used to construct the 2012 household wealth index. The table displays the inter-item correlations and Cronbach's alpha – a coefficient of reliability.[8] As apparent, with alpha at nearly 0.90, the various items used to construct the household wealth index are, overall, highly correlated. Alpha for the recalled baseline and differenced wealth indices are 0.9061 and 0.7459, respectively. The lower alpha for the differenced index can perhaps be expected, given that we would not suspect there to be significant change in many of the various wealth indicators over time.

The respondents were also directly asked to rate themselves in terms of their household's ability to meet its needs

The respondents were further asked about their ability to meet household needs. They were specifically presented with the following four descriptions and asked which reflected their own situation most closely over the past 12 months. These include the following:

- **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.

Households were subsequently coded with 1 if they reported themselves to be breaking even or doing well and 0 otherwise. The resulting binary variable is therefore a measure of the respondents' perceptions of their ability to at least meet household needs.

One of the secondary aims of the project was to bring about positive gender impacts, particularly in reducing women's subjection to violence. While it was deemed impractical to fully assess the effectiveness of the project in this respect, an attempt to measure gender attitudes was made. In particular, respondents were asked the extent to which they agreed (not at all, to a small extent, to a medium extent, or to a large extent) with the following statements:

1. It is important that sons have more education than daughters.
2. Women should leave politics to the men.
3. A woman's role is taking care of her home and family.
4. A man should have the final word about decisions in his home.
5. Men and women should share household chores.
6. A wife should obey her husband, even if she disagrees with him.
7. A wife should be able to choose her own friends even if her husband disapproves.

[8] When items are used in a scale or index, they should all measure the same underlying latent construct (e.g. household wealth status). The items, then, must be significantly correlated with one another. Cronbach's alpha is a measure of this inter-item correlation. The more the variables are correlated, the greater is the sum of the common variation they share. If all items are perfectly correlated, alpha would be 1 and 0 if they all were independent from one another. For comparing groups, an alpha of 0.7 or 0. 8 is considered satisfactory. See: Bland, M. J. & Altman, D. G. 1997. Statistics notes: Cronbach's alpha. *BMJ,* 314, 572.

8. A man's job is to earn money; a woman's job is to look after the home and family.
9. Women are as important as men in ensuring that the basic needs of families are met.
10. A husband has the right to hit his wife when she is disobedient.
11. 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 the child.
12. A man and women should share responsibility for both earning money and caring for the home and family.

Statement 10 was intentionally included to specifically measure attitudes about domestic violence. As can be observed, some of the statements are positive from a gender point of view, while others are negative. The more the respondent agreed with the positive statement, the higher the score (out of 4 possible points) the household was given and the converse the higher the level of agreement to negative statements.

Table 5.4.5.2 presents the inter-item correlations and Cronbach's alpha for all 12 statements. An overall alpha of 0.689 reveals a less than desirable level of inter-item correlation. Consequently, items with an item-test correlation lower than 0.5 were taken out. This resulted in an alpha of 0.7401. It appears that the statements with the lower item-test correlation are not measuring the same latent construct as are the other statements.

Table 5.4.5.2: Inter-item correlations of responses to the gender statements for 2012

Item	Obs	Sign	item-test correlation	item-rest correlation	average inter item covariance	alpha
Statement 1	553	+	0.5777	0.3926	0.118894	0.6589
Statement 2	553	+	0.5753	0.4272	0.122378	0.6527
Statement 3	553	+	0.552	0.3984	0.124496	0.6576
Statement 4	553	+	0.595	0.443	0.119543	0.6493
Statement 5	553	+	0.3363	0.2292	0.146338	0.6825
Statement 6	553	+	0.5051	0.3649	0.130702	0.664
Statement 7	553	-	0.2734	0.132	0.149764	0.6943
Statement 8	553	+	0.5901	0.455	0.122225	0.6492
Statement 9	553	+	0.3198	0.1828	0.14639	0.6881
Statement 10	553	+	0.5437	0.3811	0.124665	0.6604
Statement 11	553	+	0.4337	0.255	0.135662	0.682
Statement 12	553	+	0.2661	0.1549	0.150389	0.6896
Test scale					**0.13262**	**0.689**

Responses to the statements below were therefore used in the subsequent analysis. One can argue that the statements appear to be related to a specific gender construct – *attitudes towards women's subordinate position*. Principal factor analysis was then carried out on these items and the first factor was used to construct a factor score.

Only those statements found to be significantly internally consistent were used to measure gender attitudes

1. It is important that sons have more education than daughters.
2. Women should leave politics to the men.
3. A woman's role is taking care of her home and family.
4. A man should have the final word about decisions in his home.
5. A wife should obey her husband, even if she disagrees with him.
6. A man's job is to earn money; a woman's job is to look after the home and family.
7. A husband has the right to hit his wife when she is disobedient.

Figure 5.4.5.1 presents a scree plot of the eigen values that were derived for each component factor. It reveals that most of the variation in the data is explained by the first component, justifying only using it for the analysis that was undertaken.

No evidence project impact was found on any of the remaining measures analysed

FIGURE 5.4.5.1:

Scee Plot of Eigen Values for Factor Analysis on Attitudes to Roles of Women

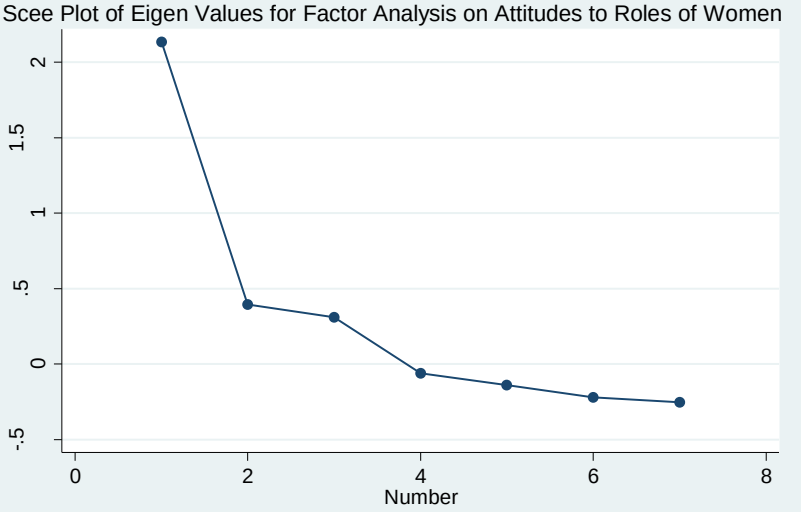


Table 5.4.5.1: HH wealth and gender – intervention HHs vs. comparison HHs

	Wealth Index 2012	Wealth Index differenced from baseline	Reported ability to meet HH needs	Gender attitude raw score	Gender attitude factor score	Attitudes towards hitting wife
Unadjusted						
Sample mean	-0.12	-0.05	0.68	16.95	0.02	3.07
Intervention village mean:	-0.32	-0.14	0.66	17.01	0.03	3.05
Comparison village mean:	0.09	0.05	0.70	16.88	0.00	3.09
Unadjusted difference :	-0.414	-0.195	-0.0461	0.133	0.0273	-0.0451
	(-1.57)	(-1.06)	(-1.11)	(0.33)	(0.35)	(-0.49)
Observations:	**553**	**553**	**552**	**553**	**553**	**553**
PSM						
Post-matching difference:	-.171674	-.097529	-.0474887	.54627	.1052028	-.01591
(kernel)	(-1.81)	(-0.83)	(-1.65)	(2.00)	(1.99)	(-0.25)
Observations:	**551**	**551**	**550**	**551**	**551**	**551**
Post-matching difference:	-.2880692	-.25791	-.0721988	.18728	.0332994	.019447
(no replacement)	(-1.57)	(-2.21)	(-1.68)	(0.46)	(0.42)	(0.20)
Observations:	**508**	**508**	**507**	**508**	**508**	**508**
Multivariable Regression						
MVR coefficient :	-0.140	-0.192	-0.0290	0.0256	-0.00608	-0.00786
(robust standard errors)	(-1.09)	(-1.04)	(-0.75)	(0.07)	(-0.08)	(-0.10)
Observations:	**553**	**553**	**552**	**553**	**553**	**553**
MVR coefficient	0.00205	-0.0106	n/a	0.0815	0.0121	0.0111
(robust reg.)	(0.02)	(-0.06)		(0.22)	(0.17)	(0.14)
Observations:	**553**	**553**		**553**	**553**	**553**
MVR coefficient :	-0.130	-0.180	-0.0281	0.00460	-0.00974	-0.00999
(with control functions)	(-1.01)	(-0.97)	(-0.73)	(0.01)	(-0.13)	(-0.12)
Observations:	**553**	**553**	**552**	**553**	**553**	**553**

t statistics in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
PSM estimates bootstrapped 1000 repetitions
Coefficients for covariates used not presented
Sample weights used for intervention versus comparison village comparison

Table 5.4.5.1 and Table 5.4.5.2 present the results of a comparison of the treatment groups in relation to the wealth indices and the ability to meet household needs and gender attitude measures. Unfortunately, again, there is no positive difference in favour of either the households in the intervention villages in general or the households belonging to the farmers' groups in particular on all the various measures used.

Table 5.4.5.2: HH wealth and gender – farmer group HHs vs. comparison HHs

	Wealth Index 2012	Wealth Index differenced from baseline	Reported ability to meet HH needs	Gender attitude raw score	Gender attitude factor score	Attitudes towards hitting wife
Unadjusted						
Sample mean	0.21	0.09	0.70	16.74	-0.02	3.10
Farmer group mean:	0.44	0.15	0.69	16.48	-0.07	3.11
Comparison village mean:	0.09	0.05	0.70	16.88	0.00	3.09
Unadjusted difference :	0.342	0.0985	-0.0119	-0.400	-0.0738	0.0220
	(1.02)	(0.48)	(-0.25)	(-0.90)	(-0.85)	(0.20)
Observations:	**411**	**411**	**411**	**411**	**411**	**411**
PSM (ATT)						
Post-matching difference:	-0.0175	0.148	-0.0432	0.0994	0.0290	0.110
(kernel)	(-0.05)	(0.67)	(-0.84)	(0.21)	(0.32)	(0.89)
Observations:	**402**	**402**	**402**	**402**	**402**	**402**
Post-matching difference:	-0.0517	0.155	-0.0534	0.145	0.0402	0.115
(no replacement)	(-0.13)	(0.62)	(-0.94)	(0.26)	(0.37)	(0.84)
Observations:	**402**	**402**	**402**	**402**	**402**	**402**
Multivariable Regression						
MVR coefficient:	0.0578	-0.00560	-0.104	-0.347	-0.0635	-0.00808
(robust standard errors)	(0.35)	(-0.03)	(-0.61)	(-0.85)	(-0.80)	(-0.09)
Observations:	**411**	**411**	**405**	**411**	**411**	**411**
MVR coefficient:	0.157	0.162	n/a	-0.0459	0.00871	0.00314
(robust regression)	(1.01)	(0.76)		(-0.10)	(0.10)	(0.03)
Observations:	**411**	**411**		**411**	**411**	**411**
MVR coefficient:	0.164	0.116	-0.0611	-0.421	-0.0765	-0.0176
(with control functions)	(1.04)	(0.55)	(-0.35)	(-1.01)	(-0.95)	(-0.18)
Observations:	**408**	**408**	**405**	**408**	**408**	**408**
LATE Analysis						
ivreg2 coefficient	-0.149	-0.250	-0.0620	-0.166	-0.0444	-0.0190
(robust standard errors)	(-0.59)	(-0.72)	(-0.87)	(-0.24)	(-0.33)	(-0.13)
Observations:	**553**	**553**	**552**	**553**	**553**	**553**

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
PSM estimates bootstrapped 1000 repetitions
Coefficients for covariates used not presented

6 Conclusions and Learning Considerations

6.1 Conclusions

The Sustainable Livelihood Development and Ethnic Minority Diversity in Lao Cai Province aimed to improve household food security and income primarily through supporting farming households to increase agricultural production and, to a lesser extent, income earned through the sale of agricultural produce. There is some evidence that the project succeeded in encouraging a small proportion of households of the project's farmer groups to adopt a number of preferred agricultural practices, e.g. improve methods for rice seeding preparation and planting of both rice seedlings and maize seeds. The households of the farming groups were also more likely to report having better access to farming extension services and, to a lesser extent, disaster preparedness information.

The most plausible explanation why there is no evidence that the project improved household food security or income is because it did not do anything unique to bolster agricultural production and/or profits

However, there is no evidence that this translated to into improvements in agricultural production and/or profits. One possible explanation why this is the case is that the differences in practice adoption between the farmer group households on the one hand and the non-farmer group and comparison households on other are not *practically significant*. For example, 80 per cent of farmer group households reported practicing the improved rice seedling planting techniques compared with 73 per cent and 69 per cent in the non-farmer group and comparison households, respectively. The differences, while statistically significant, are not great.

The small difference in agricultural practice adoption may be related to the fact that there are no considerable differences in reported exposure to the project's key interventions either. For example, 66 per cent of farmer group households reported being exposed to agricultural training versus 49 per cent and 51 percent in the non-farmer and comparison households, respectively. In other words, there is no clear evidence that the project offered anything significantly unique to the communities it targeted. It may have simply worked to aid in the promotion of preferred agricultural practices that were being promoted to all the villages in Sapa district.

Given that there is no evidence that the project was successful in bolstering agricultural production and/or profits, it is of no surprise that there is also no evidence that it improved household food security or income. On all the various household food security and income measures used, there is no positive difference between the households in the intervention and comparison villages in general and the farmer group households and comparison households in particular. In fact, while all households in both the comparison and intervention villages were found to have diets low in diversity, the households of both the intervention villages and farmer groups were actually found to be worse off than the comparison households.

A secondary objective of the project was to reduce the prevalence of violence against women. Comprehensively assessing its effectiveness in this regard was beyond the scope of the effectiveness review. However, data were collected on both gender attitudes in general and attitudes about intra-marital violence in particular. However, again, no significant differences were identified between the treatment groups.

6.1 Programme learning considerations

While the findings of this effectiveness review are not positive, they do provide the basis for learning and critical reflection. Oxfam in general and the Vietnam country team and partners in particular are encouraged to consider the following:

- *Present the findings of this review to relevant Oxfam staff/interns, district partners, and the farmer groups to further explore possible reasons why there is no evidence of project impact.*

The quantitative methods used for the effectiveness review are good for assessing *whether* the project was successful in bringing about positive changes to the targeted households. However, there are limitations on how much they can reveal about how and why the desired changes did or did not happen. There are, nevertheless, some basic quantitative facts: While there is some evidence that the project was successful in encouraging the adoption of *some* preferred agricultural practices, it did not successfully bolster agricultural production and/profits. And this is the most likely reason why it failed to bring about improvements in household food security and income.

Should the focus be to support government service delivery or to develop innovations to enhance service delivery?

It would be useful, however, to explore more deeply why the project was unsuccessful in increasing agricultural production and/or profits. Was it because insufficient numbers of farmer group members, for example, adopted the promoted practices, such as those related to rice seedling preparation? Or: Was it simply because the project did not do anything uniquely different than what was simultaneously being promoted in other villages in Sapa district?

- *Check to ensure that programmes and projects are designed to do more than simply support the roll-out of government plans and/or policy.*

Upon review, it may be concluded that the effectiveness review found no evidence of impact because the project was, in effect, supporting the district government partner to implement its own plans. With the project's targeted villages covered, more of the district partners' time and resources may have been freed up to promote similar interventions in the district's other villages. Given that the project offered nothing uniquely different to the intervention villages in general and the farmer groups in particular, no evidence of impact was identified through the effectiveness review.

As described in Section 3, impact is defined as what people gained from a programme or project that they would not have otherwise gained if the programme or project never existed. One must wonder, then, what would have happened if the Sustainable Livelihood Development and Ethnic Minority Diversity in Lao Cai Province never existed. Would the farmer group households been significantly worse off? The available evidence suggests that they would not have been. And, if the intention of the project was to simply support the government in implementing its own plans, one must ask whether the district partner would have found a way to carry out these plans without Oxfam's support.

If Oxfam Vietnam desires to go beyond supporting the roll-out of government plans and/or policy, it is likely that more effort is needed in the project design

phase. What, for example, is the nature of the problem the project seeks to address and what will it offer that will both effectively and uniquely do to address this problem, which can potentially be brought to scale by government in the future?

- *Ensure that dietary diversification considerations are substantively mainstreamed in future food security projects in Sapa district and possibly elsewhere.*

As presented in Section 5.4.4, the diets of the households in both the intervention and comparison villages are poor in terms of diversity. The project was attempting to address this in several ways, such as through the promotion of backyard gardening. However, there is no evidence that these attempts have been effective. Identifying effective interventions to change people's dietary behaviour is challenging. Nevertheless, it is recommended that both primary and secondary research be carried out for the purposes of developing, implementing, and testing interventions to address this pertinent issue.

- *Explore possibilities for adopting a more comprehensive value chain approach to bolster both household income and food security.*

As presented in Section 5, only 10 per cent of the respondents from the farmer groups reported receipt of marketing advice since the baseline period. In addition, they scored an average of just 1.33 points out of 4 possible points on the market information service access measure. It is, therefore, clear that the marketing component of this project was minor and/or not substantively implemented. It may be possible to achieve greater impact on both household income and food security through the adoption of a more comprehensive value chain approach. This could be informed by an agri-business feasibility study that examines both the comparative production advantage of the supported famers and market demand for the identified crops.

Appendix 1 : Covariate balance following propensity score matching procedures

A. All HHs in intervention villages versus HHs in comparison villages (for ITT estimate)

Step 1: Backwards stepwise regression: covariate ( ) excluded from participation model if .

```
. stepwise, pr (.2): logit treat_village $covariates
note: crop_process_07 dropped because of collinearity
                      begin with full model
p = 0.9845 >= 0.2000  removing num_prod_adult
p = 0.8560 >= 0.2000  removing head_farmer_bl
p = 0.7526 >= 0.2000  removing edu_head_primary
p = 0.6479 >= 0.2000  removing unskilled_work_07
p = 0.5413 >= 0.2000  removing hh_size
p = 0.4974 >= 0.2000  removing livestock_prod_07
p = 0.5039 >= 0.2000  removing num_adults_primary
p = 0.4762 >= 0.2000  removing farming_07
p = 0.4077 >= 0.2000  removing cas_lab_07
p = 0.3468 >= 0.2000  removing elder_head
p = 0.3526 >= 0.2000  removing elder_hh
p = 0.3425 >= 0.2000  removing iga_07
p = 0.3509 >= 0.2000  removing livestock_07
p = 0.2837 >= 0.2000  removing skilled_work_07
p = 0.2383 >= 0.2000  removing km_dist_road
p = 0.2320 >= 0.2000  removing head_indi_belief
p = 0.2116 >= 0.2000  removing male_head

Logistic regression                               Number of obs   =        553
                                                  LR chi2(9)      =      53.07
                                                  Prob > chi2     =     0.0000
Log likelihood = -356.66794                       Pseudo R2       =     0.0692

------------------------------------------------------------------------------
     treat_village |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------------+----------------------------------------------------------------
min_centre_village |   .0157312   .0082555     1.91   0.057    -.0004493    .0319117
min_commune_centre |  -.0142365   .0038439    -3.70   0.000    -.0217704   -.0067027
       min_sapa_mb |  -.0224016   .0057705    -3.88   0.000    -.0337116   -.0110916
         head_Mong |  -.9147295   .2845993    -3.21   0.001    -1.472534   -.3569252
          res_head |   .5257104   .1978344     2.66   0.008     .1379622    .9134586
    head_christian |   .4581924    .274094     1.67   0.095     -.079022    .9954068
     head_literate |  -.4359843   .1885415    -2.31   0.021    -.8055188   -.0664497
     wealth_ind_07 |  -.0518696   .0365713    -1.42   0.156     -.123548    .0198089
         num_adult |   .1198525   .0677858     1.77   0.077    -.0130053    .2527103
             _cons |   1.151413    .493878     2.33   0.020     .1834299    2.119396
------------------------------------------------------------------------------
```

Step 2: Run psmatch2 with short-listed covariates, followed by pstest to assess covariate balance.

pstest output – kernel (2 treatment observations dropped with default bandwidth):

```
. pstest $covariates
```

Variable	Mean Treated	Mean Control	%bias	t-test t	t-test p>|t|
min_centre~e	15.261	15.19	0.6	0.07	0.945
min_commun~e	33.568	34.215	-2.6	-0.33	0.745
min_sapa_mb	35.964	36.922	-4.3	-0.56	0.573
head_Mong	.63929	.62375	3.2	0.38	0.704
res_head	.73214	.72349	1.9	0.23	0.818
head_chris~n	.16071	.16357	-0.8	-0.09	0.927
head_liter~e	.36786	.35893	1.8	0.22	0.827
wealth_in~07	-.08708	-.02516	-1.9	-0.24	0.814
num_adult	3.3286	3.3708	-2.7	-0.31	0.757

pstest output – no replacement (45 treatment observations dropped & calliper of 0.35 used):

```
. pstest $covariates
```

Variable	Mean Treated	Mean Control	%bias	t-test t	t-test p>|t|
min_centre~e	13.992	14.339	-3.0	-0.33	0.740
min_commun~e	35.3	38.046	-10.8	-1.22	0.222
min_sapa_mb	38.371	38.734	-1.6	-0.19	0.848
head_Mong	.63291	.66245	-6.1	-0.67	0.502
res_head	.6962	.67089	5.5	0.59	0.554
head_chris~n	.1308	.12236	2.5	0.28	0.783
head_liter~e	.39662	.41772	-4.3	-0.47	0.641
wealth_in~07	.03876	.01329	0.8	0.09	0.932
num_adult	3.2489	3.173	4.9	0.55	0.583

B. Farmer group HHs versus HHs in comparison villages (for ATT estimate)

Step 1: Backwards stepwise regression: covariate ( ) excluded from participation model if

.

```
. stepwise, pr (.2): logit inter_village2 $covariates
note: crop_process_07 dropped because of collinearity
note: iga_07 dropped because of estimability
note: o.iga_07 dropped because of estimability
note: 3 obs. dropped because of estimability
                     begin with full model
p = 0.8299 >= 0.2000  removing km_dist_road
p = 0.7849 >= 0.2000  removing cas_lab_07
p = 0.7562 >= 0.2000  removing edu_head_primary
p = 0.5078 >= 0.2000  removing unskilled_work_07
p = 0.4394 >= 0.2000  removing elder_hh
p = 0.4261 >= 0.2000  removing skilled_work_07
p = 0.4705 >= 0.2000  removing wealth_ind_07
p = 0.3963 >= 0.2000  removing elder_head
p = 0.3066 >= 0.2000  removing male_head
p = 0.3334 >= 0.2000  removing head_literate
p = 0.2847 >= 0.2000  removing livestock_07
p = 0.2779 >= 0.2000  removing head_indi_belief

Logistic regression                               Number of obs   =        408
                                                  LR chi2(12)     =      42.48
                                                  Prob > chi2     =     0.0000
Log likelihood = -241.14442                       Pseudo R2       =     0.0809
```

inter_village2	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
min_centre_village	.0144091	.0098528	1.46	0.144	-.004902	.0337202
min_commune_centre	-.013909	.0048883	-2.85	0.004	-.0234899	-.004328
min_sapa_mb	-.0241477	.0072878	-3.31	0.001	-.0384316	-.0098637
num_prod_adult	.3275341	.1522954	2.15	0.032	.0290407	.6260276
res_head	.5130465	.2439392	2.10	0.035	.0349345	.9911586
head_Mong	-.897738	.3556262	-2.52	0.012	-1.594753	-.2007234
head_farmer_bl	1.190353	.8632919	1.38	0.168	-.5016677	2.882374
livestock_prod_07	.9048116	.4586581	1.97	0.049	.0058582	1.803765
hh_size	-.1168742	.0871519	-1.34	0.180	-.2876888	.0539404
head_christian	.7341738	.3362592	2.18	0.029	.0751179	1.39323
num_adults_primary	-.1987686	.1319872	-1.51	0.132	-.4574588	.0599216
farming_07	-1.87036	1.358326	-1.38	0.169	-4.532631	.7919108
_cons	1.184447	1.389807	0.85	0.394	-1.539524	3.908418

Step 2: Run psmatch2 with short-listed covariates, followed by pstest to assess covariate balance.

pstest output – kernel (9 treatment observations dropped with default bandwidth):

```
. pstest $covariates
```

Variable	Mean Treated	Mean Control	%bias	t-test t	t-test p>|t|
min_centre~e	15.115	15.283	-1.4	-0.11	0.912
min_commun~e	35.053	35.29	-0.9	-0.08	0.938
min_sapa_mb	37.473	39.171	-7.4	-0.64	0.525
num_prod_a~t	3.3511	3.3628	-0.8	-0.06	0.952
res_head	.70229	.72261	-4.4	-0.36	0.718
head_Mong	.61069	.58169	5.9	0.48	0.634
head_farme~l	.98473	.9802	2.7	0.28	0.781
livesto~d_07	.0687	.0673	0.5	0.04	0.964
hh_size	6.1069	6.1019	0.2	0.02	0.985
head_chris~n	.16031	.1565	1.1	0.08	0.933
num_adults~y	1.0763	1.06	1.4	0.11	0.916
farming_07	.99237	.99385	-1.6	-0.15	0.885

pstest output – no replacement (9 treatment observations dropped with default calliper):

```
. pstest $covariates
```

Variable	Mean Treated	Mean Control	%bias	t-test t	t-test p>|t|
min_centre~e	15.115	16.033	-7.9	-0.57	0.569
min_commun~e	35.053	37.725	-10.4	-0.86	0.390
min_sapa_mb	37.473	38.87	-6.1	-0.54	0.593
num_prod_a~t	3.3511	3.3817	-2.0	-0.16	0.876
res_head	.70229	.71756	-3.3	-0.27	0.786
head_Mong	.61069	.57252	7.8	0.63	0.532
head_farme~l	.98473	.96947	9.1	0.82	0.411
livesto~d_07	.0687	.06107	2.8	0.25	0.803
hh_size	6.1069	6.1298	-1.1	-0.09	0.931
head_chris~n	.16031	.16031	0.0	-0.00	1.000
num_adults~y	1.0763	1.0229	4.5	0.34	0.733
farming_07	.99237	.99237	0.0	0.00	1.000