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LIVELIHOODS IN SOUTH SUDAN

Impact evaluation of the 'South Sudan Peace and Prosperity Promotion' project

Effectiveness Review Series 2016/17

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EXECUTIVE SUMMARY

Oxfam GB's Global Performance Framework is part of the organization's effort to better understand and communicate its effectiveness, as well as enhance learning across the organization. Under this Framework, a small number of completed or mature projects are selected at random each year for an evaluation of their impact, known as an 'Effectiveness Review'. One key focus is on the extent to which the projects have promoted change in relation to relevant OGB global outcome indicators.

The global outcome indicator for the livelihoods thematic area is defined as 'total household consumption per adult equivalent per day'. This indicator is explained in more detail in Section 5 of this report.

The project 'South Sudan Peace and Prosperity Promotion Programme (SD04)' was one of those selected for an Effectiveness Review in the 2016/17 financial year.

The project activities were implemented by Oxfam GB in conjunction with the National Relief Development Corps (NRDC) for overall implementation and with the Department of Agriculture of South Sudan for specific activities (trainings in agronomical practices). The project started in October 2012 and was completed in April 2016. The project's overall objective was to improve the food security and income of vulnerable men and women, build conflict transformation capacities and build government and community capacities, to promote safety. It is important to note that the project was first implemented in Upper Nile State, but when the war broke out in December 2013, it was transferred to Rumbek Centre County in Lake State. This report will focus on the impact of the livelihood component of the project in Rumbek Centre County implemented between June 2014 and December 2015.

The project took place in four payams,[1] which were selected based on the difficulties experienced by farmers: low rainfall, poor access to markets, low capacity in crop production, and a lack of agricultural inputs. The livelihood component of the project targeted six crops for household consumption and for sale to wholesalers and local traders in the local community: groundnuts, sorghum, kudru, okra, cucumbers and onions. Other crops were grown in the project area but were not directly supported by the project. These included maize and palm. The farmers were provided with the necessary inputs and technical advice on improved methods of farming. Demonstration plots for women vegetable producers were developed, and vegetable producers were encouraged to form groups. Exchange visits were also organized. Village savings and loans associations (VSLAs) were created, trainings to support household businesses were held, and cash grants for household businesses were given.
The livelihood component of the project was intended to benefit 1,200 households (that is, approximately 9,000 individuals), through increased agricultural productivity, increased value-addition and increased sales and revenues. Overall, the livelihood component of the project aimed to develop sustainable livelihood opportunities and increase household income.

EVALUATION APPROACH

The review adopted a quasi-experimental impact evaluation design, which involved comparing households that had been supported by the project with households that had not been supported by the project, but had similar livelihood characteristics in 2013, before the project was implemented.

The Effectiveness Review was carried out in five payams in the Rumbek Centre County. A subsample of households that had participated in the livelihood component

of the project was randomly selected to be interviewed. For comparison purposes, interviews were carried out with farmer households from villages that were not involved in the project: comparison villages, all in the same part of one payam, were deemed to have had similar characteristics to the implementation villages in 2013.[2] Non-participant households were randomly selected and interviews were conducted.

In total, 308 project participants and 385 non-participants were interviewed. At the analysis stage, the statistical tools of propensity-score matching and multivariate regression were used to control for demographic and socio-economic differences between the project participants and non-participants, to increase confidence when making estimates of the project's impact. As the project targeted households that were already involved in growing the main crops, the project focused on groundnut, sorghum and vegetables for its agricultural and livelihood component. We took into account which crops households declared growing in 2013 in the analysis, among other characteristics. It is possible that some unobservable characteristics also influenced the decision to participate in the project (such as interest by participants), which we cannot account for.

RESULTS

The main component of the project under review focused on improving agricultural inputs for project participants. The data indeed suggest that more households received seeds (groundnuts, sorghum and vegetables) thanks to the project, and that they received trainings on planting groundnuts and sorghum, and on the use of fertilizer.

In the year preceding the survey (October 2015 to September 2016), usage of plough and power tillers was higher in the intervention group than in the comparison group. For the main crops in the area (sorghum, maize, groundnut, sesame),[3] land preparation took place in early 2016, after the end of the project, which would suggest a continued increased usage of distributed tools. Similarly, in the year preceding the survey, significantly more households used improved seeds or seedlings in the intervention group than in the comparison group (34 percent of households against 26 percent). However, this is a smaller proportion of households than that of households having received seeds since the project started; indeed the use of improved seeds may not be carried over from one season to the next. The project also apparently encouraged participants to adopt organic farming techniques: more households than in the comparison group produced organic fertilizer and farmed organically. This seems to have resulted in an increase in the share of households growing the targeted crops (groundnuts, sorghum, okra, kudru, cucumbers and onions), and diversification in this set of crops in the year prior to the survey. This also seems to have resulted in a change in crops that were not targeted by the project and measured in the survey: palm, which very few households grow, and maize. Some 50 percent grew maize in 2013, and 56 percent of project participants in 2016. The project also led to an increase in the volume of production for all the targeted crops, except for okra and onions. The volume of production of maize was not significantly affected by the project. Even though an increase in volume is observed for palm producers, farmers who were already engaged in palm production, or who have started between 2013 and 2016, are very few, are more likely to be among the richest households and more likely to be engaged in growing almost all of the eight crops measured in the survey. The effect on palm production may hence be very specific to those palm producers.

The project put emphasis on value-addition by crop processing. It seems that the project succeeded in changing behaviours of sorghum and okra producers (relatively more likely to process than similar comparison producers). Similarly, among producers of groundnuts, sorghum, cucumbers, kudru or okra, project participants were more likely to sell some than non-participants. Crops are mainly sold to local traders and

intermediaries, or at local markets, among both project participants and non-participants.

The project also supported non-agricultural activities through training on business plans. More households were trained on business plans in the past three years than in the comparison group (although only 17 percent of households) but less intensively (those who were trained received fewer training sessions than in the comparison group). Thirty percent of project participants received VSLA kits, which represents a seven percentage-point increase compared to the comparison group. The share of households that received cash grants or credit at a lower rate is not different between the two groups.

This support of the project towards non-agricultural activities was aimed at improving revenue diversification. We indeed observe a larger share of households receiving monetary income in the 12 months preceding the survey from farming, livestock or activities carried out off the farm. In 2016, South Sudan experienced hyperinflation,[4] a setting in which it is likely that in-kind transactions may be higher than cash ones. This Effectiveness Review focused on measuring monetary income. If the increased share of households receiving monetary income among project participants is balanced out by a decrease share of households doing in-kind transactions, compared to the group of non-participant households, the survey would not capture such a mechanism. However, measurement of income through consumption and measurement of asset-based wealth will confirm the results on the increase in the share of households receiving income from different sources.

We indeed observed higher food consumption, and total consumption (driven by food consumption, no difference in non-food consumption) among project participants, which suggests that the project was successful in improving the livelihood of the project participants. Measurement on the one hand of asset-based wealth highlights that the project participants were better off than non-participants in September 2016, but also on the other hand that assets and living conditions of the non-participants had particularly deteriorated between 2013 and 2016.

Finally, it is worth emphasizing that livestock ownership overall decreased in the surveyed population, which suggests an overall deterioration of livelihood condition. The project contributed to increasing ownership in poultry, sheep and goats at the time of the survey, but also an increased share of households had received income from selling livestock in the last 12 months. This suggests that in the short run, the project may have helped households facing shocks through livestock sales to maintain their consumption or make investments.

Livelihood components of this project were implemented in order to build peace: the project focused on bridging the gap between community institutions and farmers, and enhancing participation of women and youth in community groups. No significant effect is observed on awareness of respondents of communal plans (only 41 percent of project participants are aware of the existence of such plans). A larger share of project participants knows who the community leaders are, compared to non-participants (52 percent as against 39 percent).

Overall, the project increased women's participation in groups by 15 percentage points, and particularly in women's associations. It is worth underlining that participation of women is low in farmers' groups (29 percent among women respondents in the intervention group), and that this was not affected by the project. It is significant to note that the project did not have any impact on the quality of participation: overall, only 26 percent of respondents in the intervention group have a say in a group's decisions, and this is not different between project participants and non-participants. In addition, a smaller share of women in households who participated in the project is confident in

participating in meetings than in the comparison group (77 percent against 84 percent, significant at 10 percent only).

The project did not have an impact on women respondents having a say in the household's decisions (a quarter of respondents are involved in household decision-making) and they are less likely to take decision by themselves or influence others' decisions in the intervention group than in the comparison group. Women respondents' say in making decisions about their own movement is still quite low (39 percent on average in the intervention group). Finally, more respondents in project participant households declared that the share of their contribution to the household's resources has increased since 2013, compared to non-project participants.

One caveat of the measurements presented in this Effectiveness Review arose from the fact that the survey focused on eight crops, identified as the crops targeted by the projects (groundnuts, sorghum, kudru, okra, cucumbers, onions) and the main crops grown by project and comparison households in addition to the targeted ones (palm and maize). Based on FEWS NET 2013 report and the International Organization for Migration (IOM) 2013 report, other main crops in the county include millet, sesame, cow peas and pumpkins. Anecdotally, from other parts of the survey, 16 percent of households ate home-produced tomatoes in the last seven days (tomatoes are identified by African Development Bank (ADB) 2013 report as high-value crop for both domestic and external markets). Hence it is likely that other crops were grown by both project participants and non-participants, sesame being the most widely grown in the area. If the project enabled farmers to improve their production, processing and sales of the targeted crops at the expense of other crops, such as sesame, we do not have direct information on this in the dataset. However, other data available suggest that there was a substitution effect on processing behaviours, but that the overall effect on income is positive. Indeed on the one hand, the share of households using equipment and processing machines was slightly reduced by the project; on the other hand, even though processing of some of the targeted crops increased for project participants, the share of households earning revenue from processing stayed the same between the two groups. That suggests that project participants switched from processing some crops they grew towards processing more of the targeted crops, and that the overall effect on bringing more households towards crop processing is close to being nil. Processing is an activity traditionally undertaken by women; this substitution could hence be an effect of their not being able to extend their workload, given other farming and household commitments. It could also be that households who are processing are processing a larger share of their production.

Finally, more project participant households declared receiving monetary income from farming (of any crop), and income measured through household overall consumption and asset-based wealth was higher among the project participants than non-participants.

Key results of this Effectiveness Review

Outcome	Evidence of positive impact	Comments
Adoption of agricultural technology	Yes	The project led to increased usage of improved seeds, ploughs or power tillers, production and usage of organic materials.
Crop diversity	Cannot conclude	The project led to an increased number of crops grown among the eight crops that the survey focuses on. However, it is likely that some widely grown crops, mainly sesame, were missed in the survey. We cannot conclude whether the project's focus on a few crops led to abandoning the growing of other crops. Results on maize and palm do not suggest abandonment.
Increased produced quantity of groundnuts, sorghum, cucumbers, kudru, okra and onions	Yes (4 crops out of 6)	The project increased production of groundnuts, sorghum, cucumber and kudru for the producers of those crops. The project also increased the share of households producing each of those crops, and the other targeted crops.
Increased access to markets	Yes	A larger share of producers of groundnuts, sorghum, kudru, okra and cucumbers sold some of their harvest in the last 12 months, but among those who sold some crops, they were as likely to sell to the market centre as non-participant farmers.
Revenue diversification	Yes	The average number of sources of monetary income is higher among project participants than non-participants.
Overall household income (Global Indicator)	Yes	An effect on food consumption is observed. No effect on non-food expenditures could be detected (more likely to have been affected by difficulties of recalling information in a context of hyperinflation).
Asset-based wealth index	Yes	A positive effect of the project was observed (and a deterioration of assets in the comparison group).
Women's participation in groups	No	We observed an increase in women's participation in groups in the intervention group (through participation in women's groups). Participation of women in farmers' groups, cooperatives, credit or micro-finance groups and disaster management groups is still low (respectively 29%, 27%, 18% and 11%) and was not affected by the project. Participation in group decision-making was not different between project participants and non-participants (and was low: only 26% of respondents are involved in group decisions in the intervention group).

PROGRAMME LEARNING CONSIDERATIONS

Explore the possibilities of fostering collective marketing to improve access to market

In this project, vegetable producers were asked to form groups in order to facilitate adoption of improved agricultural practices of production and processing, but no emphasis was put on marketing. For non-vegetable producers, no emphasis was put on involvement in or formation of farmers' groups.

More project participants produced and sold the targeted crops than non-participant households. These were sold mainly to traders or in market centres; project participants and non-participants were as likely to sell these crops to traders or market centres. Joining forces in marketing may bring more farmers to accessing markets and help farmers getting a better price, and reducing costs of, and time devoted to, selling produces.

Encourage plan development to be more inclusive and improve communication of the plans to village members

Fifty-nine percent of project participants are not aware of the existence of community plans, and this is not statistically different between project participants and non-participants. While the programme supported plans' development at the payam level, this suggests that plan development could be more inclusive, and that plans could be better communicated to foster awareness and ultimately the active participation of citizens.

Support women's empowerment through leadership in mixed groups and sensitization of men

The focus of the project on vegetable production (four of the six targeted crops), and on processing – activities undertaken traditionally by women – led to a large involvement of women in the project. The vegetable producer groups created by the project were mainly women's groups; VSLAs were initially mixed groups, with a majority of women participants. However, based on discussions with the project team, most men in these groups drop out, most likely because they were not interested in the VSLAs. The fact that other groups were already open to them may have been a factor in this decision too. This is reflected in the data through more women respondents in project participant households regularly attending meetings of a group, and particularly of a women's association, than non-participants. However, this did not translate into more involvement in decision-making within those groups, nor in overall confidence in participating in meetings. In fact, an overall decrease in confidence in meetings is observed. Future projects should consider actively promoting women's leadership in decision-making in groups and accompanying women to build confidence in taking part in mixed assemblies and in speaking-up and making their voices heard. Men will need to be involved in this process, to listen to and discuss issues brought up by women.

1 INTRODUCTION

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 to enhance learning across the organization. This Framework requires project and programme teams to annually report output data across six thematic indicator areas. In addition, every year, for each thematic indicator area a modest sample of mature[5] projects are randomly selected to be evaluated through rigorous Effectiveness Reviews. One key focus is on the extent to which the projects have promoted change in relation to relevant OGB global outcome indicators.

The global outcome indicator for the livelihoods thematic area is defined as total household consumption per adult equivalent per day. This indicator is explained in more detail in Section 5 of this report.

This Effectiveness Review, which took place in September 2016, was intended to assess the impact of the South Sudan Peace and Prosperity Promotion Programme in Rumbek Centre County of the Republic of South Sudan. The project intended to build food security and improve livelihoods, to build good relationships within the community and strengthen peace.

This project was implemented in four payams in Rumbek Centre County between June 2014 and December 2015, by Oxfam in partnership with the National Relief Development Corps (NRDC) and the Department of Agriculture of South Sudan. It was intended to benefit up to 1200 households through increased agricultural productivity, increased value-addition, and increased sales and revenues. With support from the programme, these beneficiaries were expected to increase their production, produce higher-value goods, and reach more markets. In general, the South Sudan Peace and Prosperity Promotion Programme aimed mainly at ensuring improved quality and quantity of produce, sustainable livelihoods opportunities and better income.

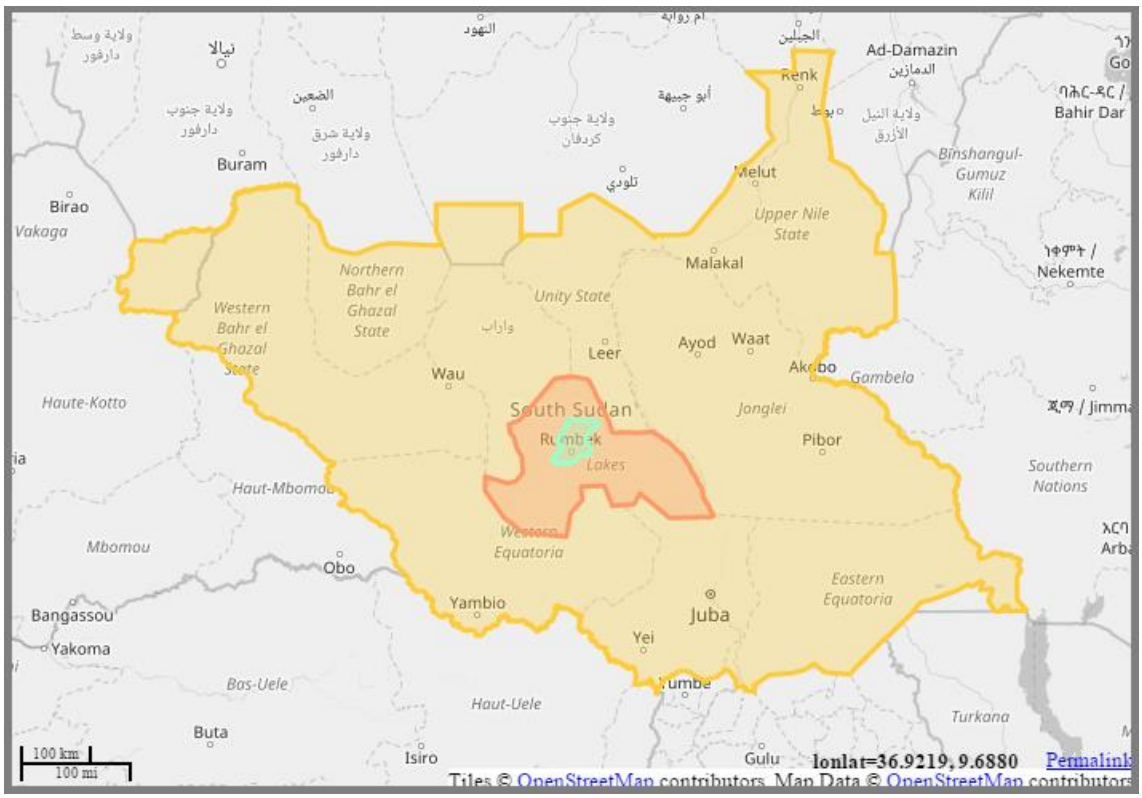
This report presents the findings of the Effectiveness Review. Section 2 briefly presents the project. Section 3 describes the evaluation design, and Section 4 describes the surveyed population. Section 5 presents the results of the data analysis, based on the comparison of outcome measures between the intervention and comparison groups. Section 6 concludes with a summary of the findings and some programme learning considerations. Finally, characteristics of participant and non-participant surveyed households are provided in Appendix 1, technical and methodological considerations on the propensity-score matching (PSM) approach are given in Appendix 2, and tests of the robustness of the results are examined in Appendix 3.

2 PROJECT DESCRIPTION

2.1 PROJECT ACTIVITIES

In the Lake region, 87 percent of households depended primarily on agriculture and livestock, as presented in a 2013 report from the African Development Bank. It is one of the regions most dependent on agriculture and livestock in South Sudan.

Figure 2.1: Location of the County of Rumbek Centre, in the Lake region of South Sudan



Source: OpenStreetMap

In June 2014, Oxfam and NRDC embarked on an agriculture scale-up programme to contribute to poverty reduction efforts and peace building in the County of Rumbek Centre of the republic of South Sudan, in four payams.

The project had two main components:

- Influencing and community-level activities up to April 2016 aimed at raising conflict awareness and reducing tensions in the county.
- Household-level activities aimed at improving food security and livelihoods, up to December 2015; these activities were also undertaken as a way to reduce causes of conflict in the area, as discussed in the next section.

This report will focus on household-level activities and changes in the households' livelihood condition, in the context of ongoing community change.

The livelihood component of the project targeted six crops for household consumption and for sale to wholesalers and local traders in the local community: groundnuts, sorghum, kudru, okra, cucumbers and onions. Other crops were grown in the project area but were not directly supported by the project, such as maize, sesame, millet and

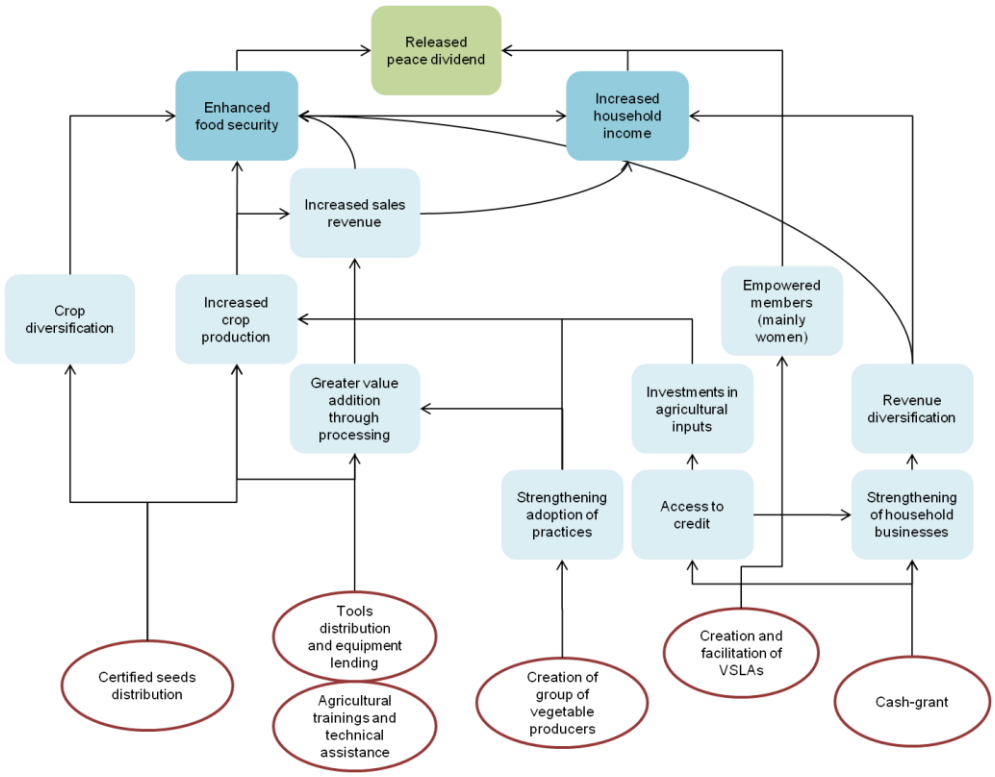
palm. Farmers were provided with inputs (groundnut, sorghum and vegetable seeds, and tools, such as ox ploughs and access to equipment) and technical advice on improved methods of farming. Demonstration plots for women vegetable producers were developed. Exchange visits were also organized and vegetable producers sensitized to organize themselves into groups in order to improve cross-learning and improved agricultural practices adoption. Village savings and loans associations (VSLAs) were formed and supported, and the gender balance within these associations was such that women were widely represented. In addition, trainings to support household businesses were held and cash grants for household businesses were given.

The project took place in a context of a flooding of the Lake region in October 2014, insecurity and ongoing conflicts (as discussed for one of the payam specifically in Section 4), and gradually developing food insecurity. In March 2016, the counties in the Lake region were classified as under stress of a food crisis or in crisis (Rumbek North County), according to the Famine Early Warning System Network (FEWS NET) Integrated Phase Classification Version 2.0, and its note published in 2016.

2.2 PROJECT LOGIC AND EXPECTED OUTCOMES

In this section, we describe how the project was supposed to achieve its goals. Using existing documentation about the project and results of discussions with the team implementing it, we can map out the intended hypothetical causal links from project activities, via outputs and intermediate outcomes, to final outcomes. Figure 2.2 presents a simplified model of how the activities carried out under the project were expected to result in improvements in food security and household income.

Figure 2.2: Project's simplified logic model and impact



Overall, the project was designed to build peace, as its livelihood component was regarded as a way to reduce risks of conflict. That is because conflicts arose due to food insecurity or access to natural resources,[6] and because the participation in activities in groups could be thought of as a way to integrate people and foster a better togetherness, particularly in a context of displacement of population. (According to the 2013 OIM report, by the end of 2012, 31 percent of the population of Rumbek Centre County had returned since 2007).

The project was expected to increase household income and food security through improvement in crop production (particularly the production of groundnuts, sorghum, kudru, okra, cucumbers and onions) and marketing, through enhanced agricultural practices and inputs.

Higher production was also expected to lead to increased sales. Ultimately, better revenues and increased diversified income for the households involved in the project were expected. Through participation in VSLAs, the project aimed to support women on the one hand and build confidence within the community and strengthen peace, on the other.

Sometimes an evaluation will test a single hypothesis. However, in the project logic presented above, a hypothesized causal chain of interlinked hypotheses is specified. The complete causal chain is what is tested in this report. Based on the project logic, the Effectiveness Review sought to answer the following key evaluation questions:

- Did the farmers adopt improved practices of crop production and agricultural technology and did they diversify crop production?
- Did the project enable monetary income generation and revenue diversification?
- Did the project participants' overall income increase thanks to the project?
- What was the impact of the project on involvement of the participants in the communal activities, and especially of women? What was the impact on women's empowerment?

3 EVALUATION DESIGN

3.1 QUASI-EXPERIMENTAL IMPACT EVALUATION

The central problem in evaluating the impact of any project or programme is how to compare the outcomes that result from that project with *what would have been the case* without that project having been carried out. In the case of this Effectiveness Review, information about the lives and livelihoods of project participants was collected through a household questionnaire – but clearly, it was not possible to observe what their situation would have been had they not had the opportunity to participate in this project. In any evaluation, that 'counterfactual' situation cannot be directly observed: it can only be estimated.

In the evaluation of programmes that involve a large number of units (whether individuals, households, or communities), it is possible to make a comparison between units that were subject to the programme and those that were not. As long as the two groups are similar in all respects except for the implementation of the specific project, observing the situation of those where the project was not implemented can provide a good estimate of the counterfactual. It is important to take note of these two terms, *intervention* and *comparison*, since they are used frequently in this report. The intervention group is made of surveyed project participants households; the comparison group is made of surveyed non-participant households. In a quantitative impact evaluation, the comparison group is chosen to be as similar as possible to the intervention group at onset of the project, so that the comparison group provides a good estimate of what would have happened to the participants in the absence of the project, that is to say the counterfactual situation.

An ideal approach to an evaluation such as this is to select at random among villages that could receive the project the villages in which the project will be implemented or select at random the households who will receive the project among a bigger pool of households who could receive the project. Random selection among a big enough pool of units minimizes the probability of there being systematic differences between the project participants and non-participants, and so maximizes the confidence that any observed differences in outcomes are due to the project.

In the case of the project examined in this Effectiveness Review, the selection of the villages involved in the project was not made at random; in fact, villages were deliberately chosen based on their being particularly vulnerable in terms of low quantity and quality of production, lack of agricultural inputs, low quality methods of crop production, low revenues and lack of access to markets.

However, discussions with the implementation staff revealed that the livelihood component of the project was initially supposed to cover a greater geographical area. Due to conflicts which arose in the country in 2014, and in a part of one payam in particular, this payam did not receive the project intervention despite being originally intended to. In the northern part of this payam, conflicts rendered the villages inaccessible to project staff and the project was not implemented. However, in the southern part of the payam, peace committees were already formed at the time of the events, but activities stopped there too. Farmers from the southern payam were considered as having similar livelihoods characteristics as the project participants at baseline. This allowed a 'quasi-experimental' evaluation approach to be adopted, in which the situation of farmers in villages where the livelihood component of the project

was not implemented was assumed to provide a reasonable counterfactual for the situation of farmers who had participated in the project activities.

To improve the confidence in making this comparison, households in the project were 'matched' with households with similar characteristics in the non-project (or 'comparison') villages. Matching was performed on the basis of a variety of characteristics – including household size, education level and indicators of material well-being, such as housing conditions and ownership of assets. Since some of these characteristics may have been affected by the project itself (particularly those relating to wealth indicators), matching was performed on the basis of these indicators *before* the implementation of the project. Baseline data were not available and so survey respondents were asked to recall some basic information about their household's situation from 2013, before the project was implemented in Rumbek Centre County. While this recall data is unlikely to be completely accurate, it is the best-available proxy for households' pre-project situation.[7]

Recall survey data provided a variety of baseline household characteristics on which matching could be carried out. These characteristics were used to calculate a 'propensity score', which is the conditional probability of the household being a participant, given the set of observable characteristics on the baseline. Project households and comparison households were then matched based on their having propensity scores within certain ranges. Please refer to Appendix 2 for a more extensive explanation of the matching procedure and tests carried out after matching to assess whether baseline characteristics are similar between the two groups.

As a check on the results derived from the propensity-score matching process, results were also estimated using multivariate regression models. Like propensity-score matching, multivariate regression also controls for measured differences between intervention and comparison groups, but it does so by isolating the variation in the outcome variable explained by being a project participant, after the effects of other explanatory variables have been accounted for. The regression models tested are described in Appendix 3.

It should be noted that both propensity-score matching, and multivariate regression rely on the assumption that the 'observed' characteristics (those that are collected in the survey and controlled for in the analysis) capture all of the relevant differences between the two groups. If there are 'unobserved' differences between the groups that matter for project participation, then estimates of outcomes derived from them may be misleading. Unobserved differences between the groups could potentially include differences in attitudes or motivation (particularly important when individuals have taken the initiative to participate in a project), differences in community leadership, or local-level differences in weather or other contextual conditions faced by households, such as risks of conflicts. The choice of which intervention and comparison villages to survey for this Effectiveness Review was made principally to minimize the potential for any such unobservable differences to bias the results, but the possibility of unobserved bias cannot be ruled out (for a discussion on the limitations, see Section 3.5).

3.2 SAMPLING APPROACH

3.2.1 Selection of comparison areas

The project was implemented in the County of Rumbek Centre in four payams. As presented above, the livelihood component of the project was initially supposed to be implemented in a fifth payam, but this did not happen because of insecurity in the targeted areas (north part of the payam). Some villages in the south part of this payam were not affected by conflicts, but also did not take part in the project activities. These

villages were identified as sound comparisons, as livelihood characteristics were similar in the comparison villages at onset of the project.

3.2.2 Selection of households

Households' lists of project participants in each payam were obtained from the partners, and a random sample of households was drawn, mainly from the participants in agriculture and livelihood activities. Some 308 households that took part in the project were interviewed.

In the comparison villages, 385 households were randomly selected from the comparison villages using the random walk sampling method. This involved first selecting a starting point where an interviewer would begin the interviews observing the following rules: starting points were chosen using a landmark, such as a church, school or road junction or any other identifiable mark; starting points were spread all over the sampling area and were not close to each other; no road was 'walked on' for a second time until all the roads of the villages had been 'walked on' (in which case the next road had to be selected and if this was not suitable, the next had to be chosen, and so on, until the right point was reached). The interviewer would begin by going to a starting point provided by the field supervisor. As the enumerator walked along the road, they sampled households at systematic intervals, as defined by the supervisor (say, after every five households, depending on the distribution of households in the village). This method was employed because, to our knowledge, there were no household lists available in the comparison villages.

3.3 DATA COLLECTION TOOL

A household questionnaire was developed by Oxfam staff, in collaboration with partners, to capture data on various outcome measures associated with the project's activities, such as agricultural and livestock activities, income sources, food consumption and expenditures, and involvement in community. Demographic data and recalled baseline data were also collected to statistically control for differences between the supported and comparison households that could not plausibly be affected by the project.

The interview consisted of two parts: the household questionnaire on households' livelihood characteristics, administered to the household head in most cases (see next section), and an individual questionnaire for the main woman decision-maker of the household (household head or spouse of the household head), to capture the extent of her decision-making role and involvement in community activities.

In 2016, South Sudan experienced very high inflation,[8] which introduces a major difficulty when it comes to the respondent estimating monetary values of production, sales, purchases and expenditures. For this reason and when possible, the report will focus on measurement of outcomes that did not require estimating in South Sudanese pounds.

The survey took place in September, which is the beginning of harvest of the main crops in the project area (FEWS NET 2013 report).

3.4 LIMITATIONS

It is important to recall that PSM and regression models can control only for the baseline differences between the households in project and comparison communities

for which data was collected in the survey. The model does not correct for all observed differences as presented in Appendix 2, but minimizes observable differences.

Based on baseline characteristics presented in Table A2.3 after matching corrections, two main aspects are not fully corrected for.

First, some differences in interviewee characteristics still hold after correction, such as the level of education: after correction, more interviewees had completed primary education in the intervention group than in the comparison group. While education of the household head is balanced, if respondents were able to provide more accurate information on a given variable of interest, that would introduce bias in our estimation of the project effect.

Second, the model takes into account whether the household declared growing groundnuts, sorghum and vegetables (cucumbers, kudru, okra, onions) in 2013. Differences in growing kudru and cucumbers in 2013 can still be observed after matching; the robustness of the results to controlling additionally for those two variables will be checked in Appendix 3. Variables relating to crops grown in 2013 seem particularly likely to be influenced by project participation. In particular, project participants may systematically miss-recall their situation in 2013 when it comes to the crops they were growing at the time because they have since started growing those crops thanks to the project. If this was the case, our estimates would be biased, and the effects of the project would potentially be underestimated. In the main results of this report, the choice was made to include these variables given the key role of the types of crops grown in the project selection process; Appendix 3 presents two models in which those variables are not included.

In addition, if there are any 'unobserved' pre-existing differences between the two groups – such as individuals' attitudes, motivation, skills or confidence – then these may bias the estimates of outcomes described in Section 5. The evaluation design and the selection of respondents were intended to minimize any potential for unobserved differences, but this possibility cannot be excluded and must be borne in mind when interpreting the results.

The comparison group interviewed for this Effectiveness Review is drawn from the South part of one payam, in which the livelihood component of the project was initially planned to be implemented in the northern part. Due to insecurity and conflicts in the northern part of the payam in 2014, project implementation was interrupted after farmers being registered and seeds being distributed. In the setting of conflicts, it is likely that households migrated from a conflict-affected area to a safe one, and this indeed was observed. Hence some households who form the comparison group, as they were randomly sampled on the spot, may have benefited from seed distribution, from the project under review. Such households are not expected to represent a large share of the comparison group (which is supported by the data presented in Section 5); in addition, if receiving such support improved their livelihood, this would drive the overall average of the comparison group up, which would lead us to present conservative results.[9]

In the intervention group, if a large proportion of households migrated or is displaced to other payams due to conflicts, it would reduce representativeness of observed project participants.

Finally, while project participants come from many villages in four payams,[10] non-participants come only from a small number of villages in one payam, reducing the validity of the comparison group. Indeed, if the differences between villages and between payams are strong in terms of the characteristics and living conditions of their inhabitants, the comparison group used in this report will not reflect all the various situations present in the intervention group.[11]

4 DESCRIPTION OF SURVEYED HOUSEHOLDS

4.1 HOUSEHOLDS' CHARACTERISTICS

Households of project participants and non-participants were compared in terms of their demographic characteristics, livelihoods activities and income situation in 2013, as the respondents recalled it at the time of the survey, in September 2016. Information on the household composition is constructed from information at the time of the survey, assuming that the project's implementation did not impact the household composition. The full comparison is shown in Appendix 1.

Households in the project and comparison areas look similar in terms of household's composition: households count on average four members, of which 21 percent are children (aged less than 15), and 88 percent are able to work. Household heads are 37 years old on average, 50 percent are men, and 11 percent of them received a formal education (4 percent completed primary school).

The gender of the household head may reflect different household compositions, and different livelihood situations. The *South Sudan Gender Analysis*, conducted between March and July 2016 by Oxfam as part of the ECHO-ERC project 'Institutionalizing Gender in Emergencies: Bridging Policy and Practice' underlines the vulnerability of women when it comes to food security as women are perceived as the main care taker and food provider within the household and will tend to reduce their own consumption to favour that of other members. The report also puts emphasis on the vulnerability of woman-headed households.

In conflict settings particularly, both men and women household heads may be separated from their spouse. As the data do not allow us to take into account whether the person identified as the household head is living with their spouse, nor whether they have a spouse, Table A1.2 presents the main differences between woman-headed and man-headed households, based on recall baseline data. Women household heads are younger than men ones (35 vs 39 years old) and less educated (5 percent vs 17 percent received a formal education, and 1 percent vs 8 percent completed primary education). Women-headed households own fewer livestock (15 cattle vs 19, significant at 10 percent only[12]) and are slightly less likely to own land (89 percent vs 93 percent, significant at 10 percent too) than men-headed ones. Women-headed households are more likely to grow vegetables overall (48 percent vs 40 percent), and kudru (32 percent vs 23 percent) and okra (46 percent vs 36 percent) in particular. These households are also more likely to grow palm (3 percent vs 1 percent) and maize (48 percent vs 39 percent). Women-headed households are also living slightly closer, on average, to the local market, based on estimates of the time needed to reach the market.

More women-headed households received income from farming in 2013 (60 percent) than did men-headed households (52 percent), and social transfers (8 percent vs 3 percent). On the other hand, men-headed households were more likely to have received income from casual labour (12 percent vs 8 percent in women-headed households, difference significant at 10 percent level only).

4.2 DIFFERENCES BETWEEN PARTICIPANTS AND NON-PARTICIPANTS IN 2013

Table A1.1 compares all surveyed households, depending on whether they are project participants or non-participants, and main differences are discussed in this section of the report.

Differences can be observed when it comes to productive activities and monetary income sources. Farming was the household main activity in 2013 in both groups, but even more so among the comparison households (96 percent among project participants and 98 percent among non-participants, significant at 10 percent only). However, farmer households in intervention areas were more likely to grow one of the six crops that the project focused on: 91 percent were growing at least one of those five crops among the project participants, but only 78 percent were among the non-participants. This difference reduces slightly when considering all the eight main crops identified in the questionnaire, but still holds, which suggests that non-participants may be growing different crops that were not explicitly asked about in the survey, like sesame.[13]

The households in the project areas were more likely to have received monetary income from any source than the non-participants. The difference is the highest for having received income from farming and processing activities: 72 percent of the project participants had in 2013, but only 50 percent of the non-participants had. Similarly, households in the project areas are less likely to be in the bottom 20 percent of the asset-based wealth distribution (see Section 5.3 for details on the calculation of this index) than households in the comparison areas (17 percent against 23 percent) and more likely to be in the top 20 percent (26 percent against 15 percent).

A large source of differences between the two samples is the interview characteristics. Among the project households, the interviewee is less likely to be a male (40 percent against 46 percent, significant at 10 percent), but more likely to have completed primary school (5 percent against 2 percent). The individual module of the survey, administered to women, was completed more often in the intervention group (65 percent against 55 percent).[14] These differences in characteristics of the survey respondents might be explained by the fact that the identity of the individual within the household who responded to the survey was influenced by participation in the project itself, as enumerators were given access to list of participants in the intervention groups, who were not necessarily household heads. The majority of outcome indicators are referring to household characteristics, however if we believe the choice of the respondent influenced the nature and quality of the responses, this might mean that the responses may not be balanced across the two groups.

4.3 CORRECTION OF THOSE DIFFERENCES

Differences that existed before the project have the potential to bias any comparison between the project and comparison groups at endline. It is therefore important to control for these baseline differences when making such comparisons.

As described in Section 3, the main approach used in this Effectiveness Review was propensity-score matching (PSM). The variables on which respondents were matched

were selected from among the full list detailed in Appendix 1, based on two key factors. Firstly, we selected variables that were thought to be the most significant in influencing respondents' participation in the project. Secondly, we aimed to include variables that could affect potential project outcomes *as well as* the likelihood of participating in the project. The list of matching variables selected and the full details of the matching procedure applied are described in Appendices 1 and 2.

After matching, households in the project and comparison groups were well balanced in terms of the recalled baseline variables used for matching. Seven of the 308 project participant households and 19 of the non-participants could not be matched and so were dropped from the analysis.

All the results described in Section 5 of the report were also tested for robustness by estimating them with various alternative PSM models and linear regression models. These robustness checks are shown in Appendix 3. The alternative models produced results that are mainly similar (in size and in statistical significance) to those presented in the tables in Section 5. Main differences in effect size and significance are discussed in Section 5.

5 RESULTS

This section presents a comparison of the interviewed households who participated in the project, and those who did not, in terms of various outcome measures relating to the project under review.

This report is intended to be free from excessive technical jargon, with more detailed technical information being reserved for the appendices and footnotes. However, there are some statistical concepts that cannot be avoided when discussing the results. In this report, results will usually be stated as the average difference between the project households (referred to as the 'intervention group') and the matched non-project households (named the 'comparison group').

In the tables of results on the following pages, statistical significance will be indicated with asterisks, with three asterisks (***) indicating a *p*-value of less than 1 percent, two asterisks (**) indicating a *p*-value of less than 5 percent and one asterisk (*) indicating a *p*-value of less than 10 percent. The higher the *p*-value, the less confident we are that the measured estimate reflects a difference that applies across the entirety of the intervention and comparison groups, rather than being due to random variation in the specific sample surveyed. Results with a *p*-value of more than 10 percent are not considered to be statistically significant.

The results are shown after correcting for observed baseline differences between the households interviewed in the project communities and those in the comparison communities using a propensity-score matching (PSM) procedure. More information about the procedure applied is found in Appendix 2. All outcomes discussed here have also been tested for robustness with alternative statistical models, as described in Appendix 3. Where those alternative models produce markedly different results from those shown in the tables of results, this is discussed in the text or in footnotes.

It is important to reiterate that a key limitation of our analysis is that we are not able to control for any unobservable differences between the project participants and comparison households – such as individuals' attitudes or motivation, differences in local leadership, weather or other contextual conditions. If these unobserved differences also influence the potential outcomes we consider in this section, then our estimates of the project's effects will be biased. This possibility must be borne in mind when interpreting the results.

It is important to stress that the results presented in this section are average results across those who participated in agriculture and livelihood activities conducted by the project between June 2014 and December 2015. It would be of interest to investigate the effects of the project at a more local level and for specific subgroups – but the small sample sizes limit the potential for detecting any differences between these various subgroups. We investigated potential differential effects of the project on women-headed and men-headed households, on the main outcomes of this Effectiveness Review, but no differential impact was found[15].

The results will be presented following the core aspects of the project: first impacts on agricultural practices and production will be explored (Section 5.1), then we will look at the ability of the project to create income generating opportunities (Section 5.2), and to improve overall household income (Section 5.3), and finally the impact of the project on involvement in groups and community activities, particularly involvement of women will be explored (Section 5.4).

5.1 AGRICULTURAL PRACTICES AND PRODUCTION

5.1.1 Project activities: seed distribution and trainings on agricultural practices

A large part of the project's activities were directly aimed at improving agricultural production through input distributions and trainings. We will focus here on exposure to components of the projects that were designed to strengthen agricultural production.

This is an important consideration as, firstly, it represents the analysis of the first step of the project's theory of change – i.e. are project participants being exposed to the intended interventions? Secondly, it is important to assess whether respondents in comparison areas also report receiving such support in their communities as this may have an effect on the differences that might be detected between the intervention and comparison groups in the outcome measures reported subsequently.

Table 5.1: Proportions of households having received support for agricultural production in the three years prior to the survey

	1 The HH was provided with groundnut seeds	2 The HH was provided with sorghum seeds	3 The HH was provided with vegetable seeds	4 A HH member attended farmers' field day	5 A HH member was provided with technical support
Intervention group mean	0.87	0.76	0.73	0.29	0.27
Comparison group mean	0.48	0.45	0.47	0.28	0.22
Difference:	0.39***	0.32***	0.27***	0.00	0.05
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Observations (intervention group)	301	301	301	301	301
Observations (total)	667	667	667	667	667

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions.

Table 5.1 shows a comparison between participants (the intervention group) and non-participants (the comparison group) in terms of receiving support for crop production between 2013 and 2016. Even though the proportions who received distributions of seeds are quite high in the comparison group (between 45 percent and 47 percent, depending on the type of seeds), the share of respondents who reported being provided with seeds is significantly higher among the project participants: 87 percent for groundnut seeds, 76 percent for sorghum seeds and 73 percent for vegetable seeds. No differences can be detected in the share of farmers attending farmers' field days (27 percent on average among project participants) or receiving technical support (27 percent on average among project participants).

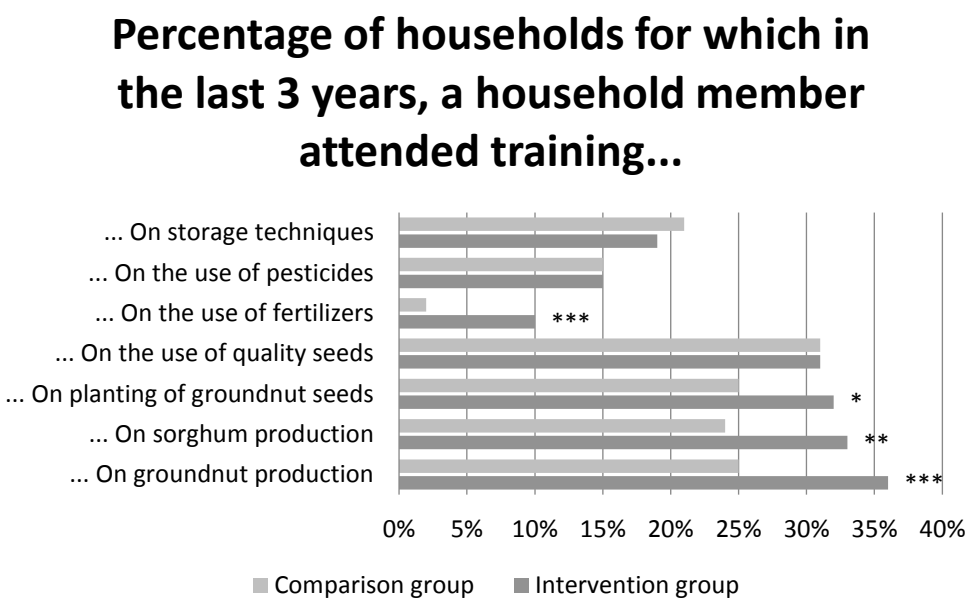
Table 5.2: Proportion of households having attended any type of agricultural training

	In the last 3 years, a HH member attended any agriculture-related training
Intervention group	0.42
Comparison group	0.33
Difference:	0.09**
	(0.04)
Observations (intervention group)	301
Observations (total)	667

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions.

Table 5.2 presents results on attendance at training related to agricultural activities, for at least one household member. While 33 percent of households attended training in the comparison group, the figure is 42 percent in the intervention group.

Figure 5.1: Percentage of households attending trainings in the last three years

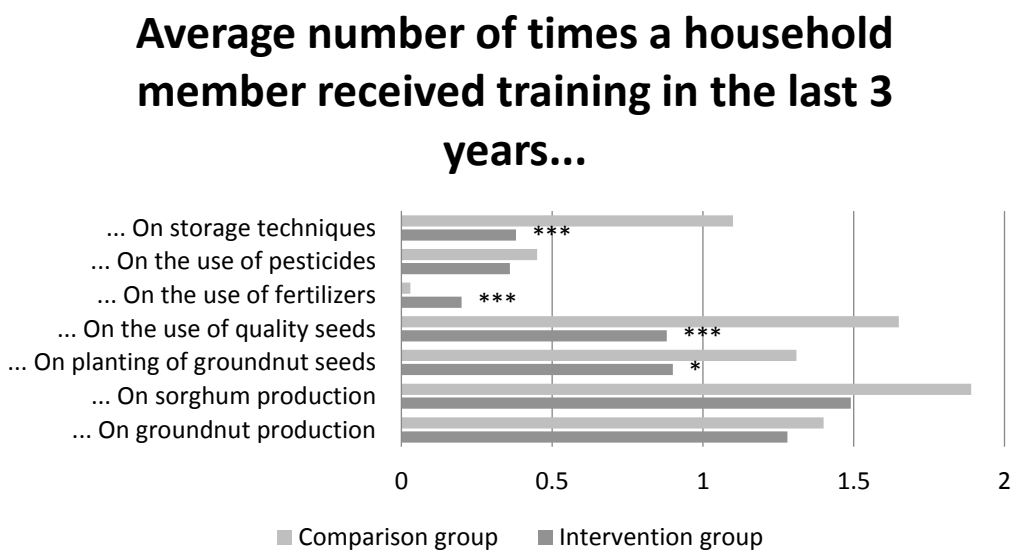


However, topics that clearly made a difference reflect the project activities: groundnut and sorghum production, and the use of fertilizer.[16] The differences in the proportions who attended training are not very high, and it is worth underlining that even in the intervention group, the share of respondents who reported attending training on the use of fertilizer is low (10 percent) (the project focused on organic fertilizer).

Figure 5.2 presents the average number of times the respondents attended each type of training. There are no statistically significant differences between the two groups for two core project activities: groundnut and sorghum production. Figure 5.1 shows that more households were trained on groundnut and sorghum production as a result of

the project. Combining Figure 5.1 and Figure 5.2 suggests that the project, however, enabled households who were reached to be trained a smaller number of times, on average, compared to those who received training in the comparison group. This does not hold for training on use of fertilizers: not only were more households reached, but they were also reached more times than those that were trained in the comparison group.

Figure 5.2: Attendance at training since 2013



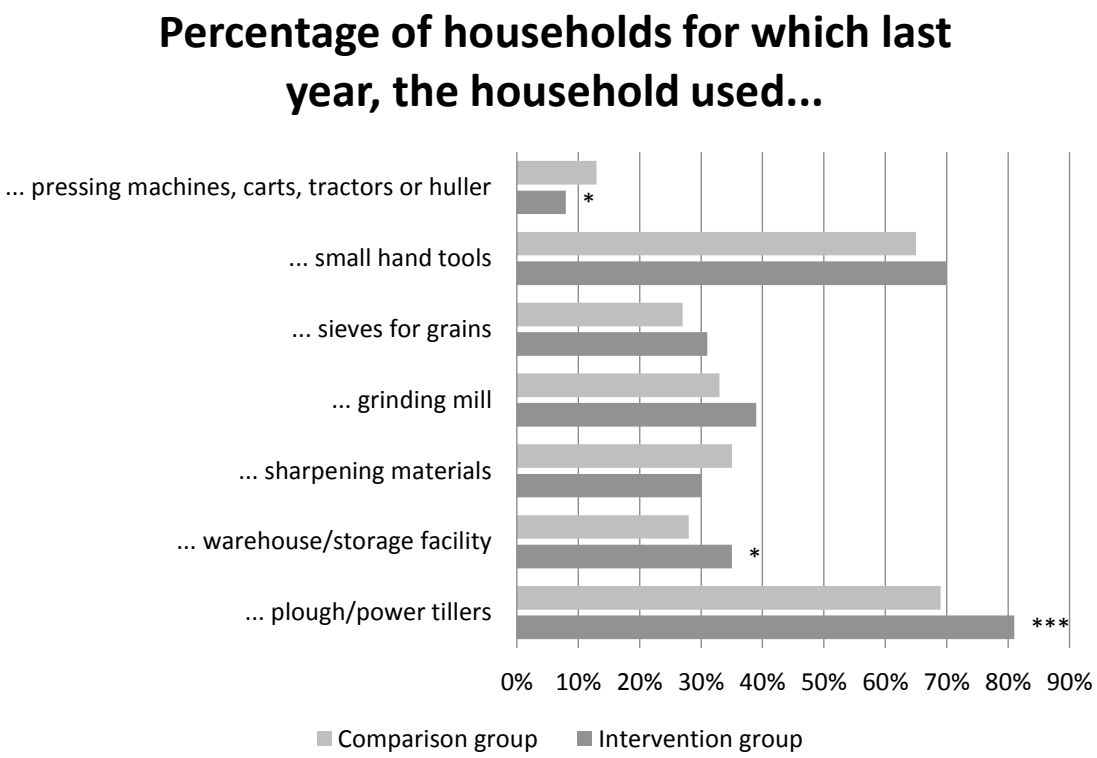
Significant negative effects are observed for training on planting of groundnut seeds, training on the use of seeds of quality, and on storage techniques (Figure 5.2), as the average number of times households attended such training is lower in the intervention group than in the comparison group. This suggests that even though a larger or the same share of households benefited from such training in both groups (Figure 5.1), those who benefited from it in the comparison group attended more sessions than those in the project group. This could suggest an important substitution of resources from some trainings to others from the local actors in charge of agricultural training (including the project team, but also other actors), or it may reflect interest of the participants themselves, which may be due to the project communication (that is, after attending training on storage techniques, one may prefer attending another training, or a training on fertilizer a second time for example).

Among the project participants, of those who attended training, a high proportion reported putting into practice what they had learned: the lowest share is for the use of fertilizer, for which 73 percent put the techniques they learned into practice, and the highest is for planting of groundnut seeds, for which 92 percent did so.

5.1.2 Usage of tools and changes in practice

The project distributed agricultural tools, such as slashers, hoes, pangas, rakes, watering cans, sieves for grains, or gave access to equipment, such as corn huskers, pressing machines, tractors, etc. As shown in Figure 5.3, this component of the project strengthened usage of ploughs and power tillers (from 69 percent in the comparison group to 81 percent in the intervention group). As shown in the theory of change (Figure 2.2), this could also be an indirect effect of more households receiving monetary income, which they may have invested in agricultural inputs, such as a plough or power tiller. More households used a warehouse or storage facilities as a result of the project: from 28 percent of households to 35 percent, difference being significant at 10 percent, and not robust to other specifications as shown in Appendix 3.

Figure 5.3: Percentage of households having used tools and facilities in the year prior to the survey



No other statistically significant positive effect is observed, and the use of equipment, such as pressing machines, carts, tractors or huller is lower in the intervention group than in the comparison group (from 13 percent of households in the comparison group to 8 percent of households in the intervention group). A possible explanation for that is that more of the comparison group may be growing crops such as sesame, in addition to the project crops, that require the use of such equipment.[17]

Table 5.3: Proportion of households having adopted different agricultural practices in the year prior to the survey

	1 Last year, the HH used seed nursery	2 Last year, the HH used production of organic concoction/ materials	3 Last year, the HH used organic farming	4 Last year, the HH used improved certified seed/seedlings	5 Last year, the HH used integrated diversified farming system	6 Last year, the HH used farm planning based on weather forecasts (rain gauge)
Intervention group mean	0.23	0.24	0.43	0.36	0.32	0.13
Comparison group mean	0.20	0.13	0.31	0.26	0.32	0.11
Difference:	0.03 (0.04)	0.10*** (0.03)	0.13*** (0.04)	0.09** (0.04)	-0.00 (0.04)	0.01 (0.03)
Observations (intervention group)	301	301	301	301	301	301
Observations (total)	667	667	667	667	667	667

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions.

According to Table 5.3, significantly more project participants produced and used organic materials as fertilizer in the last year than in the comparison group. This is consistent with more of the project participants having received training on the use of fertilizer, as highlighted in the previous section.

Similarly, emphasis put on usage of improved certified seeds seems to have had an effect among the project participants, as significantly more households used improved seed among participants than in the comparison group (36 percent against 26 percent). In both groups, the share of respondents who declared using improved seeds in the last year is lower than the share of households receiving seeds in the last three years, as presented in Table 5.1. The time reference is different between the two tables. Hence, even though a large share of households has received seeds at least once in the last three years, only a small share of households is using improved or certified seeds in the last year. This is either because only a small share of households received seeds from a project in this last year, can afford to buy some, or kept some from previous years.

5.1.3 Crop diversity and total production

Alongside encouraging project participants to implement improved agricultural methods, the project also sought to encourage farmers to increase their production of groundnuts and sorghum mainly, and vegetable (okra, kudru, cucumbers and onions mainly) for households who were already doing vegetable production. Table 5.4 presents the share of households growing any of the eight crops the survey focused on, and the average number of those eight crops cultivated by the households.

Table 5.4: Crop production: proportion of households growing crops and average number of crops grown

	1 In the last 12 months, the HH produced any crop (out of 8)	2 In the last 12 months, the household farmed any of the 6 crops targeted by the project	3 Number of crops the HH produced in the last 12 months (out of 8)	4 Number of non-cereal crops the HH produced in the last 12 months (out of 8)
Intervention group mean	0.97	0.96	3.73	2.33
Comparison group mean	0.93	0.92	2.92	1.69
Difference:	0.04** (0.02)	0.04** (0.02)	0.81*** (0.14)	0.64*** (0.10)
Observations (intervention group)	301	301	301	301
Observations (total)	667	667	667	667

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions.

The share of households growing any of the eight crops listed in the questionnaire is slightly higher in the intervention group, and this change has been driven by the six targeted crops (same effect between column 1 and column 2 of Table 5.4). However, when using alternative models of estimation that take into account differences in the specific crops grown at baseline (see Appendix 3, Table A3.6), the effect size is reduced, hence less or not significant. In other words, taking into account the fact that the project targeted mainly households who were already growing groundnut, sorghum

or vegetables in the first place (91 percent of project participants), the project had only limited success in encouraging households to start growing these crops.[18]

In both groups, almost all households were growing at least one of those eight crops in 2016. However, on average, crop diversification within this set of crops seems higher among the project participants than the comparison households: 0.81 more crop types are grown among the project participants. This difference is mainly driven by non-cereal crops (groundnut or vegetables).

As presented above, it is likely that crops that were not listed in the questionnaire were grown in 2013, most likely sesame (OIM 2013 report), in comparison or intervention areas. If there were any substitution of crops, e.g., households abandoning producing one crop to another due to the project, this would not be detected in our data. Such a substitution would alter the overall pathway of change towards improving households' income and livelihood.

Table 5.5: Proportion of households having produced each of the targeted crops

	1 In the last 12 months, the HH produced any groundnut	2 In the last 12 months, the HH produced any sorghum	3 In the last 12 months, the HH produced any cucumber	4 In the last 12 months, the HH produced any kudru
Intervention group mean	0.93	0.84	0.10	0.50
Comparison group mean	0.86	0.76	0.02	0.24
Difference:	0.07*** (0.03)	0.09*** (0.03)	0.07*** (0.02)	0.25*** (0.04)
Observations (intervention group)	301	301	301	301
Observations (total)	667	667	667	667

	5 In the last 12 months, the HH produced any okra	6 In the last 12 months, the HH produced any onion	7 In the last 12 months, the HH produced any palm	8 In the last 12 months, the HH produced any maize
Intervention group mean	0.62	0.14	0.04	0.56
Comparison group mean	0.49	0.06	0.01	0.48
Difference:	0.13*** (0.04)	0.08*** (0.03)	0.03** (0.01)	0.08* (0.04)
Observations (intervention group)	301	301	301	301
Observations (total)	667	667	667	667

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions.

The figures in Table 5.5 imply that the project has led to an increase in the share of households producing the targeted crops.

Particularly large increases of the share of households producing kudru (25 percentage points) and okra (13 percentage points) can be observed. Those effects are robust to using different estimation models (see Appendix 3, Tables A3.7 and A3.8).

Even though maize and palm were not targeted by the project, more households were producing those crops at the time of the survey among the project participants than non-participants. However, those differences are only significant at the 10 percent level for maize, which means the confidence in this result is not very strong. In Appendix 3, Table A3.8, when controlling for main crops production in 2013, the differences in the share of households growing maize are not significant, and either slightly significant or not significant for palm. This means that, holding constant main crops production in 2013, the project did not influence households' choices in starting growing palm or maize.[19]

Table 5.6: Average produced quantity of each crop

	1 Kg of groundnut produced in the last 12 months (winsorized)	2 Kg of sorghum produced in the last 12 months (winsorized)	3 Kg of cucumber produced in the last 12 months (winsorized)	4 Kg of kudru produced in the last 12 months (winsorized)
Intervention group mean	775.65	363.63	2.45	266.06
Comparison group mean	271.83	134.77	0.00	23.29
Difference:	503.82***	228.86***	2.45***	242.77***
	(105.20)	(52.15)	(0.74)	(65.48)
Observations (intervention group)	301	301	301	301
Observations (total)	667	667	667	667

	5 Kg of okra produced in the last 12 months (winsorized)	6 Kg of onion produced in the last 12 months (winsorized)	7 Kg of palm produced in the last 12 months (winsorized)	8 Kg of maize produced in the last 12 months (winsorized)
Intervention group mean	82.94	5.48	0.45	130.30
Comparison group mean	58.95	1.94	0.00	88.53
Difference:	23.99	3.54*	0.45***	41.78
	(22.86)	(1.92)	(0.16)	(27.14)
Observations (intervention group)	301	301	301	301
Observations (total)	667	667	667	667

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions.

As shown in Table 5.6, a very large increase in the average quantity of produced groundnut can be observed among the project participants, compared to non-participants. According to the 2013 ADB report, groundnut is the main cash crop in South Sudan, in addition to being an important contribution to the household's diet. Indeed, it is the most cultivated crop in the comparison area (by 86 percent of households, with average production of 272 kg among the whole comparison group), among those eight crops, and 70 percent of surveyed households had consumed home-produced groundnut in the last seven days.

The largest increase in produced quantity is observed for kudru, as average production quantity among the project participants is 10 times higher than among comparison households.

The increases presented in Table 5.6 need to be commented upon in combination with increases presented in Table 5.5. It could indeed be that the increases in the average produced quantities of a given crop as presented in Table 5.6 reflect the fact that more households are producing each crop.[20] We find that among households producing a given crop, the produced quantity increased significantly thanks to the project, except for okra, onion and maize. On average, for households who produced okra, 134 kg are produced by project participants and 120 by non-participants; for onion producers, 39 kg are produced by project participants and 32 kg for non-participants; for maize producers 233 kg are produced by project participants and 184 kg by non-participants; these differences are not significant at five percent. Hence maize, which was not a targeted crop, did not see its volume of production increase (and the share of households involved in its production only slightly increased). At least for this crop, no perverse effect of the project can be observed, by which households would give less attention to non-targeted crops.

Palm production, on the other hand, increased for households who produce this crop. This could reflect positive effects of the project on other crops by the providing of agricultural inputs and training on agronomical techniques. Very few households produce palm (only 4 percent in 2016 among the project participants), and they are among the richest households (based on recall baseline asset-based measure of wealth), already producing on average six crop types of the eight included in the survey. Palm is considered a high value crop, as mentioned in the 2013 ADB report. This positive effect on volume of production of non-targeted crops is hence most likely very specific to this subset of palm-grower households.

5.2 INCOME GENERATING ACTIVITIES

5.2.1 Processing and improved access to market

The project aimed to increase income and revenues by increasing the value added to households' crop production. Processing includes any transformation to the produce before selling it, such as shelling, drying, preparing and putting in jars.[21]

Households in the project areas indeed reported being more likely to process crops (except for onion and palm, for which processing is very low, and not different between participants and non-participants). The project increased the share of households that processed any of the eight crops they grew from 52 percent to 69 percent. In fact, project participants are on average more likely to process between half and one more crops (0.71) than non-participants (Table 5.7). As previously stated, it is important to put emphasis on the fact that data is available only for eight crops. If this increase in processing some of those eight crops took place at the expense of processing other crops on which we do not have data, we unfortunately cannot know this (see Section 5.2.3 for more elements on this point).

Table 5.7: Proportion of households having processed crops

	1 The HH has been processing any crop before selling	2 Number of crops processed before selling (out of 8)
Intervention group mean	0.69	2.16
Comparison group mean	0.52	1.44
Difference:	0.17*** (0.04)	0.71*** (0.16)
Observations (intervention group)	301	301
Observations (total)	667	667

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions.

A significant increase in the households who processed a given crop before selling it is observed as a result of the project for all crops but onion, palm and maize (Table 5.8).

Table 5.8: Proportion of households having processed a crop before selling it

	1 The HH has been processing groundnuts before selling	2 The HH has been processing sorghum before selling	3 The HH has been processing cucumber before selling	4 The HH has been processing kudru before selling
Intervention group mean	0.57	0.48	0.05	0.28
Comparison group mean	0.45	0.33	0.01	0.15
Difference:	0.11*** (0.04)	0.15*** (0.04)	0.04** (0.02)	0.13*** (0.03)
Observations (intervention group)	301	301	301	301
Observations (total)	667	667	667	667

	5 The HH has been processing okra before selling	6 The HH has been processing onion before selling	7 The HH has been processing palm before selling	8 The HH has been processing maize before selling
Intervention group mean	0.40	0.07	0.02	0.29
Comparison group mean	0.22	0.05	0.01	0.22
Difference:	0.18*** (0.04)	0.02 (0.02)	0.01 (0.01)	0.07* (0.04)
Observations (intervention group)	301	301	301	301
Observations (total)	667	667	667	667

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions.

When comparing Table 5.8 with Table 5.5, the increase is partly driven by the increase in the share of households producing each crop described in Section 5.1.3. Among households who produced a given crop, project participants were as likely as non-participants to process groundnuts, cucumber, kudru, onion, palm or maize.[22] They were statistically more likely to process sorghum and okra. For this matter, the project does not seem to have been successful in changing behaviours towards project participants being more likely to start processing all of the targeted crops (it could be, however, that households are processing a higher share of their harvest, which we do not measure).

In the project logic (presented in Section 2.2), processing is seen as a way to increase sales and revenues. According to Table 5.9, 69 percent of project participants sold any of the eight crop types, whereas only 41 percent of non-participants did. Of those who sold some, the same average number of crop types was sold in both groups (2.7, ratio of column 2 over column 1). Once again, whether this is due to a substitution of cash crops (the project participants having substituted former cash crops for the ones targeted by the project) or not, cannot be observed.

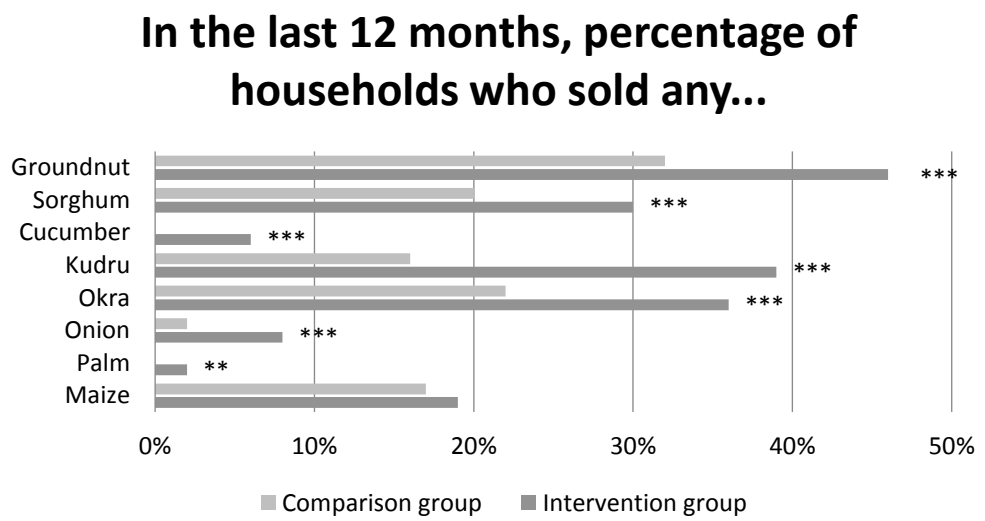
Table 5.9: Sales in the 12 months prior to the survey

	1 The HH sold any crop (out of 8)	2 Number of crops sold (out of 8)	3 The HH sold any crop to local trader or middle persons (for those 8 crops)	4 The HH sold any crop to market centres and local markets (for those 8 crops)
Intervention group mean	0.69	1.85	0.25	0.46
Comparison group mean	0.41	1.10	0.15	0.24
Difference:	0.28*** (0.04)	0.75*** (0.15)	0.10*** (0.04)	0.23*** (0.04)
Observations (intervention group)	301	301	301	301
Observations (total)	667	667	667	667

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions.

Figure 5.4 shows the differences between intervention and comparison groups in terms of the share of households having sold any of each of the eight crop types over the last 12 months.

Figure 5.4: Percentage of households having sold any crop in the last 12 months, per crop type



Similarly, as above, the fact that a higher share of households produced project crops led to a higher share of households declaring selling any. Among the producers of a given crop, however, the share of households who sold some of their produced crops is different between participants and non-participants for all of the targeted crops except for onion. For those five crops, the project seems to have significantly influenced behaviours towards commercialization (among project participants, 49 percent of groundnut producers are selling some; 36 percent of sorghum producers, 60 percent of cucumber producers, 78 percent of kudru producers and 58 percent of okra producers).[23]

A positive correlation between processing and selling any of the produced crops can be observed for each crop for which we have enough data. This means either that one is more likely to sell a processed crop than a raw one, or that households who were more likely to sell their crops were more likely to process beforehand.

In addition to the emphasis put on processing, the project encouraged vegetable producers to form groups for enhanced learning purposes. An unintended effect of the formation of such groups could have been grouped marketing. The data does not support this unintended effect: most of the sales were made through local traders or intermediaries, or at local markets. Table 5.9 shows more project participants selling any of those eight crops to traders or on local markets (columns 3 and 4), but that reflects the overall increase in share of households selling any crop (column 1).[24] In other words, project implementation did not change behaviours when it comes to who to sell to.

5.2.2 Business support and Village Saving and Loan Associations (VSLAs) formation

Apart from direct support to agricultural production and marketing, the project supported household income generating activities through support of household businesses and improved access to credit. Such activities may also enhance agricultural production if any additional income generated is used to increase investments in agricultural inputs.

In Table 5.10, it seems that in the last three years, more households attended training on business plans among the project participants than among the non-participants (17 percent against 5 percent). However, those who attended such training attended more

times in the comparison group (which explains similar average number of times a household member received training between the two groups, in column 2).

Table 5.10: Training attendance on business plans

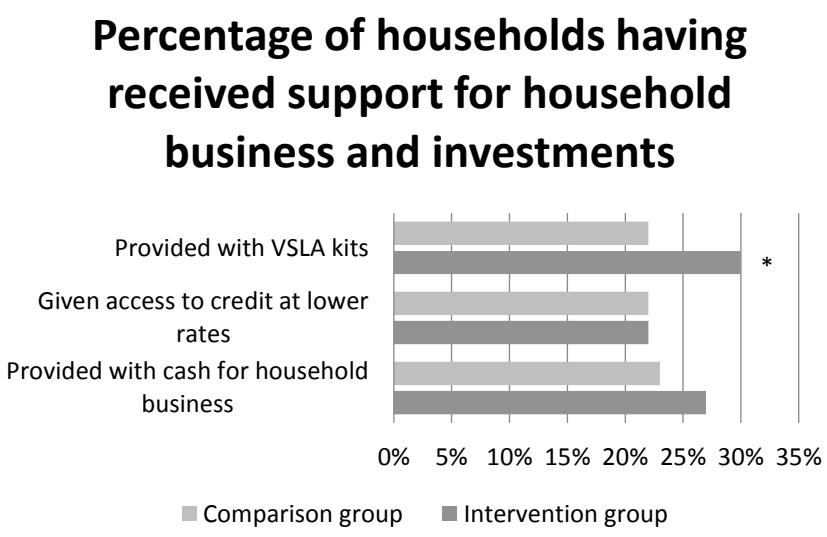
	1 In the last 3 years, a HH member attended training on business plans	2 Since 2013, number of times a HH member received training on business plans
Intervention group mean	0.17	0.31
Comparison group mean	0.05	0.21
Difference:	0.12*** (0.03)	0.09 (0.14)
Observations (intervention group)	301	301
Observations (total)	667	667

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions.

30 percent of households declared being provided with VSLA kits (passbooks, record book, metallic cash box and padlocks) among the project participants, against 22 percent among the non-participants (difference significant at 10 percent, see Figure 5.5).

In the final evaluation report by Foncier Consultant, according to focus group discussions conducted in March 2016, 'beneficiaries in Rumbek County repeatedly mentioned cash grants and training in microfinancing as the most helpful activities'. This Effectiveness Review focused on the agriculture and livelihood component of the project, and sampled project participants among those who at least took part in seed distributions. As shown on Figure 5.5, households were not exposed to cash grants in a greater proportion than in the comparison group, and access to credit, from any NGO or government or cooperative, does not look different between the two groups.

Figure 5.5: Percentage of households having received support (in the three years prior to the survey)



5.2.3 Revenue diversification

Table 5.11 presents the share of households who declared receiving monetary income from different agriculture and livestock related activities. 83 percent of project participants declare having received any monetary income from farming activities in the last 12 months, whereas only 64 percent of comparison households do. This suggests first that the eight crops in the survey do not capture all sources of farming income (only 41 percent of households in the comparison group and 67 percent sold any of the eight crops). Second, even if we do not have data on all the crops that the households grew, this result suggests that more households received monetary income, all crops together, among the project participants than comparison households.

The share of households making any income from processing (all crops together) is not different from one another in the two groups, which support the assumption that there may be substitution effects that are unobserved. The project may have put emphasis on value-addition on certain crops, at the expense of processing of other crops: processing is traditionally a task undertaken by women, and it could be that the time devoted to processing could not be expended.

Table 5.11: Proportion of households having received any income from agriculture and livestock

	1 In the past 12 months, the household received any income from farming	2 In the past 12 months, the household received any income from processing	3 In the past 12 months, the household received any income from livestock rearing	4 In the past 12 months, the household received any income from selling livestock	5 In the past 12 months, the household received any income from fishing or hunting
Intervention group mean	0.83	0.49	0.52	0.41	0.09
Comparison group mean	0.64	0.46	0.37	0.30	0.11
Difference:	0.20***	0.03	0.15***	0.11***	-0.02
	(0.03)	(0.04)	(0.04)	(0.04)	(0.03)
Observations (intervention group)	301	301	301	301	301
Observations (total)	667	667	667	667	667

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions.

Table 5.12 shows an increase in the share of households receiving income from casual labour and household businesses.

Table 5.12: Proportion of households having received any income from business or other labour

	1 In the past 12 months, the household received any income from casual labour	2 In the past 12 months, the household received any income from business	3 In the past 12 months, the household received any income from waged job
Intervention group mean	0.21	0.25	0.17
Comparison group mean	0.10	0.14	0.13
Difference:	0.12***	0.12***	0.04
	(0.03)	(0.03)	(0.03)
Observations (intervention group)	301	301	301
Observations (total)	667	667	667

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions.

Column 1 of Table 5.13 shows a slight increase in the share of households receiving income from rents, and column 3 could reflect the cash grant component of the project (statistically significant at 10 percent only, which is consistent with the above findings shown in Figure 5.5).

Table 5.13: Proportion of households having received any income from other revenue

	1 In the past 12 months, the household received any income from rents	2 In the past 12 months, the household received any income from remittances	3 In the past 12 months, the household received any income from social transfers	4 In the past 12 months, the household received any income from any other sources
Intervention group mean	0.07	0.21	0.08	0.29
Comparison group mean	0.02	0.19	0.04	0.27
Difference:	0.04**	0.02	0.03*	0.02
	(0.02)	(0.04)	(0.02)	(0.04)
Observations (intervention group)	301	301	301	301
Observations (total)	667	667	667	667

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions.

Figure 5.6: Percentage of households having received revenue from different sources in the last 12 months

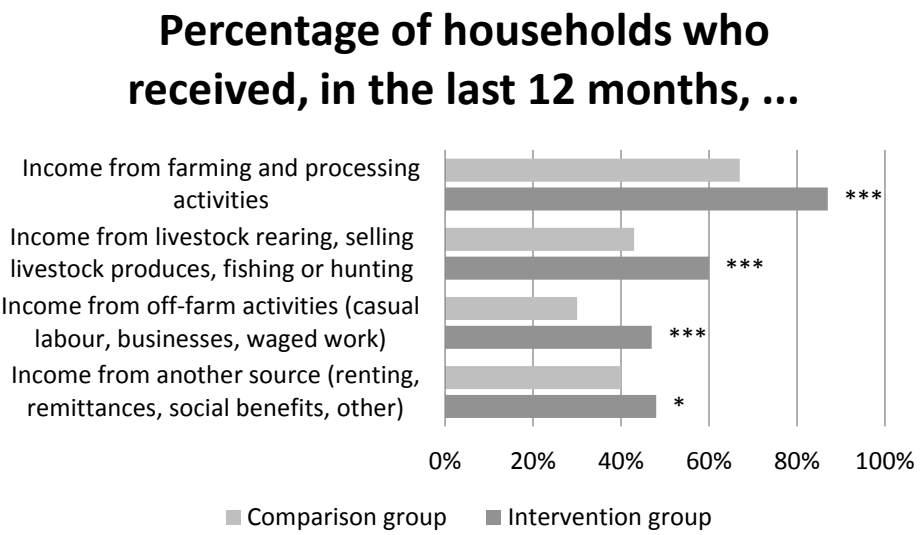


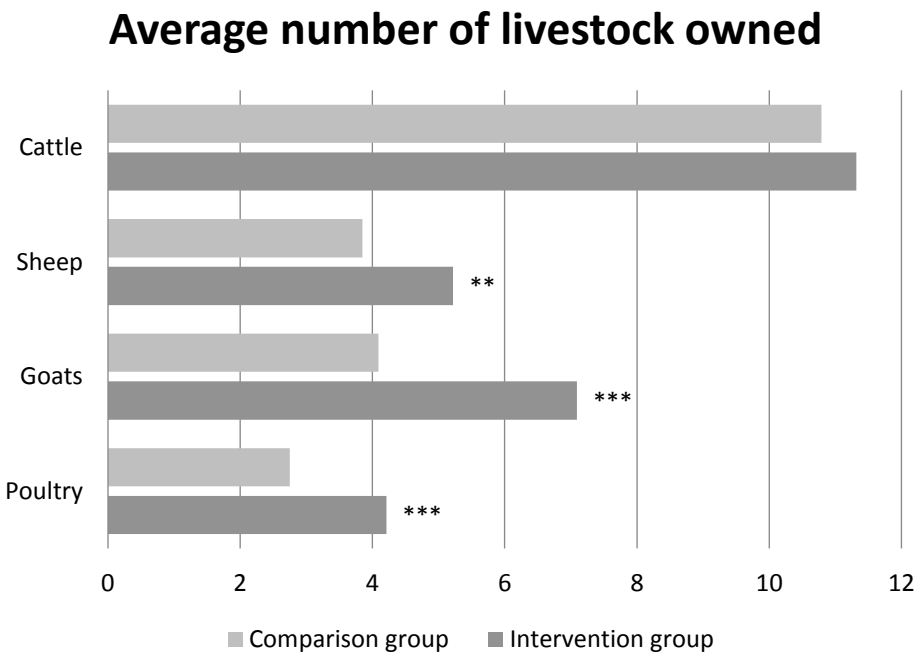
Figure 5.6 shows the proportion of households having received monetary income from farming and processing activities, from activities related to livestock, from off-farm activities and from other sources. Differences between project participants and non-participants are statistically significant at 1 percent, except for the last category, for which it is only significant at 10 percent. On average, project participant households received income from 2.3 categories of the 4 presented on Figure 5.6, against 1.8 among non-participants.[25]

5.2.4 Livestock

Livestock are not only a source of food and revenue through sales of livestock products, but also are often considered informal saving devices. Livestock thefts are also an important source of conflict, and livestock loss a consequence of displacement (Foncier Consultant 2016 report). Overall in the surveyed sample, the number of livestock owned is lower at the time of the survey than in 2013, as respondents recalled it.

At the time of the survey, almost all households owned livestock, and the project led to increases in the share of households owning livestock (96 percent of project participants, against 89 percent of non-participants – difference statistically significant). The average number of goats and poultry owned is higher among project participants than in the comparison group; cattle and sheep ownership is similar in both groups at the time of the survey (Figure 5.7). A larger share of project participants declared having received income from selling livestock than the comparison group (Table 5.11, column 4). It is hence likely that project participants accumulated a bit more livestock than non-participants and were able to sell some in the past 12 months. The survey took place right after the lean season, and it is possible that the project helped project participants to maintain their livelihood throughout this season (and their current level) by selling livestock. Selling livestock may also have helped project participants make investments, such as investments in agricultural inputs (plough or improved seeds) which contributed to increases in their production.

Figure 5.7: Livestock ownership



Among both comparison and intervention households, the number of cattle varies a lot, which explains the high average number of cattle in both groups. Despite there being no difference in the *average* number of cattle owned, there is a clear difference between the intervention and comparison households lower down the scale. In each group, 5 percent of the households own more than 50 cattle. In fact, 79 percent of project participants owned at least one head of cattle, against 68 percent of non-participant. This difference is statistically significant.

5.3 HOUSEHOLD INCOME AND WEALTH

5.3.1 Household income

Measuring household income directly is problematic: self-reported measures of total income are generally regarded as unreliable, given the wide variety of endeavours such populations engage in to generate income. Most households were engaged in other livelihood activities; a direct income measure would have to collect detailed information about the contribution of each of these activities to household income. This is not to mention that income of different household members may not necessarily be pooled within the household, making overall household income hard to measure.

In addition, if one were to measure total income, one would have to consider the variety of costs that the household is facing when engaging in different livelihood activities, as net income is what matters when it comes to characterizing the household's well-being.

For these reasons, the survey did not attempt to collect data on total household income directly. However, there is a widely recognized and strong association between household income and consumption. The Effectiveness Review therefore followed common practice in micro-level socio-economic analysis, by considering household consumption and expenditures as an indicator of income.[26]

This overall measure of household consumption is particularly important in the setting of the project under review because as the project was putting emphasis on specific

types of crops, it may be that the project had fostered increased engagement in production of some of those crops at the expense of lower engagement in production of other crops or other sources of income. If this is the case, overall household consumption, as a measure of the household's well-being, will not have improved.

To that end, respondents were asked to provide detailed information about their recent expenditure on both food and non-food items. Firstly, the respondents were asked from a list of 27 products what types of food they had consumed over the previous seven-day period, and 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 or a gift – how much it would be worth if it was purchased from the local market. In addition, the respondents were asked about the approximate value of all food consumed by the household outside of the dwelling.

The respondents were also asked how much they spent on particular regular non-food items and services from a list of 18 items, such as gas, soap, and transport costs over the past 30 days. Finally, they were asked to estimate the value of other occasional types of expenditure that they had incurred over the previous 12 months from a list of 19 items, which included clothes, medical expenses and home repair.

The household expenditure measure was calculated by converting each of the expenditure types into a per day figure and adding them together. This figure was then divided by a factor representing household size to generate a per day, per person expenditure figure that would take into account the household structure, called per adult equivalent.[27] Food and non-food indicators are presented separately and together in Table 5.14 (columns 1, 2 and 3).[28]

Based on Table 5.14, we are confident that project participants have a higher total consumption than non-participants, and that this is driven by food consumption.

Table 5.14: Household consumption and expenditure

	1 Total food consumption (SSP) per adult equivalent per day (winsorized)	2 Total non-food consumption (SSP) per adult equivalent per day (winsorized)	3 Total daily food AND non-food consumption (SSP) per adult equivalent per day (winsorized)	4 Log - Total food consumption (SSP) per adult equivalent per day (winsorized)	5 Log - Total daily food AND non-food consumption (SSP) per adult equivalent per day (winsorized)
Intervention group mean	227.25	33.57	260.64	4.55	4.87
Comparison group mean	143.34	32.79	183.43	3.93	4.35
Difference:	83.92*** (26.96)	0.78 (5.01)	77.20** (30.33)	0.62*** (0.13)	0.52*** (0.10)
Observations (intervention group)	301	301	301	301	301
Observations (total)	667	667	667	667	667

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions.

As mentioned earlier, South Sudan experienced hyperinflation in 2016, which makes recalling non-food expenditures, particularly over the past 12 months, a very difficult exercise for respondents. We are more confident about food consumption, as

respondents were asked about their consumption over the last 7 days; however, it may also mean that people's estimates of the market value of their home-produced crops may be out of date at the time of the survey. However, at the time of the survey, such recall mistakes should not be different between participants and non-participants, which would mean that the mean presented in Table 5.14 may be biased, but in the same way so that the difference should reflect difference between the two groups.[29]

Columns 4 and 5 of Tables 5.14 present logarithmic transformation of household food and total consumption (columns 1 and 3), in which more weight is given to households with low level of expenditures. First, the fact that the differences between the two groups in columns 4 and 5 are significant means that the results of columns 1 and 3 are not driven by the households with particularly high expenditure.

Second, to interpret results displayed under columns 4 and 5, let's take the exponential: switching from the comparison to the intervention group, we observe an increase in food consumption geometric mean of 86 percent, and total consumption geometric mean of 68 percent.

5.3.2 Wealth

In this section, we explore the project's impact on household's wealth. Like livestock, wealth may be interpreted in two ways from the perspective of livelihoods. Firstly, wealth may be seen as a *driver* of household income, insofar as households can sell off assets in times of crisis but also more easily finance the costly investments needed to adapt livelihood strategies and innovate. However, wealth may also be regarded as exactly the type of well-being indicator – a 'final' outcome – that would be improved in livelihoods interventions. Typically, these types of final well-being outcomes take more time to change than more immediate drivers or characteristics of livelihoods.

During the course of the questionnaire, respondents were asked to provide information about their household's ownership of various assets (including livestock, productive equipment, and household goods), as well as about the conditions of the family's house, both in 2013 and at the time of the survey. This information on asset ownership and housing conditions was used to generate an index of overall household wealth.

The wealth index was generated under the assumption that if each of the assets and housing characteristics constituted suitable indicators of household wealth, they should be correlated with each other. That is, a household that scores favourably on one particular wealth indicator should be more likely to do so for other wealth indicators. A small number of items that had low or negative correlations with the others were therefore not considered good wealth indicators and so were excluded from the index.[30]

A data reduction technique called principal component analysis (PCA) was used to produce two indices of overall wealth, one based on the recalled data from 2013, and one based on the household's situation at the time of the survey. In particular, our wealth index is taken directly from the first principal component.[31] PCA enables us to assign weights to the different assets, to capture as much information as possible from the data. Broadly, PCA assigns more weight to those assets that are *less* correlated with all the other assets, as these carry more information. By contrast, items with *more* intra-correlation are given less weight.

In order to ensure the same weights were applied to assets for both the recalled wealth index and the wealth index for the time of the survey, the two 'waves' of data were first pooled before undertaking the PCA procedure. This means changes in wealth can be more easily compared over time. It should also be noted that the wealth index for 2013 is the measure that has been used throughout this analysis to control for baseline differences in wealth status between project and non-project households.

The wealth index hence computed is a score, which characterizes the distribution of wealth in the population. Hence at baseline, as shown in Table A1.1, more participants were in the highest 20 percent of the distribution, for example, before PSM correction. It is worth underlining, however, that the assets on which we have information in this dataset do not allow us to distinguish well between the lowest 70 percent of households. This is because many households do not own the assets listed in the survey, and have similar livestock ownership and housing characteristics. In other words, the asset-based wealth index used in this report is better at discriminating among the richest households, than the poorest. We indeed observe a relatively wide distribution of wealth on the top part of the distribution.

For the analysis in this section, we start by 'normalizing' the wealth index.[32] This means that the impacts of the project that we report can be directly understood as the *number* of standard deviations by which the project improved wealth. The standard deviation is a measure of the breadth of the distribution.

Column 1 of Table 5.15 shows the difference in wealth index between the two groups. Hence, after correcting for initial baseline differences using the regular matching procedure that has been used throughout the other tables in this report, we observe an average difference of 0.30 standard deviations. This is partly driven by the wide distribution of wealth on the top part of the distribution: the effect is robust to excluding the top values,[33] although of smaller size (0.2 standard deviations).

Table 5.15: Wealth

	1 Normalized wealth index	2 Change in normalized wealth index since 2013
Intervention group mean	0.21	0.05
Comparison group mean	-0.09	-0.08
Difference:	0.30***	0.13**
	(0.09)	(0.05)
Observations (intervention group)	301	300
Observations (total)	667	664

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions.

In column 2, however, we take a slightly different approach. We calculate the differences between wealth at the time of the survey and in 2013, and compare these differences between project participants and non-participant households in the matched sample.[34] This column shows that not only the project participants improved their situation (average positive change in normalized wealth index among project participants), but also that non-project participants saw their situation deteriorate (negative change) since 2013.[35]

Also, as presented earlier, the project seems to have enabled project participants to sell some of their animals in the last 12 months, without further deterioration of their livestock (same average number of cattle owned in both groups), and sheep, poultry and goat ownership is higher among the project participants on average. This is consistent with the results on the general wealth index (which takes into account livestock ownership).

5.4 GOVERNANCE AND WOMEN'S PARTICIPATION

5.4.1 Governance

The project aimed to strengthen local governance and community organization, to improve inclusiveness of communities (women and youth particularly), and ultimately build peace and conflict resolution capacities. Therefore, the questionnaire explored awareness of respondents when it comes to local governance, as well as involvement. These data were initially planned to be complemented by qualitative data (focus group discussions with project participants), but due to insecurity, the focus group discussions were not held.

Column 1 of Table 5.16 explores whether respondents are aware of community plans being put in place. Community plans are proposals put together by communities, which target activities that the community members believe can solve particular problems. Example activities might be constructing roads to improve the transport network in the area. In the intervention group 41 percent were aware of such plans and 38 percent in the comparison group. This difference is not statistically significant.

Among project participants, 32 percent reported that either they or a household member attended a community planning meeting in the last three years (column 2 of Table 5.16). This is not different in the comparison group.

Table 5.16: Proportion of respondents being aware of or having participated in communal planning

	1 The respondent is aware of community plans that have been taking place in the community	2 A HH member participated in any of these planning meetings in the last 3 years	7 The respondent knows who the leaders of the community/association are
Intervention group mean	0.41	0.32	0.52
Comparison group mean	0.38	0.30	0.39
Difference:	0.03	0.02	0.12***
	(0.04)	(0.04)	(0.04)
Observations (intervention group)	301	301	301
Observations (total)	667	667	667

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions.

However, more project participants declared knowing who the leaders of the community were than in the comparison group (52 percent against 39 percent).

5.4.2 Women's participation in groups and meetings

The project under review did not organize women's rights training but the team gender officer supported the different project activities to raise awareness on women's rights. In the intervention group 19 percent of households declared having attended training on women's rights in the last 3 years, against only 3 percent in the comparison group (column 1 of Table 5.17). This is likely to reflect the sensitization done by the gender officer when supporting groups' creation and group participation.[36]

Table 5.17: Training on women's rights

	1 In the last 3 years, a HH member attended training on women's rights	2 Since 2013, number of times a HH member received training on women's rights
Intervention group mean	0.19	0.52
Comparison group mean	0.03	0.03
Difference:	0.17***	0.49***
	(0.02)	(0.10)
Observations (intervention group)	301	301
Observations (total)	667	667

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions.

Comparing column 1 and 2, it seems that households who participated in the programme received such sensitization more times than those who did not participate in the programme (report between column 1 and 2).

The results presented in the rest of this section and the following section are calculated based on the subsample of households for which the individual module of the survey was filled (59 percent of the overall sample). These are households for which the main woman decision maker of the household was available. Based on their recalled baseline characteristics, they are a bit different from the overall sample. As presented in Table A1.3 in Annex 1, in this sub-sample, 73 percent of households are women-headed, with household heads being less educated (7 percent received a formal education), more likely to be farming groundnut, sorghum, kudru, okra and maize in 2013 than the rest of the sample, more likely to be already receiving income from farming and processing activities in 2013 (61 percent), and overall worse-off based on the asset-based wealth index that was computed for this project (households for which the survey module was filled in are over-represented in the lowest 20 percent of the wealth distribution). The results that will be displayed hereafter are not representative of the overall sample of participants and non-participants. In particular, women-headed households are more represented in this sample. This is important because the respondents may face different situations depending on whether they are household heads, or the main woman decision maker in men-headed households.

In the intervention group, the respondent could be directly involved in project activities or not. As shown in Table A1.1, the individual module, administered to women, was filled in more often in the intervention group than in the comparison group (65 percent against 55 percent).[37] To correct for this and make sure our sample is balanced on baseline characteristics, we ran a different PSM model on this subsample of households.

As presented in Section 2.2, the project aimed to improve women's participation in group activities, particularly in village savings and loans associations. Women respondents were asked about their participation in women's associations, farmers' associations or a rural club, cooperatives, credit or microfinance groups, disaster management groups and social support groups. More precisely, respondents were asked whether they regularly attended meetings of each of those groups.

More respondents in the intervention group indeed were taking part in a group at the time of the survey (60 percent, against 45 percent in the comparison group), whereas 48 percent did in 2013 (not significantly different in the two groups after PSM correction). This effect is driven by participation in women's associations (51 percent among project participants, 26 percent among non-participants). Women's participation in other groups is still quite low (and not different between the intervention and

comparison groups): on average among the project participants, 29 percent of women participate in farmers' associations or a rural club, 29 percent in a social support group, 27 percent in cooperatives, 18 percent in credit or microfinance group and 11 percent in disaster management group.

10 percent of the women respondents in the project participant households started regularly attending meetings of a group between 2013 and 2016 (column 3 of Table 5.18).

Women who participate in a group participate on average in three groups (and this is not statistically significantly different in comparison and intervention groups). A large share of women are not involved in any group (55 percent in the comparison group, column 1 of Table 5.18), but those who participate tend to have several commitments.

Table 5.18: Proportion of women respondents having participated in groups and reported feeling confident in meetings

	1 The respondent participates in a group	2 The respondent is involved in making the group's decisions	3 The respondent has started participating in a group since 2013	4 The respondent is confident in meetings
Intervention group	0.60	0.26	0.10	0.77
Comparison group	0.45	0.28	0.00	0.84
Difference:	0.15*** (0.06)	-0.02 (0.06)	0.10** (0.05)	-0.08* (0.05)
Observations (intervention group)	196	196	196	196
Observations (total)	406	406	406	406

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions.

However, involvement in the group's decisions is not different between the two groups (column 2), as measured by the respondent answering that they participate in making decisions in any group to a large or medium extent (26 percent of respondents among project participants). Increased participation in a group does not seem to come with increased involvement in decision making: among project participants, 42 percent of the women who participate in women's associations are involved in decision making in these associations, and this is not different between the two groups. Let's also underline that it is not only participation of women in farmers' associations that is low in our sample, but also women's involvement in decision making, if they participate, is too: 23 percent among the project participants.

Finally, respondents are asked about their opinion about two statements to better understand their confidence in speaking-up in a meeting. Specifically, we measure confidence if the respondent disagrees with the statement that 'Public forums held in your village can be intimidating – it is difficult for a women like you to stand up and voice any concerns' or agrees that 'If a decision were made in a public forum that might negatively affect your life and those of your children, you would not hesitate to stand up and protest, despite the possible negative consequences'. We observed a difference in confidence in meetings among the project participants, as less respondents answered in a way that would show that they are confident in speaking up (77 percent, against 84 percent in the comparison group). Among the project participants, confidence in

meetings is positively correlated with regularly taking part in at least one group. As more respondents took part in groups among project participants than among non-participants, this may reflect a selection effect: the 40 percent of women who are left not participating in any group among project participants are the least confident.

5.4.3 Women's participation in household's decision making and to the household's resources

We then explored participation in households' decision making, as presented in Table 5.19. We considered different areas of the household activities[38] and asked whether the respondent is involved in making decisions for each of those areas, and with whom (husband, or other household member). Results presented in Table 5.19 are hence the perception of the main household decision maker, among women, and their contribution to household's decision, in a sample where 73 percent of households are women-headed.[39]

In column 1, we show the share of respondents who are involved alone or jointly with another household member in decisions regarding all areas of household activities. No difference is observed between the two groups, and only 26 percent among the project participants household. Column 2 explores whether the respondent either takes decisions by herself in all those areas, or considers that she can influence others' decisions. 43 percent of women in the comparison group, against only 27 percent among the project participants do.

Table 5.19: Proportion of women respondents participating in household's decision making

	1 The respondent is involved in HH decision making	2 The respondent makes most of the HH decisions by herself or influences others' decisions
Intervention group	0.26	0.27
Comparison group	0.21	0.43
Difference:	0.05	-0.16***
	(0.04)	(0.06)
Observations (intervention group)	196	196
Observations (total)	406	406

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions.

The respondent's autonomy to make decisions about her own movement is not different between the two groups, and 39 percent of the respondents in households that took part in the project have a say in the decision to travel to visit relatives outside the community, or to participate in community group activities or meetings, as shown in Table 5.20.

Table 5.20: Proportion of women respondents having a say in making decision about their own movement

	1 The respondent has a say in making decision about her own movement
Intervention group	0.39
Comparison group	0.32
Difference:	0.07 (0.05)
Observations (intervention group)	196
Observations (total)	406

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions.

Finally, 42 percent of the respondents in project participant households declared that the share of their contribution to the household's resources has increased since 2013 (Table 5.21), against 27 percent in the comparison group. By targeting vegetable growers and processing activities, traditionally activities performed by women, the project may have contributed to increasing women's resources within the household relative to other household contributors.

Table 5.21: Proportion of women respondents having increased or same share of contribution to the household's resources

	1 The respondent's contribution to the household's resources has increased since 2013	2 The respondent's contribution to the household's resources has stayed the same since 2013
Intervention group	0.42	0.40
Comparison group	0.27	0.35
Difference:	0.15*** (0.05)	0.05 (0.06)
Observations (intervention group)	196	196
Observations (total)	406	406

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions.

One side effect, which this Effectiveness Review cannot explore, is whether the project added to women's overall workload by putting emphasis on activities that they are mainly responsible for. Further work would be needed to understand whether this is the case.

6 CONCLUSIONS

6.1 CONCLUSIONS

This section summarizes the main findings from Section 5.

The results show that thanks to the project more households received seeds (groundnut, sorghum and vegetable), and that more households received trainings on planting groundnuts and sorghum, and on fertilizer, than in the comparison group.
In the year preceding the survey (October 2015 to September 2016), usage of plough and power tillers was higher in the intervention group than in the comparison group. For the main crops in the area (sorghum, maize, groundnut, sesame), land preparation took place in early 2016, that is to say after the end of the project, which suggests a continued increased usage of distributed tools. Similarly, usage of improved seeds or seedlings is observed in the year prior to the survey, significantly more than in the comparison group (34 percent of households against 26 percent). The project also apparently encouraged participants to adopt organic farming techniques: more households than in the comparison group produced organic fertilizer and used organic farming techniques.

This seems to have resulted in an increase in the share of households growing the targeted crops (groundnuts, sorghum, okra, kudru, cucumbers and onions), and diversification in this set of crops in the year prior to the survey. This also seems to have resulted in a change in crops that were not targeted by the project and measured in the survey: palm, which very few households grow, and maize, which 50 percent grew in 2013, and 56 percent of project participants in 2016. The project also led to an increase of the volume of production for all the targeted crops, except for okra and onions. The volume of production of maize was not significantly affected by the project. Even though an increase in volume is observed for palm producers, farmers who were already engaged in palm production, or who had started between 2013 and 2016, are very few, more likely to be among the richest households and more likely to be engaged in growing almost all of the eight crops measured in the survey. The effect on palm production may hence be very specific to those palm producers.
The project put emphasis on value-addition by crop processing: sorghum and okra producers are relatively more likely to process the crop they produced than similar comparison producers. Similarly, among producers of groundnuts, sorghum, cucumbers, kudru or okra, project participants were more likely to sell some than non-participants. Crops are mainly sold to local traders and intermediaries, or at local markets, among both project participants and non-participants.

The project also supported non-agricultural activities through training on business plans. More households were trained on business plans in the past three years than in the comparison group (although only 17 percent of households) but less intensively (those who were trained received fewer training sessions than in the comparison group). Some 30 percent of project participants received VSLA kits, which represents a seven percentage point increase compared to the comparison group. The share of households that received cash grants or credit at a lower rate is not different between the two groups.
This support of the project towards non-agricultural activities was aimed at improving revenue diversification. We indeed observed a larger share of households receiving monetary income in the 12 months preceding the survey from farming, livestock or off-farm activities. In the context of the 2016 hyperinflation, it is likely that in-kind transactions were more frequent than cash ones. Even though this Effectiveness Review focused on receiving monetary income, measurement of income through

consumption and measurement of asset-based wealth confirm the positive results of the project.

We indeed observed higher food consumption and total consumption (driven by food consumption, no difference in non-food consumption) per capita among households participating in the project, which suggests that the project was successful in improving the livelihood of the project participants. Measurement of asset-based wealth highlights on the one hand that the project participants were better off than non-participants in September 2016, but also on the other hand that assets and living conditions of the non-participants deteriorated between 2013 and 2016.
Finally, it is worth emphasizing that livestock ownership overall decreased in the surveyed population, which suggests an overall deterioration of livelihood condition. The project contributed to increasing ownership in poultry, sheep and goats at the time of the survey, but also increase share of households having received income from selling livestock in the last 12 months. This suggests that in the short run, the project may have helped households facing shocks through livestock sales maintain their consumption or make investments.

Livelihood components of this project were implemented in order to build peace, through enhancing participation of women and youth in community groups and reducing the gap between community institutions and farmers. No effect is observed on awareness of respondents of communal plans (and only 41 percent of project participants are aware of such plans that have been taking place), although a larger share of project participants knows who the community leaders are (52 percent among project participants, against 39 percent among non-participants).
Overall, the project increased women's participation in groups by 15 percentage points, and particularly in women's associations. It is worth underlining that participation of women is low in farmers' groups (29 percent among women respondents in the intervention group), and that this was not affected by the project. It is significant to note that the project did not have any impact on the quality of participation: overall, only 26 percent of respondents in the intervention group have a say in a group's decisions, and this is not different between project participants and non-participants. In addition, a smaller share of women in households who participated in the project is confident in participating in meetings than in the comparison group (77 percent against 84 percent, significant at 10 percent only).

Among women respondents to the individual module, the project did not have an impact on their say in the household's decisions (a quarter of respondents are involved in household decision making) and they are less likely to take decision by themselves or influence others' decisions in the intervention group. Women respondents' say in making decisions about their own movement is still quite low (39 percent on average in the intervention group). Finally, more respondents in project participant households declared that the share of their contribution to the household's resources has increased since 2013, compared to non-project participants.

The survey focused on two crops that were not targeted by the project (palm and maize), and while it is likely that other crops were grown, mainly sesame, we do not have evidence of substitution effects (farmers increasing their production of the targeted crops but reducing their production of other crops). Indeed, based on results on maize production, it seems that the volume of production of other crops was not affected by the project (average produced quantity was not statistically different between project participants and non-participants among producers). However, processing behaviours may have been. Indeed, the share of households using equipment and processing machines was slightly reduced by the project on the one hand; on the other hand, even though processing of some of the targeted crops increased among project participants, the share of households earning revenue from processing stayed the same between the two groups. That suggests that project participants switched from processing some crops they grew towards processing more

of the targeted crops, and that the overall effect on bringing more households towards crop processing is nil. Processing is an activity traditionally undertaken by women; this substitution could hence be an effect of their not being able to extend their workload, given other farming and household commitments. It could be that households who are processing are processing a larger share of their production.
Finally, the fact that more project participant households declared receiving monetary income from farming (of any crop), and that income measured through household overall consumption and asset-based wealth were higher among the project participants than non-participants, suggest that the overall effect of the project at the household level is positive.

6.2 PROGRAMME LEARNING CONSIDERATIONS

Explore possibilities of fostering collective marketing to improve access to market

In this project, vegetable producers were asked to form groups in order to facilitate adoption of improved agricultural practices of production and processing, but no emphasis was put on marketing. For non-vegetable producers, no emphasis was put on involvement in or formation of farmers' groups.

More project participants produced and sold the targeted crops, than non-participant households. These were sold mainly to traders or in market centres; project participants and non-participants were as likely to sell these crops to traders or market centres. Joining forces in marketing may bring more farmers to accessing markets and help farmers getting a better price, and reducing costs of, and time devoted to, selling produces.

Encourage plan development to be more inclusive and improve communication of the plans to village members

Fifty-nine percent of project participants are not aware of the existence of community plans, and this is not statistically different between project participants and non-participants. While the programme supported plans' development at the payam level, this suggests that plan development could be more inclusive on the one hand, and that plans could be better communicated on the other hand, to foster awareness and ultimately the active participation of citizens.

Support women's empowerment through leadership in mixed groups and sensitization of men

The focus of the project on vegetable production (four of the six targeted crops), and on processing – activities undertaken traditionally by women – led to a large involvement of women in the project. The vegetable producer groups created by the project were mainly women's groups; VSLAs were initially mixed groups, with a majority of women participants. However, based on discussions with the project team, most men in these groups drop out, most likely because they were not interested in the VSLAs. The fact that other groups were already open to them may have been a factor in this decision too. This is reflected in the data through more women respondents in project participant households regularly attending meetings of a group, and particularly of a women's association, than non-participants. However, this did not translate into more involvement in decision-making within those groups, nor in overall confidence in participating in meetings. In fact, an overall decrease in confidence in meetings is observed. Future projects should consider actively promoting women's leadership in decision-making in groups and accompanying women to build confidence in taking part

in mixed assemblies and in speaking-up and making their voices heard. Men will need to be involved in this process, to listen to and discuss issues brought up by women.

APPENDIX 1: BASELINE STATISTICS BEFORE MATCHING

Table A1.1: Descriptive statistics: comparison between intervention and comparison households at baseline

	N	Intervention mean	Comparison mean	Difference	Standard error
Household head characteristics					
Household head age	693	37.31	37.01	0.29	0.74
Household head is a male (%)	693	48.05	52.21	-4.16	3.82
Household head is in good or fair health, and able to do domestic or livelihood	693	97.08	96.36	0.71	1.37
Household head received any formal education (%)	693	11.04	11.43	-0.39	2.42
Household head completed primary education (%)	693	5.52	3.64	1.88	1.58
Household head completed secondary education (%)	693	0.32	0.26	0.06	0.41
Household characteristics					
Household size	693	3.86	3.81	0.05	0.16
Proportion of household members who are children (less than 15 years) (%)	693	19.47	22.45	-2.98	1.95
Proportion of household members that are in good or fair health, and able to do work (%)	693	87.98	88.81	-0.83	1.5
Interview characteristics					
Interviewee age	693	36.22	36.41	-0.19	0.74
Interviewee is a male (%)	693	39.61	45.97	-6.36*	3.78
Interviewee is in good or fair health, and able to do domestic or livelihood work (%)	693	97.08	96.1	0.97	1.4
Interviewee received any formal education (%)	693	12.01	9.61	2.4	2.36
Interviewee completed primary education (%)	693	5.19	2.34	2.86**	1.42
Interviewee completed secondary education (%)	693	0	0	0	0
Interviewee is a Christian (%)	693	95.45	97.14	-1.69	1.43
Interviewee is married (%)	693	91.23	93.77	-2.53	2
Interviewee can read and write a simple letter (%)	693	16.23	11.43	4.81*	2.62
The household head is the interviewee (%)	693	89.29	91.43	-2.14	2.25
The module of the survey for women respondents was filled in (%)	693	64.61	55.06	9.55**	3.74
Observations	693				

Table A1.1 (cont.)

	N	Intervention mean	Comparison mean	Difference	Standard error
Livestock and agriculture					
Number of cattle owned in 2013	693	17	17.25	-0.26	1.92
Number of sheep owned in 2013	693	6.15	5.11	1.04	0.68
Number of goats owned in 2013	693	8.19	8.21	-0.02	0.76
Number of poultry owned in 2013	693	5.18	5.12	0.06	0.6
The household owned any land in 2013 (%)	693	88.96	91.95	-2.99	2.23
Farming was the household main activity in 2013 (%)	693	96.43	98.44	-2.01*	1.18
The household grew vegetables (cucumbers, kudru, okra, onions) in 2013 (%)	693	57.47	32.99	24.48***	3.68
The household farmed any of the 8 main crops in 2013 (%)	693	91.88	81.3	10.58***	2.63
The household farmed more than the median number of crops (out of the 8 crops identified) (%)	693	62.01	38.18	23.83***	3.72
The household reported any 'Don't know' values on recall data on crops (%)	693	5.84	5.71	0.13	1.79
The household farmed any of the 6 crops identified by the project in 2013 (%)	693	90.91	78.44	12.47***	2.77
The household farmed groundnuts in 2013 (%)	693	83.12	72.21	10.91***	3.19
The household farmed sorghum in 2013 (%)	693	77.92	58.44	19.48***	3.52
The household farmed cucumbers in 2013 (%)	693	5.19	0.78	4.42***	1.24
The household farmed kudru in 2013 (%)	693	44.16	15.06	29.09***	3.25
The household farmed okra in 2013 (%)	693	54.22	30.91	23.31***	3.66
The household farmed onions in 2013 (%)	693	10.71	3.12	7.60***	1.86
The household farmed palm in 2013 (%)	693	3.57	0.52	3.05***	1.03
The household farmed maize in 2013 (%)	693	51.95	37.14	14.81***	3.76
Number of minutes it took from the household's house to reach the local market in 2013	693	69.9	69.24	0.65	4.74
Log – Number of minutes it took from the household's house to reach the local market in 2013	693	3.55	3.7	-0.15	0.11
Observations	693				

Table A1.1 (cont.)

	N	Intervention mean	Comparison mean	Difference	Standard error
Monetary income and wealth					
The household received any income from farming and processing activities in 2013 (%)	693	71.75	50.13	21.62***	3.66
The household received any income from livestock rearing, selling livestock products, fishing or hunting in 2013 (%)	693	51.95	43.38	8.57**	3.81
The household received any income from off-farm activities (casual labour, businesses, waged work) in 2013 (%)	693	37.99	22.6	15.39***	3.44
The household received any income from another source (renting, remittances, social transfers, etc.) in 2013 (%)	693	40.58	23.12	17.47***	3.47
In 2013, the household received any income from farming (%)	693	68.18	45.45	22.73***	3.7
In 2013, the household received any income from processing (%)	693	39.29	30.91	8.38**	3.63
In 2013, the household received any income from livestock rearing (%)	693	46.1	33.25	12.86***	3.7
In 2013, the household received any income from selling livestock products (%)	693	32.79	30.65	2.14	3.56
In 2013, the household received any income from fishing or hunting (%)	693	10.39	8.05	2.34	2.2
In 2013, the household received any income from casual labour (%)	693	14.94	6.75	8.18***	2.32
In 2013, the household received any income from business (%)	693	17.86	11.17	6.69**	2.66
In 2013, the household received any income from waged job (%)	693	20.78	9.87	10.91***	2.68
In 2013, the household received any income from rents (%)	693	6.17	1.3	4.87***	1.39
In 2013, the household received any income from remittances (%)	693	16.88	11.69	5.19*	2.65
In 2013, the household received any income from social transfers (%)	693	7.79	3.38	4.42**	1.71
In 2013, the household received any income from any other sources (%)	693	25	15.06	9.94***	3.01
The household was in the lowest 20% of the wealth distribution, in 2013 (%)	693	17.21	23.38	-6.17**	3.09
The household was in the second 20% of the wealth distribution, in 2013 (%)	693	19.81	19.22	0.58	3.03
The household was in the third 20% of the wealth distribution, in 2013 (%)	693	18.18	21.3	-3.12	3.06
The household was in the fourth 20% of the wealth distribution, in 2013 (%)	693	18.51	21.3	-2.79	3.06
The household was in the highest 20% of the wealth distribution, in 2013 (%)	693	26.3	14.81	11.49***	3.03
Meeting attendance for women respondents					
The respondent regularly attended meetings in 2013 (%)	411	50.25	35.38	14.87***	4.84
Observations	693				

Table A1.2: Comparison between women-headed and men-headed households

	N	Women-headed HH mean	Men-headed HH mean	Difference	Standard error
Household head characteristics					
Household head age	693	34.92	39.33	-4.41***	0.72
Household head is in good or fair health, and able to do domestic or livelihood	693	96.8	96.56	0.24	1.36
Household head received any formal education (%)	693	5.23	17.19	-11.96***	2.36
Household head completed primary education (%)	693	1.16	7.74	-6.57***	1.55
Household head completed secondary education (%)	693	0	0.57	-0.57	0.41
Household characteristics					
Household size	693	3.72	3.94	-0.22	0.15
Proportion of household members who are children (less than 15 years) (%)	693	21.33	20.93	0.4	1.95
Proportion of household members that are in good or fair health, and able to do work (%)	693	89.46	87.43	2.03	1.49
Interview characteristics					
Interviewee age	693	35.03	37.61	-2.58***	0.73
Interviewee is a male (%)	693	1.45	84.24	-82.79***	2.07
Interviewee is in good or fair health, and able to do domestic or livelihood work (%)	693	96.51	96.56	-0.05	1.39
Interviewee received any formal education (%)	693	5.23	16.05	-10.81***	2.31
Interviewee completed primary education (%)	693	1.16	6.02	-4.85***	1.41
Interviewee completed secondary education (%)	693	0	0	0	0
Interviewee is a Christian (%)	693	97.67	95.13	2.55*	1.42
Interviewee is married (%)	693	88.66	96.56	-7.90***	1.96
Interviewee can read and write a simple letter (%)	693	11.34	15.76	-4.42*	2.6
The household head is the interviewee (%)	693	97.38	83.67	13.72***	2.17
The module of the survey for women respondents was filled in (%)	693	86.63	32.38	54.25***	3.12
Observations	693				

Table A1.2 (cont.)

	N	Women-headed HH mean	Men-headed HH mean	Difference	Standard error
Livestock and agriculture					
Number of cattle owned in 2013	693	15.28	18.97	-3.68*	1.91
Number of sheep owned in 2013	693	5.51	5.63	-0.12	0.68
Number of goats owned in 2013	693	8.03	8.37	-0.34	0.75
Number of poultry owned in 2013	693	5.23	5.06	0.17	0.6
The household owned any land in 2013 (%)	693	88.66	92.55	-3.89*	2.21
Farming was the household main activity in 2013 (%)	693	96.8	98.28	-1.48	1.18
The household grew vegetables (cucumbers, kudru, okra, onions) in 2013 (%)	693	48.26	39.54	8.71**	3.76
The household farmed any of the 8 main crops in 2013 (%)	693	86.63	85.39	1.24	2.64
The household farmed more than the median number of crops (out of the 8 crops identified) (%)	693	52.33	45.27	7.05*	3.79
The household reported any 'Don't know' values on recall data on crops (%)	693	6.4	5.16	1.24	1.77
The household farmed any of the 6 crops identified by the project in 2013 (%)	693	85.17	82.81	2.37	2.79
The household farmed groundnuts in 2013 (%)	693	77.33	76.79	0.53	3.2
The household farmed sorghum in 2013 (%)	693	67.15	67.05	0.1	3.57
The household farmed cucumbers in 2013 (%)	693	2.91	2.58	0.33	1.24
The household farmed kudru in 2013 (%)	693	32.56	23.5	9.06***	3.4
The household farmed okra in 2013 (%)	693	46.22	36.39	9.83***	3.73
The household farmed onions in 2013 (%)	693	7.27	5.73	1.54	1.87
The household farmed palm in 2013 (%)	693	2.91	0.86	2.05**	1.03
The household farmed maize in 2013 (%)	693	48.26	39.26	9.00**	3.76
Number of minutes it took from the household's house to reach the local market in 2013	693	66.68	72.35	-5.67	4.71
Log - Number of minutes it took from the household's house to reach the local market in 2013	693	3.52	3.74	-0.22**	0.11
Observations	693				

Table A1.2 (cont.)

	N	Women-headed HH mean	Men-headed HH mean	Difference	Standard error
Monetary income and wealth					
The household received any income from farming and processing activities in 2013 (%)	693	62.5	57.02	5.48	3.73
The household received any income from livestock rearing, selling livestock products, fishing or hunting in 2013 (%)	693	46.22	48.14	-1.92	3.8
The household received any income from off-farm activities (casual labour, businesses, waged work) in 2013 (%)	693	27.03	31.81	-4.77	3.46
The household received any income from another source (renting, remittances, social transfers, etc.) in 2013 (%)	693	33.14	28.65	4.49	3.51
In 2013, the household received any income from farming (%)	693	59.59	51.58	8.02**	3.77
In 2013, the household received any income from processing (%)	693	37.5	31.81	5.69	3.61
In 2013, the household received any income from livestock rearing (%)	693	40.41	37.54	2.87	3.71
In 2013, the household received any income from selling livestock products (%)	693	33.14	30.09	3.05	3.54
In 2013, the household received any income from fishing or hunting (%)	693	8.72	9.46	-0.73	2.19
In 2013, the household received any income from casual labour (%)	693	8.43	12.32	-3.89*	2.32
In 2013, the household received any income from business (%)	693	15.12	13.18	1.94	2.65
In 2013, the household received any income from waged job (%)	693	13.37	16.05	-2.67	2.69
In 2013, the household received any income from rents (%)	693	4.07	2.87	1.2	1.39
In 2013, the household received any income from remittances (%)	693	12.79	15.19	-2.4	2.64
In 2013, the household received any income from social transfers (%)	693	7.56	3.15	4.41***	1.7
In 2013, the household received any income from any other sources (%)	693	20.35	18.62	1.72	3.01
The household was in the lowest 20% of the wealth distribution, in 2013 (%)	693	22.09	19.2	2.9	3.08
The household was in the second 20% of the wealth distribution, in 2013 (%)	693	21.51	17.48	4.03	3.01
The household was in the third 20% of the wealth distribution, in 2013 (%)	693	18.6	21.2	-2.6	3.04
The household was in the fourth 20% of the wealth distribution, in 2013 (%)	693	18.31	21.78	-3.46	3.04
The household was in the highest 20% of the wealth distribution, in 2013 (%)	693	19.48	20.34	-0.87	3.04
Meeting attendance for women respondents					
The respondent regularly attended meetings in 2013 (%)	693	37.79	12.89	24.90***	3.17

Table A1.3: Comparison between households in which the module administered to the main woman decision-maker of the household was filled

Only characteristics for which the difference is statistically significant at most at the 10% level are shown.

	N	The module was not filled - mean	The module was filled - mean	Difference	Standard error
Household head characteristics					
Household head is a male (%)	693	83.69	27.49	56.19***	3.23
Household head received any formal education (%)	693	17.02	7.3	9.72***	2.42
Household head completed primary education (%)	693	6.74	2.92	3.82**	1.59
Household characteristics					
Proportion of household members who are children (less than 15 years) (%)	693	23.65	19.39	4.25**	1.97
Interview characteristics					
Interviewee age	693	37.62	35.44	2.19***	0.75
Interviewee is a male (%)	693	83.69	15.33	68.36***	2.82
Interviewee received any formal education (%)	693	16.67	6.57	10.10***	2.36
Interviewee completed primary education (%)	693	6.38	1.7	4.68***	1.43
Interviewee is married (%)	693	95.04	91	4.04**	2.02
Interviewee can read and write a simple letter (%)	693	16.31	11.68	4.63*	2.65
The household head is the interviewee (%)	693	98.23	85.16	13.07***	2.22
Livestock and agriculture					
Number of cattle owned in 2013	693	20.58	14.78	5.81***	1.93
Farming was the household main activity in 2013 (%)	693	98.94	96.59	2.34*	1.19
The household grew vegetables (cucumbers, kudru, okra, onions) in 2013 (%)	693	34.04	50.61	-16.57***	3.79
The household farmed any of the 8 main crops in 2013 (%)	693	82.98	88.08	-5.10*	2.68
The household farmed more than the median number of crops (out of the 8 crops identified) (%)	693	40.78	54.26	-13.48***	3.84
The household farmed any of the 6 crops identified by the project in 2013 (%)	693	79.08	87.35	-8.27***	2.82
The household farmed groundnuts in 2013 (%)	693	73.05	79.81	-6.76**	3.25
The household farmed sorghum in 2013 (%)	693	58.16	73.24	-15.08***	3.59
The household farmed kudru in 2013 (%)	693	19.86	33.58	-13.72***	3.44
The household farmed okra in 2013 (%)	693	31.56	47.93	-16.37***	3.76
The household farmed maize in 2013 (%)	693	37.59	47.93	-10.34***	3.82

Table A1.3 (cont.)

	N	The module was not filled - mean	The module was filled - mean	Difference	Standard error
Monetary income and wealth					
The household received any income from farming and processing activities in 2013 (%)	693	52.48	64.72	-12.24***	3.77
The household received any income from livestock rearing, selling livestock products, fishing or hunting in 2013 (%)	693	41.13	51.34	-10.20***	3.85
The household received any income from another source (renting, remittances, social transfers, etc.) in 2013 (%)	693	24.11	35.52	-11.41***	3.55
In 2013, the household received any income from farming (%)	693	46.45	61.8	-15.35***	3.8
In 2013, the household received any income from processing (%)	693	28.37	38.93	-10.56***	3.66
In 2013, the household received any income from livestock rearing (%)	693	30.14	45.01	-14.87***	3.73
In 2013, the household received any income from selling livestock products (%)	693	25.89	35.52	-9.64***	3.58
In 2013, the household received any income from remittances (%)	693	11.35	15.82	-4.47*	2.68
In 2013, the household received any income from social transfers (%)	693	1.42	8.03	-6.61***	1.72
The household was in the lowest 20% of the wealth distribution, in 2013 (%)	693	15.6	24.09	-8.48***	3.12
The household was in the third 20% of the wealth distribution, in 2013 (%)	693	23.76	17.52	6.24**	3.09
Meeting attendance for women respondents					
The respondent regularly attended meetings in 2013 (%)	693	0	42.58	-42.58***	2.95
Observations	693				

Table A1.4: Comparison between intervention and comparison groups for households in which the module administered to the main woman decision maker of the household was filled

	N	Intervention mean	Comparison mean	Difference	Standard error
Household head characteristics					
Household head age	411	36.36	37.23	-0.87	0.93
Household head is a male (%)	411	26.63	28.3	-1.67	4.42
Household head is in good or fair health, and able to do domestic or livelihood	411	95.98	95.75	0.23	1.97
Household head received any formal education (%)	411	6.53	8.02	-1.49	2.57
Household head completed primary education (%)	411	3.02	2.83	0.18	1.67
Household head completed secondary education (%)	411	0.5	0.47	0.03	0.69
Household characteristics					
Household size	411	3.73	3.79	-0.06	0.18
Proportion of household members who are children (less than 15 years) (%)	411	18.57	20.17	-1.6	2.53
Proportion of household members that are in good or fair health, and able to do work (%)	411	87.93	88.15	-0.22	2
Interview characteristics					
Interviewee age	411	34.55	36.27	-1.72*	0.91
Interviewee is a male (%)	411	13.07	17.45	-4.39	3.56
Interviewee is in good or fair health, and able to do domestic or livelihood work (%)	411	96.98	95.28	1.7	1.91
Interviewee received any formal education (%)	411	8.04	5.19	2.85	2.45
Interviewee completed primary education (%)	411	2.51	0.94	1.57	1.28
Interviewee completed secondary education (%)	411	0	0	0	0
Interviewee is a Christian (%)	411	94.47	98.11	-3.64**	1.85
Interviewee is married (%)	411	87.94	93.87	-5.93**	2.82
Interviewee can read and write a simple letter (%)	411	15.08	8.49	6.58**	3.16
The household head is the interviewee (%)	411	84.92	85.38	-0.45	3.52

Table A1.4 (cont.)

	N	Intervention mean	Comparison mean	Difference	Standard error
Livestock and agriculture					
Number of cattle owned in 2013	411	14.4	15.13	-0.74	2.34
Number of sheep owned in 2013	411	5.17	5.31	-0.14	0.79
Number of goats owned in 2013	411	7.65	7.89	-0.24	0.91
Number of poultry owned in 2013	411	4.92	4.9	0.02	0.69
The household owned any land in 2013 (%)	411	89.95	91.98	-2.03	2.83
Farming was the household main activity in 2013 (%)	411	94.47	98.58	-4.11**	1.78
The household grew vegetables (cucumbers, kudru, okra, onions) in 2013 (%)	411	61.81	40.09	21.71***	4.83
The household farmed any of the 8 main crops in 2013 (%)	411	93.97	82.55	11.42***	3.16
The household farmed more than the median number of crops (out of the 8 crops identified) (%)	411	65.33	43.87	21.46***	4.81
The household reported any 'Don't know' values on recall data on crops (%)	411	7.04	6.13	0.9	2.45
The household farmed any of the 6 crops identified by the project in 2013 (%)	411	92.96	82.08	10.89***	3.24
The household farmed groundnuts in 2013 (%)	411	85.93	74.06	11.87***	3.93
The household farmed sorghum in 2013 (%)	411	79.4	67.45	11.94***	4.34
The household farmed cucumbers in 2013 (%)	411	5.53	0.94	4.58***	1.72
The household farmed kudru in 2013 (%)	411	49.75	18.4	31.35***	4.41
The household farmed okra in 2013 (%)	411	58.29	38.21	20.08***	4.84
The household farmed onions in 2013 (%)	411	11.06	3.77	7.28***	2.55
The household farmed palm in 2013 (%)	411	4.02	0.94	3.08**	1.52
The household farmed maize in 2013 (%)	411	55.28	41.04	14.24***	4.89
Number of minutes it took from the household's house to reach the local market in 2013	411	68.73	72.14	-3.4	5.96
Log – Number of minutes it took from the household's house to reach the local market in 2013	411	3.6	3.63	-0.03	0.15

Table A1.4 (cont.)

	N	Intervention mean	Comparison mean	Difference	Standard error
Monetary income and wealth					
The household received any income from farming and processing activities in 2013 (%)	411	73.87	56.13	17.74***	4.65
The household received any income from livestock rearing, selling livestock products, fishing or hunting in 2013 (%)	411	55.78	47.17	8.61*	4.93
The household received any income from off farm activities (casual labour, businesses, waged work) in 2013 (%)	411	38.19	18.87	19.32***	4.35
The household received any income from another source (renting, remittances, social transfers, etc.) in 2013 (%)	411	48.24	23.58	24.66***	4.58
In 2013, the household received any income from farming (%)	411	70.85	53.3	17.55***	4.73
In 2013, the household received any income from processing (%)	411	41.71	36.32	5.39	4.82
In 2013, the household received any income from livestock rearing (%)	411	51.26	39.15	12.11**	4.89
In 2013, the household received any income from selling livestock products (%)	411	37.19	33.96	3.22	4.73
In 2013, the household received any income from fishing or hunting (%)	411	8.04	10.38	-2.34	2.86
In 2013, the household received any income from casual labour (%)	411	15.08	4.25	10.83***	2.85
In 2013, the household received any income from business (%)	411	18.59	9.91	8.69**	3.42
In 2013, the household received any income from waged job (%)	411	21.61	6.6	15.00***	3.34
In 2013, the household received any income from rents (%)	411	7.04	0.94	6.09***	1.89
In 2013, the household received any income from remittances (%)	411	21.11	10.85	10.26***	3.57
In 2013, the household received any income from social transfers (%)	411	11.06	5.19	5.87**	2.67
In 2013, the household received any income from any other sources (%)	411	29.15	14.15	14.99***	3.99
The household was in the lowest 20% of the wealth distribution, in 2013 (%)	411	20.6	27.36	-6.76	4.22
The household was in the second 20% of the wealth distribution, in 2013 (%)	411	21.61	21.23	0.38	4.06
The household was in the third 20% of the wealth distribution, in 2013 (%)	411	17.59	16.98	0.61	3.74
The household was in the fourth 20% of the wealth distribution, in 2013 (%)	411	15.08	20.75	-5.68	3.79
The household was in the highest 20% of the wealth distribution, in 2013 (%)	411	25.13	13.68	11.45***	3.86
Meeting attendance for women respondents					
The respondent regularly attended meetings in 2013 (%)	411	50.25	35.38	14.87***	4.84
Observations	411				

APPENDIX 2: METHODOLOGY USED FOR PROPENSITY-SCORE MATCHING

The analysis of outcome variables presented in Section 5 of this report involved group mean comparisons using propensity-score matching (PSM). The basic principle of PSM is to match each participant with a non-participant that was observationally similar at baseline and to obtain the programme treatment effect by averaging the differences in outcomes across the two groups after project completion. Unsurprisingly, there are different approaches to matching, i.e. to determining whether or not a household is observationally 'similar' to another household. For an overview, we refer to Caliendo and Kopeinig (2008).

The following sections describe and test the specific matching procedure followed in this Effectiveness Review.

Estimating propensity scores

Given that it is extremely hard to find two individuals with exactly the same characteristics, Rosenbaum and Rubin (1983) demonstrate that it is possible to match individuals using a prior probability for an individual to be in the intervention group, naming this its *propensity score*. More specifically, propensity scores are obtained by pooling the units from both the intervention and comparison groups and using a statistical probability model (e.g. a *probit* regression) to estimate the probability of participating in the project, conditional on a set of observed characteristics.

Table A2.1 presents the probit regression results used to estimate the propensity scores in our context. To guarantee that none of the matching variables were affected by the intervention, we only considered variables that were measured at baseline, and only those variables that were unlikely to have been influenced by anticipation of project participation (Caliendo and Kopeinig, 2008).

Table A2.1: Estimating the propensity score on variables used for matching

	Marginal effect	Standard error	p-value
Household head received any formal education	-0.04	0.07	0.51
Household head is a male	-0.01	0.04	0.78
Log – Household size	0.03	0.05	0.46
Proportion of household members who are children (less than 15 years)	-0.04	0.10	0.66
Log - Number of minutes it took from the household's house to reach the local market in 2013,	0.00	0.01	0.78
The household received any income from farming and processing activities in 2013	0.14**	0.05	0.00
The household received any income from livestock rearing, selling livestock products, fishing or hunting in 2013	-0.07	0.05	0.14
The household received any income from off farm activities (casual labour, businesses, waged work) in 2013	0.10*	0.05	0.04
The household received any income from another source (renting, remittances, social transfers, etc.) in 2013	0.08	0.05	0.12
Farming was the household main activity in 2013	-0.23	0.13	0.07
The household owned any land in 2013	-0.13	0.07	0.06
The household farmed groundnuts in 2013	-0.05	0.06	0.39
The household farmed sorghum in 2013	0.20***	0.05	0.00
The household farmed vegetables (cucumbers, kudru, onions, okra) in 2013	0.15**	0.04	0.00
The household was in the second 20% of the wealth distribution, in 2013	0.13*	0.06	0.05
The household was in the third 20% of the wealth distribution, in 2013	0.06	0.07	0.35
The household was in the fourth 20% of the wealth distribution, in 2013	0.03	0.06	0.69
The household was in the highest 20% of the wealth distribution, in 2013	0.13	0.07	0.06
Observations	693		

The construction of the wealth index is described in Section 5. Variables dated 2013 are estimates, based on recall data.
Dependent variable is binary, taking 1 for project participant households, and 0 otherwise.

* p < 0.1, ** p < 0.05, *** p < 0.01.

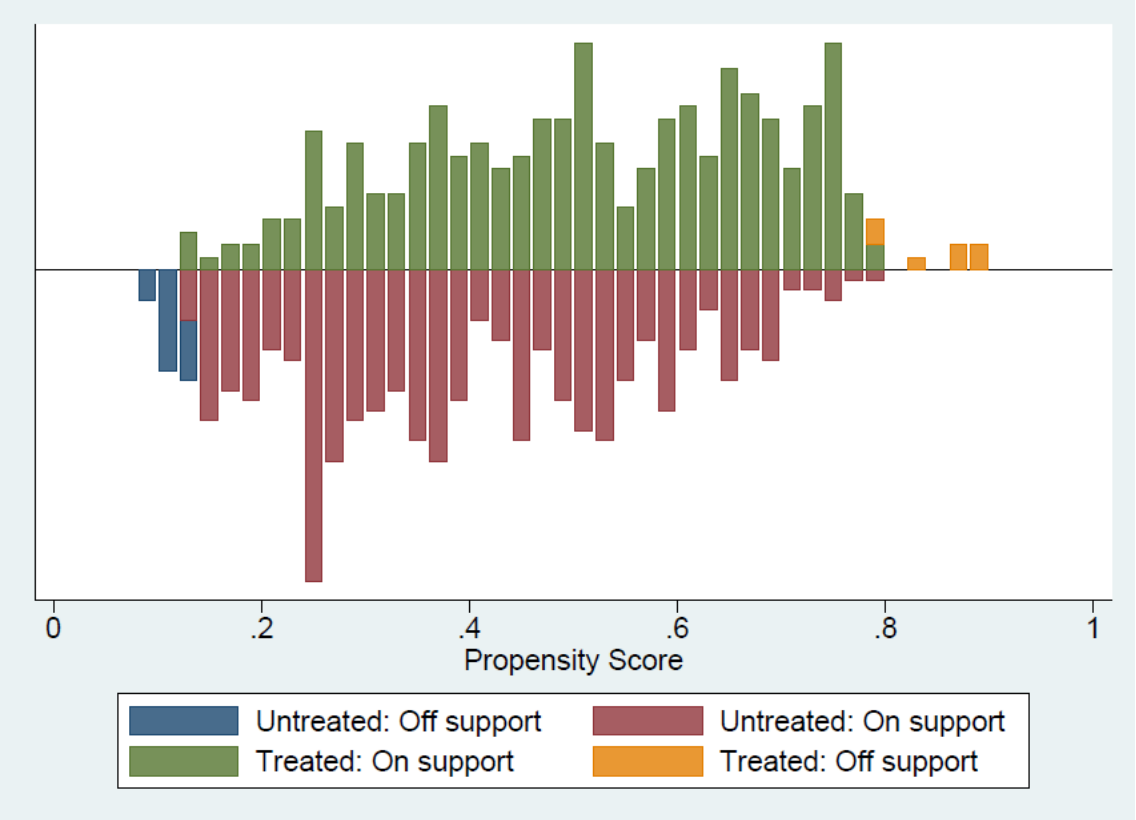
Defining the region of common support

After estimating the propensity scores, the presence of a good *common support area* needs to be checked. The area of common support is the region where the propensity-score distributions of the treatment and comparison groups overlap. The common support assumption ensures that 'treatment observations have a comparison observation "nearby" in the propensity score distribution' (Heckman, LaLonde and Smith, 1999). Since some significant differences were found between the intervention and comparison groups in terms of the baseline and demographic characteristics (as detailed in Section 4.2), some of the households in the intervention group are too different from the comparison group to allow for meaningful comparison. We developed a minima and maxima comparison, deleting all observations whose propensity score was smaller than the minimum and larger than the maximum in the opposite group (Caliendo and Kopeinig, 2008). In this particular case, 19 of the 385 households

surveyed in the comparison villages and 7 of the 308 households surveyed in the intervention villages were dropped because they lay outside the common support area. This means that the estimates of differences in outcome characteristics between the two groups apply to this subsample of project participants and non-participants; that is, they do represent the surveyed population as a whole (less than 4 percent of observations fell out of the common support).

Figure A2.1 illustrates the area of common support and indicates the proportion of households lying on and off the common support area, by treatment group.

Figure A2.1: Propensity score on and off common support



Matching intervention households to comparison households

Following Rosenbaum and Rubin (1983), after estimating the propensity scores and defining the area of common support, individuals are matched on the basis of their propensity score. The literature has developed a variety of matching procedures. For the main results presented in this Effectiveness Review we chose to employ the method of kernel matching (note that we use alternative matching procedures as a means of robustness checks in Appendix 3). The kernel matching method weights the contribution of each comparison group member, attaching greater weight to those comparison observations that provide a better match with the treatment observations. One common approach is to use the normal distribution with mean zero as a kernel, and weights given by the distribution of the differences in propensity score. Thus 'good' matches get a larger weight than 'poor' matches.

We used the *psmatch2* module in STATA using 0.1 as a bandwidth and restricted the analysis on the area of common support. When using PSM, standard errors of the estimates were bootstrapped (stratified by community) using 1,000 repetitions to account for the additional variation caused by the estimation of the propensity scores and the determination of the common support.[40]

Check balancing

For PSM to be valid, the intervention group and the matched comparison group need to be balanced in that they need to be similar in terms of their observed baseline characteristics. This should be checked. The most straightforward method to do this is to test whether there are any statistically significant differences in baseline covariates between the intervention and comparison groups in the matched sample. The balance of each of the matching variables after kernel matching is shown in Table A2.2. None of the variables implemented for the matching is statistically significant once the matched sample is used.

Table A2.2: Balancing test on the set of covariates used for matching, after matching

	Intervention group mean	Comparison group mean	p-value
Household head received any formal education (%)	11.3	10.06	0.64
Household head is a male (%)	48.5	46.43	0.63
Log – Household size	1.21	1.2	0.88
Proportion of household members who are children (less than 15 years) (%)	19.67	18.67	0.62
Log - Number of minutes it took from the household's house to reach the local market in 2013.	3.58	3.64	0.62
The household received any income from farming and processing activities in 2013	71.1	69.58	0.68
The household received any income from livestock rearing, selling livestock products, fishing or hunting in 2013	51.5	51.46	0.99
The household received any income from off farm activities (casual labour, businesses, waged work) in 2013	36.88	37.28	0.93
The household received any income from another source (renting, remittances, social transfers, etc.) in 2013	40.2	36.95	0.46
Farming was the household main activity in 2013 (%)	97.67	97.26	0.79
The household owned any land in 2013 (%)	89.37	89.75	0.89
The household farmed groundnuts in 2013 (%)	83.39	81.68	0.58
The household farmed sorghum in 2013 (%)	77.41	75.31	0.54
The household grew vegetable in 2013 (%)	56.48	55.09	0.74
The household was in the second 20% of the wealth distribution, in 2013 (%)	20.27	20.58	0.93
The household was in the third 20% of the wealth distribution, in 2013 (%)	18.6	18.67	0.99
The household was in the fourth 20% of the wealth distribution, in 2013 (%)	17.94	17.41	0.87
The household was in the highest 20% of the wealth distribution, in 2013 (%)	25.58	24.68	0.82
Observations	667		

The matching process reduces the differences between the two groups, as shown in Table A2.3, but does not correct for all of them.

Table A2.3: Balancing test on other baseline characteristics, after matching

	Intervention group mean	Comparison group mean	p-value	Level of significance
Household head characteristics				
Household head age	37.25	38.6	0.1	*
Household head is in good or fair health, and able to do domestic or livelihood	97.01	94.27	0.17	
Household head completed primary education (%)	5.65	2.91	0.1	*
Household head completed secondary education (%)	0.33	0.64	0.67	
Household characteristics				
Household size	3.82	3.77	0.74	
Proportion of household members that are in good or fair health, and able to do work (%)	88.06	90.01	0.23	
Interview characteristics				
Interviewee age	36.14	37.76	0.05	*
Interviewee is a male (%)	39.87	39.41	0.91	
Interviewee is in good or fair health, and able to do domestic or livelihood work (%)	97.01	93.73	0.12	
Interviewee received any formal education (%)	12.29	8.35	0.12	
Interviewee completed primary education (%)	5.32	1.52	0.01	***
Interviewee is a Christian (%)	95.35	97.3	0.2	
Interviewee is married (%)	91.03	93.5	0.32	
Interviewee can read and write a simple letter (%)	16.61	13.32	0.32	
The household head is the interviewee (%)	89.04	90.3	0.63	
The module of the survey for women respondents was filled in (%)	64.45	62.67	0.66	

Table A2.3 (cont.)

	Intervention group mean	Comparison group mean	p-value	Level of significance
Livestock and agriculture				
Number of cattle owned in 2013	16.95	18.15	0.64	
Number of sheep owned in 2013	5.99	5.47	0.49	
Number of goats owned in 2013	8.13	8.13	0.99	
Number of poultry owned in 2013	5.13	5.2	0.92	
The household farmed cucumbers in 2013 (%)	4.98	1.58	0.03	**
The household farmed kudru in 2013 (%)	43.52	27.74	0.00	***
The household farmed okra in 2013 (%)	53.49	51.33	0.62	
The household farmed onions in 2013 (%)	10.3	7	0.23	
The household farmed palm in 2013 (%)	3.32	1.2	0.12	
The household farmed maize in 2013 (%)	51.5	52.22	0.87	
The household farmed any of the 8 main crops in 2013 (%)	91.69	90.27	0.53	
The household farmed more than the median number of crops (out of the 8 crops identified) (%)	61.79	58.13	0.37	
The household reported any 'Don't know' values on recall data on crops (%)	5.65	3.81	0.31	
The household farmed any of the 6 crops identified by the project in 2013 (%)	90.7	88.59	0.38	
Number of minutes it took from the household's house to reach the local market in 2013	70.59	69.14	0.79	
Monetary income and wealth				
In 2013, the household received any income from farming (%)	67.77	64.55	0.41	
In 2013, the household received any income from processing (%)	38.87	44.93	0.16	
In 2013, the household received any income from livestock rearing (%)	45.85	41.5	0.32	
In 2013, the household received any income from selling livestock products (%)	32.56	34.35	0.67	
In 2013, the household received any income from fishing or hunting (%)	10.3	15.01	0.16	
In 2013, the household received any income from casual labour (%)	14.62	11.37	0.29	
In 2013, the household received any income from business (%)	17.61	17.55	0.99	
In 2013, the household received any income from waged job (%)	19.6	15.27	0.22	
In 2013, the household received any income from rents (%)	5.98	2.27	0.04	**
In 2013, the household received any income from remittances (%)	16.28	17.47	0.73	
In 2013, the household received any income from social transfers (%)	7.97	5.29	0.22	
In 2013, the household received any income from any other sources (%)	24.92	27.38	0.55	
The household was in the lowest 20% of the wealth distribution, in 2013 (%)	17.61	18.67	0.73	
Among the women interviewed, the respondent regularly attended meetings in 2013 (%)	32.23	28.13	0.33	

After matching, some of the characteristics are still imbalanced: household heads in the intervention group are slightly younger (37 vs 39, difference significant at 10 percent) and more likely to have completed primary education (6 percent vs 3 percent, difference significant at 10 percent). As the household head is the respondent in almost 90 percent of the cases in both groups, those differences are reflected in the age and education of the interviewee: 36 years old vs 38 on average – significant at 10 percent – and 6 percent completed primary education, vs 2 percent in the comparison group (significant at 1 percent). Farming characteristics, as per the type of crops that were grown by the household, are balanced, except for cucumbers and kudru. In Appendix 3, one model of estimation is run that corrects for such an imbalance (model 2). Results are overall consistent with results that are presented in Section 5 of the report (and any difference is discussed in Section 5). Households in the intervention group are also more likely to have received income from rents in the last 12 months (6 percent vs 2 percent).

None of the estimations presented in this report take into account the potential correlation of error terms within villages.

APPENDIX 3: ROBUSTNESS CHECKS

In order to address the validity of the results presented in Section 5, additional analyses with different estimation techniques were performed. This section presents the different econometric models used to test the robustness of the estimates presented in Section 5.

Model 1. Linear regression

The first basic specification for estimating the impact of project participation is an Ordinary Least Squares (OLS) model.

$$Y_i = \alpha + \beta_1 Project\ participation_i + \delta' X_i + \varepsilon_i$$

Where Y_i is the dependent variable; the variable of interest is the dummy variable *Project Participation* that assumes value equal to 1 when the household is enrolled in the project, 0 otherwise; X_i is a vector of household characteristics. In this model, we use the matching variables presented in table A.2.1 as the covariates we want to account for. In the tables following only $\beta_1$will be reported.

Model 2. Linear regression with additional control variables

The same specification as above is used, and estimations are done with OLS. 2 additional covariates are accounted for: whether the household grew cucumbers in 2013 and whether the household grew kudru. This is because even after matching corrections in the main model (which takes into account whether the household grew any vegetable in 2013), those 2 variables are imbalanced as shown in table A2.3, while it is likely that they influence the outcome variables.[41]

Model 3. Linear regression with propensity-score weighting

Following the example of Hirano and Imbens (2001),[42] we estimate an alternative set of OLS regressions that apply the same model as in 1 but weighting the observations according to the propensity score. Observations are assigned weights equal to one for the intervention households and $\hat{P}(\boldsymbol{X_i})/(1-\hat{P}(\boldsymbol{X_i}))$ for the comparison households. The variable $\hat{P}(\boldsymbol{X_i})$ represents the probability of a household being in the intervention group, given their observable characteristics, measured through the vector of matching variables $\boldsymbol{X_i}$ – this was estimated in the probit regressions in Appendix 2. We report the estimates of β_1 in the same way as the standard OLS regressions.

$$\boldsymbol{Y_i = \alpha + \beta_1 Project\ participation_i + \delta_2' Z_i + \delta_1' X_i} \\ \boldsymbol{+ \varepsilon_i Y_i Project\ participation_i X_i Z_i \hat{e}(x)/(1-\hat{e}(x))\beta_1}$$

Model 4. PSM kernel model without baseline variables on crop production

This model used a similar set of variables as the one presented in the main report, except for variables on 2013 crop production. The three dummies for growing groundnuts, sorghum and vegetables in 2013 are not included.

Model 5. Propensity-Score Matching – Nearest Neighbour

The nearest neighbour matching algorithm matches each observation from the intervention group with an observation from the comparison group that is closest in terms of their propensity score. In this robustness check, we use a new propensity

score, close to the one in model 4, and apply nearest neighbour matching 'without replacement', meaning that comparison observations can be matched to intervention observations only once[43]. We present results of one-to-one matching with replacement.

For this model, in the overall sample, we match on:

- Household head gender and level of education.
- The (log-transformed) household size and proportion of children in the household.
- Whether the household received any income in 2013 from farming activities, livestock or animals-related activities, off farm activities, or other source.
- Wealth distribution.

In the sub-sample for which the individual module was filled out (two last tables of this appendix), we match on the same set of variables, with the exception of the proportion of children in the household.

Models 4 and 5 do not take into account crop production in 2013, even though it is likely to influence the livelihood outcomes under review in this evaluation. If one is concerned that crop production in 2013 is measured with error, and with systematic differential error between comparison and intervention groups, then these models provide an alternative measurement of the ones discussed in Section 5 of this report. Particularly, if the concern is that households who started growing some of the targeted crops thanks to the project may have wrongly remembered their already growing this crop in 2013, one can think of those estimates as an upper bound of the project's impact.

The robustness checks for the main results discussed in Section 5 are presented below, referring to the subsection of Section 5.

Robustness checks for subsection 5.1.1

Table A3.1

	1 The HH was provided with groundnut seeds	2 The HH was provided with sorghum seeds	3 The HH was provided with vegetable seeds
OLS regression	0.42***	0.32***	0.30***
	(0.03)	(0.04)	(0.04)
N	693	693	693
OLS regression with additional variables	0.42***	0.32***	0.29***
	(0.03)	(0.04)	(0.04)
N	693	693	693
OLS with PS weighting	0.38***	0.30***	0.25***
	(0.03)	(0.04)	(0.03)
N	667	667	667
Kernel matching with alternative variables	0.46***	0.38***	0.33***
	(0.04)	(0.04)	(0.04)
N	682	682	682
Nearest neighbour	0.38***	0.35***	0.29***
	(0.06)	(0.06)	(0.06)
N	680	680	680

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01.

Table A3.2

	4 In the last 3 years, a HH member attended training on groundnut production	5 ... On sorghum production	6 ... On planting of groundnut seeds
OLS regression	0.11***	0.10**	0.07*
	(0.03)	(0.03)	(0.03)
N	693	693	693
OLS regression with additional variables	0.10***	0.08**	0.06*
	(0.03)	(0.03)	(0.03)
N	693	693	693
OLS with PS weighting	0.10***	0.08**	0.06*
	(0.03)	(0.03)	(0.03)
N	667	667	667
Kernel matching with alternative variables	0.14***	0.12***	0.10***
	(0.04)	(0.04)	(0.04)
N	682	682	682
Nearest neighbour	0.07	0.05	0.04
	(0.05)	(0.05)	(0.05)
N	680	680	680

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01.

Robustness checks for subsection 5.1.2

Table A3.3

	1 Last year, the HH used plough/power tillers	2 Last year, the HH used warehouse/storage facility	3 Last year, the HH used seed nursery
OLS regression	0.10**	0.07*	0.02
	(0.03)	(0.04)	(0.03)
N	693	693	693
OLS regression with additional variables	0.10***	0.05	-0.01
	(0.04)	(0.04)	(0.03)
N	693	693	693
OLS with PS weighting	0.11***	0.07*	0.02
	(0.04)	(0.04)	(0.03)
N	667	667	667
Kernel matching with alternative variables	0.11***	0.11***	0.06*
	(0.03)	(0.04)	(0.03)
N	682	682	682
Nearest neighbour	0.13***	0.09	0.01
	(0.04)	(0.05)	(0.05)
N	680	680	680

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01.

Table A3.4

	4 Last year, the HH used production of organic concoction/ materials	5 Last year, the HH used organic farming	6 Last year, the HH used use of improved certified seeds/seedlings
OLS regression	0.09***	0.09*	0.08*
	(0.03)	(0.03)	(0.03)
N	693	693	693
OLS regression with additional variables	0.09***	0.09**	0.07**
	(0.03)	(0.04)	(0.03)
N	693	693	693
OLS with PS weighting	0.10***	0.11***	0.09**
	(0.03)	(0.04)	(0.04)
N	667	667	667
Kernel matching with alternative variables	0.09***	0.12***	0.09**
	(0.03)	(0.04)	(0.04)
N	682	682	682
Nearest neighbour	0.07*	0.12**	0.05
	(0.04)	(0.05)	(0.05)
N	680	680	680

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01.

Table A3.5

	7 Last year, the HH used pressing machines, carts, tractors or huller
OLS regression	-0.04
	(0.02)
N	693
OLS regression with additional variables	-0.05*
	(0.03)
N	693
OLS with PS weighting	-0.06**
	(0.03)
N	667
Kernel matching with alternative variables	-0.02
	(0.02)
N	682
Nearest neighbour	-0.04
	(0.04)
N	680

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01.

Robustness checks for subsection 5.1.3

Table A3.6

	1 In the last 12 months, the HH produced any crop (out of 8)	2 In the last 12 months, the household farmed any of the 6 crops targeted by the project
OLS regression	0.03	0.03
	(0.02)	(0.02)
N	693	693
OLS regression with additional variables	0.03	0.03*
	(0.02)	(0.02)
N	693	693
OLS with PS weighting	0.03*	0.03*
	(0.02)	(0.02)
N	667	667
Kernel matching with alternative variables	0.06***	0.07***
	(0.02)	(0.02)
N	682	682
Nearest neighbour	0.04*	0.04*
	(0.02)	(0.02)
N	680	680

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01.

Table A3.7

	1 In the last 12 months, the HH produced any groundnuts	2 In the last 12 months, the HH produced any sorghum	3 In the last 12 months, the HH produced any cucumbers	4 In the last 12 months, the HH produced any kudru
OLS regression	0.06**	0.07**	0.07***	0.24***
	(0.02)	(0.03)	(0.02)	(0.03)
N	693	693	693	693
OLS regression with additional variables	0.06**	0.07**	0.05***	0.14***
	(0.02)	(0.03)	(0.01)	(0.03)
N	693	693	693	693
OLS with PS weighting	0.06***	0.08***	0.07***	0.24***
	(0.02)	(0.03)	(0.02)	(0.04)
N	667	667	667	667
Kernel matching with alternative variables	0.10***	0.20***	0.08***	0.32***
	(0.03)	(0.03)	(0.02)	(0.04)
N	682	682	682	682
Nearest neighbour	0.14***	0.17***	0.09***	0.32***
	(0.04)	(0.05)	(0.02)	(0.05)
N	680	680	680	680

Table A3.8

	5 In the last 12 months, the HH produced any okra	6 In the last 12 months, the HH produced any onions	7 In the last 12 months, the HH produced any palm	8 In the last 12 months, the HH produced any maize
OLS regression	0.13***	0.07***	0.02*	0.07
	(0.03)	(0.02)	(0.01)	(0.04)
N	693	693	693	693
OLS regression with additional variables	0.15***	0.05***	0.02	0.05
	(0.03)	(0.02)	(0.01)	(0.04)
N	693	693	693	693
OLS with PS weighting	0.12***	0.07***	0.03**	0.07*
	(0.03)	(0.03)	(0.01)	(0.04)
N	667	667	667	667
Kernel matching with alternative variables	0.26***	0.10***	0.04***	0.17***
	(0.04)	(0.02)	(0.01)	(0.04)
N	682	682	682	682
Nearest neighbour	0.25***	0.07**	0.04***	0.21***
	(0.05)	(0.03)	(0.01)	(0.05)
N	680	680	680	680

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01.

Table A3.9

	1 Kg of groundnut produced in the last 12 months (winsorized)	2 Kg of sorghum produced in the last 12 months (winsorized)	3 Kg of cucumber produced in the last 12 months (winsorized)	4 Kg of kudru produced in the last 12 months (winsorized)
OLS regression	456.33***	238.00***	2.24**	250.65***
	(93.41)	(56.49)	(0.69)	(66.73)
N	693	693	693	693
OLS regression with additional variables	421.75***	243.65***	1.62***	194.88***
	(86.47)	(59.21)	(0.62)	(63.40)
N	693	693	693	693
OLS with PS weighting	486.05***	221.07***	2.44***	242.11***
	(99.12)	(49.21)	(0.74)	(65.31)
N	667	667	667	667
Kernel matching with alternative variables	490.39***	247.88***	2.41***	289.18***
	(104.57)	(49.83)	(0.73)	(73.48)
N	682	682	682	682
Nearest neighbour	546.95***	250.45***	2.41***	294.83***
	(115.19)	(51.42)	(0.73)	(73.38)
N	680	680	680	680

Table A.3.10

	5 Kg of okra produced in the last 12 months (winsorized)	6 Kg of onion produced in the last 12 months (winsorized)	7 Kg of palm produced in the last 12 months (winsorized)	8 Kg of maize produced in the last 12 months (winsorized)
OLS regression	28.90	2.52	0.33**	56.16*
	(20.98)	(1.33)	(0.12)	(26.20)
N	693	693	693	693
OLS regression with additional variables	10.55	0.94	0.31**	49.29*
	(21.67)	(1.27)	(0.12)	(27.09)
N	693	693	693	693
OLS with PS weighting	22.08	3.12*	0.43***	41.87
	(22.44)	(1.89)	(0.16)	(26.49)
N	667	667	667	667
Kernel matching with alternative variables	57.27**	4.22**	0.50***	61.76***
	(24.11)	(1.89)	(0.17)	(23.54)
N	682	682	682	682
Nearest neighbour	52.26**	5.03***	0.50***	76.33***
	(25.55)	(1.77)	(0.17)	(21.95)
N	680	680	680	680

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01.

Robustness checks for subsection 5.2.1

Table A3.11

	1 The household has been processing any crop before selling	2 Number of crops processed before selling (out of 8)	3 The household sold any crop (out of 8)
OLS regression	0.17***	0.69***	0.27***
	(0.04)	(0.13)	(0.04)
N	693	693	693
OLS regression with additional variables	0.18***	0.64***	0.24***
	(0.04)	(0.14)	(0.04)
N	693	693	693
OLS with PS weighting	0.15***	0.65***	0.27***
	(0.04)	(0.15)	(0.04)
N	667	667	667
Kernel matching with alternative variables	0.14***	0.85***	0.30***
	(0.04)	(0.15)	(0.04)
N	682	682	682
Nearest neighbour	0.15***	0.78***	0.26***
	(0.05)	(0.20)	(0.05)
N	680	680	680

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01.

Table A3.12

	4 Number of crops sold (out of 8)	5 The HH sold any crop to local trader or intermediaries (for those 8 crops)	6 The HH sold any crop to market centres and local markets (for those 8 crops)
OLS regression	0.71***	0.09**	0.21***
	(0.12)	(0.03)	(0.04)
N	693	693	693
OLS regression with additional variables	0.54***	0.06**	0.20***
	(0.12)	(0.03)	(0.04)
N	693	693	693
OLS with PS weighting	0.70***	0.09***	0.22***
	(0.14)	(0.03)	(0.04)
N	667	667	667
Kernel matching with alternative variables	0.95***	0.11***	0.24***
	(0.14)	(0.03)	(0.04)
N	682	682	682
Nearest neighbour	0.80***	0.07*	0.25***
	(0.18)	(0.04)	(0.05)
N	680	680	680

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01.

Robustness checks for subsection 5.2.2

Table A3.13

	1 The HH was provided with cash for household business	2 The HH was provided with VSLA kits	3 The HH was given access to credit at lower rates
OLS regression	0.04	0.06	0.01
	(0.03)	(0.03)	(0.03)
N	693	693	693
OLS regression with additional variables	0.03	0.06*	-0.00
	(0.03)	(0.03)	(0.03)
N	693	693	693
OLS with PS weighting	0.02	0.06*	-0.00
	(0.03)	(0.03)	(0.03)
N	667	667	667
Kernel matching with alternative variables	0.07**	0.08**	0.04
	(0.03)	(0.04)	(0.03)
N	682	682	682
Nearest neighbour	0.04	0.07	0.02
	(0.04)	(0.04)	(0.05)
N	680	680	680

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01.

Robustness checks for subsection 5.2.3

Table A3.14

	1 In the past 12 months, the household received any income from farming	2 In the past 12 months, the household received any income from processing	3 In the past 12 months, the household received any income from livestock rearing
OLS regression	0.22***	0.02	0.16***
	(0.03)	(0.03)	(0.03)
N	693	693	693
OLS regression with additional variables	0.22***	0.03	0.16***
	(0.03)	(0.04)	(0.03)
N	693	693	693
OLS with PS weighting	0.19***	0.02	0.15***
	(0.03)	(0.04)	(0.03)
N	667	667	667
Kernel matching with alternative variables	0.21***	0.06	0.18***
	(0.03)	(0.04)	(0.04)
N	682	682	682
Nearest neighbour	0.18***	-0.00	0.13**
	(0.05)	(0.05)	(0.06)
N	680	680	680

Table A3.15

	4 In the past 12 months, the household received any income from selling livestock	5 In the past 12 months, the household received any income from business	6 In the past 12 months, the household received any income from rents
OLS regression	0.11***	0.09**	0.05**
	(0.03)	(0.03)	(0.02)
N	693	693	693
OLS regression with additional variables	0.10***	0.09***	0.05***
	(0.03)	(0.03)	(0.02)
N	693	693	693
OLS with PS weighting	0.11***	0.11***	0.05***
	(0.03)	(0.03)	(0.02)
N	667	667	667
Kernel matching with alternative variables	0.12***	0.10***	0.05***
	(0.04)	(0.03)	(0.02)
N	682	682	682
Nearest neighbour	0.12**	0.11***	0.01
	(0.05)	(0.04)	(0.04)
N	680	680	680

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01.

Robustness checks for subsection 5.3.1 & 5.3.2

Table A3.16

	1 Log – Total food consumption (SSP) per adult equivalent per day (winsorized)	2 Log – Total daily food AND non-food consumption (SSP) per adult equivalent per day (winsorized)	4 Normalized wealth index
OLS regression	0.69***	0.56***	0.22***
	(0.12)	(0.09)	(0.06)
N	693	693	693
OLS regression with additional variables	0.70***	0.57***	0.25***
	(0.13)	(0.10)	(0.07)
N	693	693	693
OLS with PS weighting	0.61***	0.51***	0.28***
	(0.12)	(0.09)	(0.07)
N	667	667	667
Kernel matching with alternative variables	0.78***	0.63***	0.29***
	(0.13)	(0.10)	(0.09)
N	682	682	682
Nearest neighbour	0.84***	0.70***	0.31***
	(0.16)	(0.13)	(0.09)
N	680	680	680

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01.

Robustness checks for subsection 5.4.1

Table A3.17

	1 The respondent is aware of community plans that have been taking place in the community	2 A HH member participated in any of these planning meetings in the last 3 years	3 The respondent knows who the leaders of the community/association are
OLS regression	0.05	0.03	0.11**
	(0.04)	(0.04)	(0.04)
N	693	693	693
OLS regression with additional variables	0.04	0.03	0.12***
	(0.04)	(0.04)	(0.04)
N	693	693	693
OLS with PS weighting	0.02	0.01	0.12***
	(0.04)	(0.04)	(0.04)
N	667	667	667
Kernel matching with alternative variables	0.10**	0.09**	0.17***
	(0.04)	(0.04)	(0.04)
N	682	682	682
Nearest neighbour	0.09*	0.08*	0.16***
	(0.05)	(0.05)	(0.05)
N	680	680	680

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01.

Robustness checks for subsection 5.4.2

Table A3.18

	1 In the last 3 years, a HH member attended training on women's rights
OLS regression	0.15***
	(0.02)
N	693
OLS regression with additional variables	0.14***
	(0.02)
N	693
OLS with PS weighting	0.16***
	(0.02)
N	667
Kernel matching with alternative variables	0.17***
	(0.02)
N	682
Nearest neighbour	0.13***
	(0.04)
N	680

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01.

Table A3.19

	1 The respondent participates in a group	2 The respondent has started participating in a group since 2013	3 The respondent's contribution to the HH's resources has increased since 2013
OLS regression	0.13**	0.10**	0.16**
	(0.05)	(0.04)	(0.05)
N	411	411	411
OLS regression with additional variables	0.12**	0.09**	0.19***
	(0.05)	(0.04)	(0.05)
N	411	411	411
OLS with PS weighting	0.13**	0.10**	0.16***
	(0.05)	(0.04)	(0.05)
	406	406	406
N	0.13**	0.08*	0.12**
Kernel matching with alternative variables	(0.06)	(0.05)	(0.05)
N	407	407	407
Nearest neighbour	0.04	0.09**	0.11
	(0.06)	(0.05)	(0.07)
N	398	398	398

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01.

Robustness checks for subsection 5.4.3

Table A3.20

	1 The respondent is involved in HH decision making	2 The respondent takes HH decisions by herself or influence others	3 The respondent has a say in making decision about her own movement	4 The respondent is confident in meetings
OLS regression	0.04	-0.17***	0.05	-0.08
	(0.04)	(0.05)	(0.05)	(0.04)
N	411	411	411	411
OLS regression with additional variables	0.03	-0.15***	0.05	-0.07
	(0.05)	(0.05)	(0.05)	(0.04)
N	411	411	411	411
OLS with PS weighting	0.05	-0.17***	0.08*	-0.08*
	(0.04)	(0.05)	(0.04)	(0.04)
	406	406	406	406
N	0.02	-0.16***	0.03	-0.10**
Kernel matching with alternative variables	(0.05)	(0.06)	(0.06)	(0.04)
N	407	407	407	407
Nearest neighbour	0.04	-0.11*	0.06	-0.13**
	(0.05)	(0.06)	(0.06)	(0.06)
N	398	398	398	398

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01.

REFERENCES

African Development Bank (2013) *Infrastructure Action Plan in South Sudan: A Program for Sustained Strong Economic Growth*, from https://www.afdb.org/en/countries/east-africa/south-sudan/infrastructure-action-plan-in-south-sudan-a-program-for-sustained-strong-economic-growth/

Bland, M. and Altman, D. G. (1997) Statistics Notes: Cronbach's Alpha. *British Medical Journal*, 314(7080), 572.

Caliendo, M. and Kopeinig, S. (2008) Some Practical Guidance for the Implementation of Propensity-Score Matching, *Journal of Economic Surveys*, Wiley Blackwell, vol. 22(1), 31–72.

Deaton, A. and Zaidi, S. (2002) *Guidelines for constructing consumption aggregates for welfare analysis*. Living standards measurement study (LSMS) working paper; no. LSM 135. Washington, D.C. : The World Bank.

FEWS NET (2013) *South Sudan Livelihood Zones and Descriptions*.

FEWS NET (2016) *South Sudan Food Security Outlook, October 2015 to March 2016.*

Filmer, D. and Pritchett, L. H. (2001) Estimating Wealth Effects without Expenditure Data – Or Tears: An Application to Educational Enrollments in States of India. *Demography*, 38(1), 115–32.

Forcier Consulting (2016) *Final Evaluation for Oxfam Novib's South Sudan Peace and Prosperity Promotion Programme*.

Heckman, J. J., LaLonde, R. J. and Smith, J. A. (1999). The Economics and Econometrics of Active Labour Market Programs, *Handbook of Labor Economics*, 3(A), 1865–2097.

Hirano, K. and Imbens G.W. (2001) Estimation of Causal Effects using Propensity-Score Weighting: An Application to Data on Right Heart Catheterization. *Health Services & Outcomes Research Methodology*, vol. 2, 259–278.

International Organization for Migration (2013) *Village Assessment Survey County Profiles.*

Leuven, E. and Sianesi. B. (2003) *PSMATCH2: Stata Module to Perform Full Mahalanobis and Propensity-Score Matching, Common Support Graphing, and Covariate Imbalance Testing.* Version 4.0.11. Retrieved 20 April 2017, from https://ideas.repec.org/c/boc/bocode/s432001.html

Oxfam (2017) *South Sudan Gender Analysis, a snapshot situation analysis of the differential impact of the humanitarian crisis on women, girls, men and boys in South Sudan.*

Rosenbaum, P. R. and Rubin, D. B. (1983) The Central Role of the Propensity Score in Observational Studies for Causal Effects. *Biometrika*, 70(1), 41–55.

Vyas, S. and Kumaranayake, L. (2006) *Constructing socio-economic status indices: how to use principal components analysis.*

NOTES

[1] Payam is the second-lowest administrative division of South Sudan.

[2] The project was initially planned to be implemented in another part of this payam, but because of insecurity that arose there in 2014, implementation was interrupted after seed distribution. Accessibility of these villages was reduced and neither the project officers during project implementation, nor the surveyors at the time of this Effectiveness Review could go to this part of the payam. In the part of the payam that formed the comparison group of this study, peace committees were formed at the onset of the project but following conflicts that had arisen in the other part of the payam, activities were not conducted.

[3] FEWS NET, 2013, *South Sudan Livelihood Zones and Descriptions*

[4] According to the National Bureau of Statistics of South Sudan, the country experienced an annualized inflation rate of 682.1% September 2016 (time of the survey).

[5] A mature project has been running for long enough – typically at least 2.5 years – to have a reasonable expectation of impact, with either an expenditure rate of at least 70% or completion of most project activities.

[6] Focus group discussions conducted with government officials in Rumbek County indeed show that access to natural resources is one of the major causes of conflict (Final Evaluation for Oxfam Novib's South Sudan Peace and Prosperity Promotion Programme, prepared by Forcier Consulting); descriptive statistics show that 52.8% of respondents identify access to land for cultivation as a cause of conflict, 29% identify access to grazing land and 29% for access to water sources.

[7] Potential caveats linked to recall baseline data are discussed in Section 3.5.

[8] According to the National Bureau of Statistics of South Sudan, the country experienced an annualized inflation rate of 682.1% in September 2016, i.e. at the time of the survey.

[9] The fact that in some comparison villages, some households initially benefited from the project through seed distribution (or being enrolled in peace committees) could be a problem if non-participants benefited indirectly from being neighbours or relatives of the participants. Based on the Foncier Consulting Final Report, it seems reasonable to assume that any indirect benefits were very small. If one assumes that there were indirect benefits on non-participant households' livelihoods, the results presented in this report may be underestimated.

[10] 63% of the surveyed intervention households is made of project participants from payam A, while project participants in payam A represent a quarter of project participants (Table 3.1). If this payam presents any specificity in terms of livelihood conditions, results will be driven by these specificities and will not be representative of the overall group of project participants.

[11] The programme and the survey took place in only five payams, which represents too small a number of clusters to use traditional methods of clustering with PSM; because of data limitations, we cannot cluster at the village level. Intra-cluster correlation will reduce our ability to detect an effect, particularly in a setting when the comparison group is made of a smaller number of clusters than the intervention group.

[12] Only differences that are statistically significant at least at the 10% level are discussed as differences in this report; the level of significance of the differences discussed in this section is shown in tables A1.1 and A1.2. A 10% level of significance means that there is up to 1 in 10 chances that the data will conform to a statistical model where the means in the two groups are not different, a 5% level that there is up to 1 in 20 chance. Due to small sample sizes, statistical significance helps interpret the observed differences, and describe how confident we are in the estimates provided. 5% is the usual minimum standard, hence any differences statistically significant at a 10% level are flagged in this report.

[13] Based on the Village Assessment Survey County Profiles, prepared by the International Organization for Migration in 2013, in the payam in which most surveyed households did not take part in the project, main crops were maize, sesame, groundnuts, vegetables and millet in 2012. Millet and sesame were also among the main crops grown in the project payams, and so were sorghum, maize, groundnut and vegetables. At the time of the fieldwork preparation, palm and maize appeared as the main crops grown.

[14] A description of the sample of households in which the individual module was filled in is presented in Section 5.4 of this report, and main differences are shown in Table A1.3 in Appendix 1.

[15] Regression models with PSM weighting and interaction terms were run.

[16] More project participants also reported attending training on planting groundnut seeds than in the comparison group, but this result is statistically significant only at the 10% level, which means we do not have a high level of confidence that this applies among the project participants as a whole, rather than only among the particular sample who were surveyed. This difference does not always hold when using different statistical models (Appendix 3, Table A3.1.1).

[17] Robustness checks shown in Appendix 3 show that the effect size is reduced when not controlling for project crop production in 2013 (model 4 and 5), and hence not significant any more.

[18] Alternatively, in model 4 and 5 of Appendix 3, which are not accounting for baseline differences in crop grown, effect sizes are higher.

[19] The effect sizes are larger and significant if crop production in 2013 is not accounted for in 2013, as shown in Appendix 3, which is similar for the effect on the quantities of okra, onion and maize produced.

[20] Table 5.6 includes all households, even those who do not produce a given crop, counted as producing 0 kg.

[21] This is where the gender of the respondent may matter in this analysis: processing is in a lot of cases an activity performed by women, hence women respondents may be more likely to remember information on crop processing more accurately than male respondents. In the main model presented in this report, PSM, allows correction for the initial imbalance in the sample, including on the gender of the respondent (see Table A2.3).

[22] This is estimated on a very small sample for cucumber, onion and palm, given the small shares of producers of such crops.

[23] A significant increase is observed for palm too but, as mentioned above, sample sizes are very small for cucumber, onion and palm, so we do not have a great confidence in the results for these crops.

[24] Conditional on selling any of the production of the eight crops, the differences between the two groups are not statistically significant at 5%.

[25] When disaggregating this and considering all the categories displayed in Tables 5.11, 5.12 and 5.13, project participants received monetary income from 3.6 sources on average, against 2.8 in the comparison group.

[26] We consider food consumption in the last seven days of the whole household at the dwelling, and also ask for food consumption outside.

[27] Adult equivalence scales are a way to take into account not only the number of household members, but also their age, acknowledging that household member of different age may have different needs, and potential economies of scales of consumption linked to household size (the more household members, the more needs, but not in a proportionate way). Instead of dividing total household consumption by the number of household members (per capita measure), one divides total household consumption by the number of adult equivalent (each member above 15 count for 1 and each member below 15 count for 1/3), power 0.9, following Deaton and Zaidi (2002)

[28] For each indicator, as the distribution of the indicator is broad, outlying values are identified and taken care of in two different ways: first, the top 1% values are replaced by the lowest value of the top 1% (winsorization); second, all observations that are higher than the mean plus 3 standard deviations (which measures the breadth of the distribution) are replaced by the maximum value within the mean plus 3 standard deviations. Results are consistent and the first type of correction is presented in Table 5.14.

[29] Similarly, the list of food items may miss some cereals or vegetables, which would lead to the means presented in table 5.14 to be under-estimated, but not the difference between the two groups, as long as those missing items were consumed in the same way by both groups.

[30] We ensure the item-rest correlation for each asset is greater than 0.1. We also ensure that Cronbach's alpha is at least 0.7, following the guidance of Bland and Altman (1997).

[31] We follow the approach of Filmer and Pritchett (2001). However in this case, the first component explains a small share of the total variance (only 17%, and the second one only 10%). Following Vyas and Kumaranayake (2006), this, however, seems consistent with general practice, as the studies they review use a first component that explains between 12 to 27%.

[32] To do this, we subtract the mean of the wealth index, and then divide by its standard deviation. This means the results of this Effectiveness Review can be more easily compared to other similar evaluations.

[33] Identified as over 3 standard deviations.

[34] For the results in column 2, it is necessary to omit recalled wealth from the matching process. These results present something similar to a difference-in-differences specification. However, the baseline data is recalled rather than measured at baseline.

[35] Similarly, the result is robust to excluding the extreme values.

[36] We found a higher positive correlation between attending training on women's rights and participating in women's association group (vegetable group), as well as in credit and microfinance groups (VSLA group) in the intervention group than in comparison, which would support this hypothesis.

[37] This is most likely because more women respondents answered the main part of the survey in the intervention group. In households in which the respondent to the main part of the survey was a man, it was necessary to ask the main women decision maker in the

household to respond to the women's module of the questionnaire. In some cases she may not have been available at the time of the interview.

[38] Keeping and managing household income, buying and selling of productive assets (land/machines), buying and selling livestock, how much money to invest in business activities, what food to buy and consume how children should be educated, housework and care of persons.

[39] Women-headed households in this sub-sample are households with a smaller number of adults (2.7 vs 3.1). Involvement in decision making may reflect different situations for the surveyed respondents, based on whether the respondent is the main adult decision maker of the household, or whether the respondent has to bargain with her spouse. Due to small sample sizes and missing information on other decision-makers, we cannot explore this further. Figures presented in Table 5.19 are averages over different household structures.

[40] Bootstrapping is a statistical procedure where repeated samples are drawn from the original sample and parameters, such as standard errors, are re-estimated for each draw. The bootstrapped parameter is calculated as the average estimate over the total number of repeated draws.

[41] An additional model, including three other imbalance variables (having earned money from rents in the year prior to 2013, age of the household head and the household head completed primary school) as control variables, was run. Results were consistent with this second model hence are not shown in this appendix.

[42] Choosing whether to match with and without replacement involves a trade-off between bias and variance. If we allow replacement, the average quality of matching will increase and the bias will decrease, especially when the distribution of the propensity score is very different in the intervention and comparison group. However, allowing for replacement increases the variance of the estimates because, in effect, the number of distinct comparison observations is reduced (Caliendo and Kopeinig, 2008).

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