IMPACT ASSESSMENT REPORT

United Republic of Tanzania

Agricultural Sector Development Programme – Livestock (ASDP-L) and the Agriculture Service Support Programme (ASSP)

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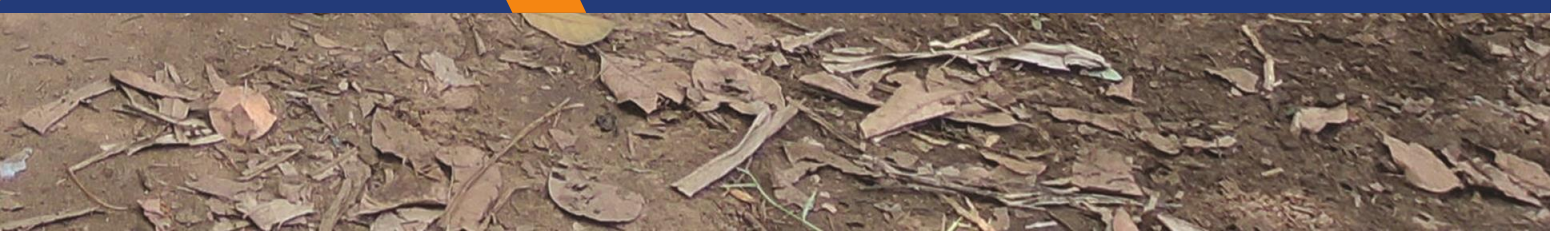
IFAD
Investing in rural people



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Executive summary

Decades of agricultural research have led to the development of technological innovations and improved farming practices that hold a huge potential for increasing agricultural production and achieving global food security. However, the level of dissemination and adoption of this knowledge is still inadequate, especially among smallholder farmers in developing countries. In an effort to enhance the adoption of such technical innovations and improved practices, agricultural extension approaches like Farmer Field Schools (FFS) have been widely advocated. FFS are usually participatory and informal methods of training and assisting farmers in their own locality, to adopt and adapt new technologies that can improve their farming practices.

The ASDP-L and ASSP projects were implemented in Zanzibar between 2007 to 2017, with an aim to contribute towards the Government initiatives to increase agricultural productivity and profitability, generate employment in rural areas and ensure national and household food security. The purpose of the projects was to empower crop and livestock farmers through capacity building and training activities offered in the form of FFS, so as to improve their agricultural production systems.

The impact assessment on the ASDP-L and ASSP projects is based on a quantitative household data collected in 2018 from about 2082 FFS participants and non-participants. Information obtained via a qualitative study by the project implementation team was used to support the quantitative survey design and interpretation of results from the quantitative data analysis for this impact assessment. Statistical matching techniques were used in the sampling and data analysis to identify and select a proper comparison group for the FFS participants.

The results from the study indicate a higher rate of adoption of improved practices among FFS participants, especially in extension-led FFSs. Particularly for livestock producers, the adoption of these practices has in turn led to higher returns on livestock revenue both from livestock assets and products. For crop producers, FFS participation was seen to have significantly increased vegetable yield, value of banana production and total crop revenue, especially for the high adopters. Also, participating in FFS helped participants to diversify their sources of income by engaging in off-farm and self-employment activities, while enhancing food security and market access outcomes. Asset based poverty indicators also point to substantial poverty reduction among FFS participants. In terms of empowerment, while all primary decision makers of households were found to be empowered in collective agency by participating in FFS, female participants were particularly empowered in the domain of ownership of land and other assets, input in productive decision, access to and decision on credit, control over the use of income, mobility, and group membership.

In terms of implications for development policy and practice, it is possible to state that the collective learning approach of FFS has a value particularly in enhancing the adoption of improved practices and in stimulating empowerment of smallholder farmers in the collective domain as well as in individual sphere. However, such an approach requires adequate technical facilitation – and appropriate farmers mentoring as well as continuous monitoring, to ensure that innovation is adopted on a longer-term basis, and used over time. With respect to the heterogeneity of the FFS trainings that involved a large number of activities (spanning livestock and crop production) and the results that indicated a higher effectiveness of FFS with a livestock-related training component, a recommendation would be to have a more focused curriculum, perhaps assessing before-hand the profitability of the technology and the possible uptake, given the specificities of the agro-ecological context.

1. Introduction

Agriculture is the largest and most important sector of the Tanzanian economy, given the country's diverse production base, including livestock, staple food crops and a variety of cash crops. The agriculture sector contributes about one quarter of GDP and employs three quarters of the country's labour force, while agricultural products account for one third of exports. Despite rapid structural changes in parts of the sector, smallholders still dominate agricultural production in Tanzania and most farmers continue to use low, purchased-input technologies that result in poor yields and marginal economic returns. Although recent economic growth is believed to have trickled down to Tanzania's poorest people, approximately 70 percent of Tanzanians continue to live on less than US$2.00 a day. Over the years, the agricultural sector has failed to achieve a growth rate considered necessary for poverty reduction due to several challenges that include high transaction costs due to the poor state or lack of infrastructure; under-investment in productivity enhancing technologies; limited provision of agricultural services such as credit and extension services; insufficient technical know-how on post-harvest losses; and weak market linkages with to domestic and international markets.

Back in 2001, the government of Tanzania adopted the Agricultural Sector Development Strategy (ASDS) with an aim to support and deal with the challenges of achieving the objectives of the National Strategy for Growth and Reduction of Poverty (NSGRP) and the Tanzania Development Vision (TDV) 2025, through its primary objective of sustaining annual agricultural growth rate at 5%. The strategy's priorities were to create a favourable environment for commercial activities; strengthening the institutional framework that governs the sector; improve delivery of support services with a delineation of public/private roles; and improve the functioning of output and input markets.

In line with the ASDS, the government of Tanzania and their development partners integrated the activities and guidance of the Agricultural Sector Support Programme (ASSP), which focused on interventions to improve the effectiveness of agricultural research and extension services, and the District Area Development Plan (DADP), which focuses on district area agricultural investments and services, into a single Agricultural Sector Development Programme (ASDP) Framework and Process Document. The main components in the ASDP are: investment and implementation; policy, regulatory and institutional framework; research, advisory services and training; private sector development, marketing and rural finance; and cross-cutting & cross-sectoral issues.

As part of the IFAD10 IAA, the Agricultural Sector Development Programme-Livestock (ASDP-L) and Agricultural Service Support Programme (ASSP) were selected for an ex-post impact assessment study. The ASDP-L project which is a sub component of the "Investments and Implementation" component of the ASDP, and ASSP were approved by IFAD in 2005 and 2004 respectively. The goal of both projects was to develop the agricultural production systems and empower livestock keepers and farmers in Zanzibar, through the provision of capacity building and training activities in the form of Farmer Field Schools.

A Farmer Field School (FFS), is an agricultural extension approach where a group of selected farmers meet regularly to receive trainings from FFS facilitators, field agents from government ministries, NGOs, local organizations, or farmer groups (Braun and Duveskog, 2011). The FFS approach was originally developed in Asia in the 1980s as a response to the failure of the commonly applied Training and Visit (T&V) extension model to prevent disease outbreaks. The hands-on practical learning in FFS emerged as a means of facilitating critical decision-making skills among farmers to deal with complex farming problems (Gallagher, 2003). FFS uses a learner-centred, problem-based approach to teaching, involving field observations, the relating of these observations to the ecosystem, and applying previous experience through group discussions with new information being available to make informed crop or livestock management

decisions (Duveskog, 2006). A group of farmers who meet regularly (usually weekly) in the field form the field school, while plants or animals at the learning site form the main study materials. The learning takes place under the guidance of a trained facilitator, who helps promote active participation, group dialog, and reflection.

Most frequently cited impacts of FFS include both increases in agricultural production and empowerment in the domain of individual and collective agency. Substantial benefits of FFS have also emerged in terms of increases in farm productivity, reducing farmers' use of pesticides, and improved farming knowledge.

The literature also discusses the role of FFS as an extension model, though with contradictory arguments. One view is the relative high cost per farmer of such an extension approach; others point to the fact that FFS should not be considered just as an extension model but rather a complementary educational instrument that provides intangible public goods that cannot be measured only in agricultural terms.

Few studies have focused specifically on empowerment and FFS, but wider developmental benefits are reported in terms of poverty reduction and human and collective action (Mancini, van Bruggen, & Jiggins, 2007; Van den Berg & Jiggins, 2007; Zuger, 2004). A recent study carried out by IFPRI in East Africa demonstrated significant impacts of FFS on the lives, productivity, and incomes of especially women-headed households and people of low literacy levels. While the study refers to empowerment-related impacts, it lacks concrete measures of them (Davis et al., 2010). Other studies notably the one by Friis-Hansen's (2008) study of FFS and NAADS groups in Soroti Uganda shows that FFS served as a platform and catalyst, therefor the success of demand-driven advisory services. This study also points at poverty reduction among the studied groups, but it does not attempt to explain the relationship of FFS to potential empowerment and poverty reduction.

One study particularly aimed at more systematically establishing links between FFS, empowerment, and increased well-being among participants (Friis-Hansen and Duveskog, 2012). This study defined empowerment as "a process that increases the capabilities of smallholder farmers and farmer groups to make choices and to influence collective decisions towards desired actions and outcomes on the basis of those choices" (Friis-Hansen, 2004). Findings indicate that group-based learning can lead to empowerment and act as a pathway towards increased well-being. However, while the study finds relationship between FFS participation and empowerment (albeit only in the individual sphere e.g. in the domains of trust, critical thinking and household decision making), the direct link between FFS participation and well-being, and between poverty and empowerment appeared mixed, with the poorest not perceiving power as an issue.

The available evidence has also pointed to the reality that few studies are methodologically rigorous, and can establish causal attribution, given the reality that FFS participants self-select into the projects and therefore have characteristics, such as ability, entrepreneurship and learning outcomes, that make them systematically different from the farmers that are parts of the comparison group (Waddington et al, 2014).

ASDP-L and ASSP provided two distinct sets of FFS curriculum. While the interventions offered under ASDP-L focused on livestock rearing, FFS activities offered under ASSP were tailored for crop producers. Beneficiaries of both programmes were expected to experience significant welfare improvements by way of greater productivity and increased income from sales of crops and livestock products. The key outcome indicators of interest in this impact assessment relate closely to IFAD's Strategic Objectives (SOs), which correspond to the indicators in the Sustainable Development Goals (SDGs): increased agricultural productive capacity (SO1), strengthened linkages between smallholder farmers and agricultural markets (SO2), and resilience (SO3). Due to the similarity in the intervention type - FFS, both projects are evaluated for ex-post impact assessment as one package.

Accordingly, the following sections of this report presents details of the ASDP-L and ASSP interventions, theory of change and research questions, data and methodology used to achieve objective estimate of impact, results obtained and policy implications from this study.

2. Theory of Change and Main Research Questions

Prior to assessing the impact of the ASDP-L and ASSP projects in Zanzibar, Tanzania, it is vital to first examine the project's theory of change, which refers to how the project activities and investments are supposed to bring forth the intended impact(s). Also, important to be addressed are the relevant research questions for this impact assessment, as it relates with the specifics of the ASDP-L and ASSP.

2.1. ASDP-L and ASSP Theory of Change

At the inception of the projects, rural households in Zanzibar were heavily reliant on agriculture as the main sources of income and nutrition. The sector accounted for more than 70 percent of export earnings, 70 percent of the employment and on average 25 percent of the GDP (OCGS, 2007). However, the agriculture sector in Zanzibar has over the years faced key constraints in achieving a growth rate that is adequate to bring sufficient numbers of rural poor above the poverty line, including high transaction costs due to the poor state or lack of infrastructure; under-investment in productivity enhancing technologies; limited provision of agricultural services such as credit and extension services; insufficient technical know-how on post-harvest losses; and weak market linkages with to domestic and international markets.

In 2005, in response to the need of improving the agricultural productivity of farmers in Zanzibar through improved farming practices and marketing strategies, IFAD designed and developed ASDP-L (for livestock production) and ASSP (for crop production) projects. Both ASDP-L and ASSP were designed with the aim of developing the agricultural production systems, and empowering livestock keepers and farmers in Zanzibar through the provision of capacity building and training activities offered in the form of Farmer Field Schools (FFS). Over the course of these interventions, about 1,200 FFSs have been established or supported. The additional funding granted in 2015 to extend the project interventions allowed the activities to be delivered to another 300 FFSs, and to strengthen the activities delivered by the District Farmer Fora (DFF) and apex organisations operating in each project district. There was a total of 10 DFF established as part of the intervention.

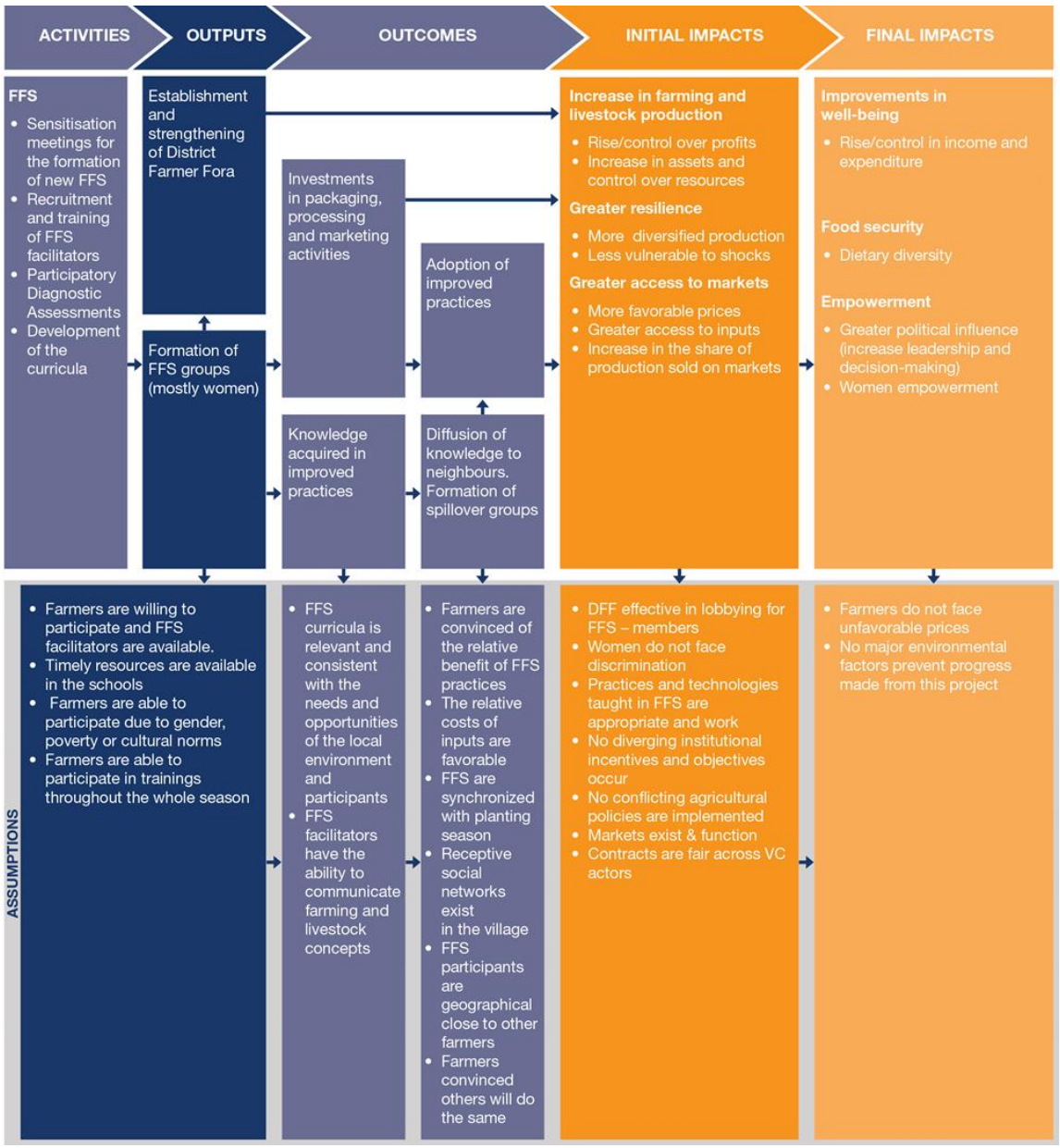
Farmer field schools (FFS) are generally methods of training or education aimed at assisting farmers to learn informally, in their own environment and in a participatory format (FAO, 2001). A typical FFS usually consists of 15-20 members with a shared common interest in learning about ways to improve their agricultural practices (Mvena et al., 2010). The FFS method is a participatory approach to farmer education and extension, where a trainer is a facilitator rather than an instructor, enabling the farmers to be actively involved in learning, problem solving and in the dissemination of new techniques (Davis et al., 2012). Following a developed curriculum focused and adapted for specific crop, livestock or other agricultural practice, FFS facilitators demonstrate to participants, the potential benefits from adopting improved methods and techniques, usually by comparing traditional practices and improved practices on a farm (mostly on experimental plots).

In consonance with standard FFS practice, for both ASDP-L and ASSP projects, project staff members first trained selected facilitators in the shehias covered by the projects on improved production practices and marketing strategies, which then offered the training to FFS participant farmers who are the direct beneficiaries residing in the shehias covered by the projects. For ASDP-L, the FFS topics included the use of artificial insemination, cross breeding, calf rearing, improved feeding systems, strengthening of linkages

between farms and markets, delivering services from veterinary and animal health workers, building livestock cows' and goats' sheds for cows and goats, constructing biogas digester facilities, and producing slurry from animal manure to improve soil fertility in project communities. For ASSP, FFS topics included land preparation, use of manure, planting in rows and spacing, organic farming, promotion of growing crops with high nutritional values, experimental farm trials, drip irrigation, soil fertility and erosion control, integrated pest management (IPM), and strengthening of crop producer, processing, and marketing associations. For both ASDP-L and ASSP, climate adaptation practices were also promoted in the FFSs.

Following the project's intervention details, highlighted in Figure 1 is the theory of change (TOC) for the projects. It summarizes the framework of the intervention, spanning from inputs (activities) to outputs, outcomes and impacts.

Figure 1: Theory of change



Looking at the casual pathways of Figure 1, note that the designed outcome expected from the FFSs is the adoption of acquired knowledge in improved practices and marketing by the beneficiary farmers. It was also expected that the acquired knowledge through FFS participation will be diffused largely into the local community in the form of farmer-to farmer knowledge sharing with neighbours or friends, who are referred to as *FFS spillovers.* As the improved practices get adopted by the FFS participants and disseminate to spillover farmers, it can contribute to an increase in crop and livestock productivity and hence an increase in agricultural income for farmers in Tanzania (Davis et al., 2012). Interwoven in the increase in productivity and agricultural income, are also the benefits of resilience to economic and climate-related shocks.

Another outcome from the formation of FFS groups, which would have a positive impact on the well-being of the participants, is the farmers' investments in group packaging, processing, and marketing activities (Waddington et al., 2014). A greater access to market has been shown to increase agricultural productivity, firstly by facilitating specialisation and increase in the agricultural produce sold in markets, and secondly through intensification of input use (Kamara, 2004).

Empowerment of the participatory farmers is another planned impact of the ASDP-L and ASSP FFS interventions. By accessing the FFS curricula and gaining new knowledge, farmers may moreover feel empowered and capable of taking on a greater role in the community to pursue their interests. It is usually argued as the most significant impact of FFS participation, as it tends to build the capacity of the local farmer groups and strengthening their ability to make well informed choices or decisions, which can ultimately lead to increased uptake of innovations in agricultural practices, access to services and market access (Friis-Hansen and Duveskog, 2012). In rural communities, FFS programs are somewhat seen as a venture point for vulnerable farmers to create their own cohesive economic empowerment groups, capable of venturing into collective and commercially-oriented activities (Gwary et al., 2015). Thus, empowering rural farmers also allows them to boldly start new commercial ventures, outside their usual agricultural practice. According to IFAD (2015), 62% of the FFS participants were women; also, female participants assumed 65% of FFS leadership positions. Similarly through FFS participation, the socio-economic empowerment of rural women, in the form of intra-family decision making process, household contribution and increased income, can be improved (Fakhi and Sikira, 2018). Consequently, the ASDP-L and ASSP FFS interventions are expected to have substantially propelled empowerment of the rural farmers and especially women.

The final planned impact of the ASDP-L and ASSP FFS interventions is improved food security. Owing to increased productivity as a direct result of adopting the knowledge of improved agricultural practices, obtained from participating in the FFSs, households are less likely to experience hunger in the lean period and more likely to have better and nutritious meals for their children. What is then expected is that, techniques learned from participating in the ASDP-L and ASSP FFSs will be sufficient for the participatory farmers to be able to manage production yields and agricultural cycles, and thus stem food insecurity. In Tanzania, Larsen and Lilleor (2014) have shown that FFS participation has strong and sustained positive effects on food security among participating households, in terms of access to food, food consumption, and quality of diet.

Critical to the successful establishment of FFSs are the assumptions that, for a given locality where the FFS is planned, there are farmers willing and available to participate in the scheme, timely resources are available and importantly there are no cultural bottlenecks hindering extensive farmer participation. Furthermore, to achieve the desired outcome from the FFSs, it is also assumed that the FFS curricula used in the project is relevant to the local needs and agricultural practices of the area. Other relevant assumptions taken into consideration in the theory of change are: chosen FFS facilitators can communicate effectively livestock and farming concepts; the FFS participants or local farmers are convinced that the new knowledge

they have received is beneficial; the FFS scheme is timely, to be in sync with farming seasons; and that the farmers are convinced that the relative cost of inputs outweigh the potential benefits of the improved practices learned from the FFS scheme. In addition, to foster better linkages with market, it is assumed that DFF are effective at defending the interest of FFS members they represent. Welfare improvements occur if investments in the promoted FFS practices yield their expected returns and no external factor (such as conflict, severe price changes, environmental shocks, etc.) eliminates these benefits to farmers.

In terms of unintended consequences, this may materialize if DFF are ineffective or unable to represent farmers adequately. For instance, DFF may be biased and have preferential channels towards certain groups, or towards only those who can repay their services. In addition, conditional on the scale of adoption of improved agricultural practices promoted by the FFSs, the latter may have an impact on the local agricultural supply. By selling at a lower price, FFS participants may end up benefiting net consumers, but harming net producers particularly those who did not attend the FFSs and did not adopt improved practices and did not experience a growth in production. Lastly, a crucial unintended impact is one where FFS may have led farmers to diversify their livelihoods so much so to lead progressive farmers to move out of agriculture. Through the empowerment channel – FFS participants might initiate more profitable off-farm activities able to generate the highest share of their income gain.

2.2. Project Coverage and Targeting

The project was implemented in ten districts of Zanzibar as illustrated in Figure 2. Table 1 indicates the distribution of FFS by district and by FFS batch up to 2016, as provided by the PMU.

Figure 2: Map of project area

Table 1: Distribution of FFS by district and FFS batch (2016 data):

District	Number of Programme Shehias	Total no. of FFS groups	First batch	Second batch	Third batch	Four batch	Fifth batch	First batch	Total no. of beneficiary households
Central	40	164	613	734	386	587	576	2896	4758
North A	32	164	649	780	377	627	592	3025	5125
North B	33	164	737	786	370	612	600	3105	4109
South	21	163	717	796	381	635	584	3113	5681
West A and B	31	193	586	736	384	629	585	2920	4560
Micheweni	22	163	723	767	400	659	539	3088	4208
Wete	35	163	625	800	395	645	616	3032	4801
Chake Chake	30	163	644	800	400	634	610	3088	4307
Mkoani	31	163	630	800	395	655	488	2968	4133
	275	1500	5924	6999	3488	5683	5190	27235	41682

Source: PMU

In accordance to the discussion with the project management unit in Zanzibar, the targeting strategy of the projects was as follows:

- The projects started FFS first in the poorest shehias in each district.
- In each targeted shehias, household members self-selected in the FFS. Only one member per household could participate in a FFS.
- The projects immediately excluded all farmers with employment in other sectors.
- The projects focused on those dependent on farming, fishing or livestock.
- The projects gave priority to farmers with a stated willingness to share their knowledge with their neighbours.

Four activities are required before an FFS can start operating: the sensitisation meetings for the formation of a new FFS in the targeted villages, the recruitment and training of FFS facilitators, participatory diagnostic assessments during which the Project Management Unit (PMU) staff (Agricultural Services Facilitation Team, ASFT) assessed the needs of each targeted village and the development of the FFS curricula. By June 2014, the projects had rolled out activities in 1,200 FFSs across nine districts (Central, North A, North B, South, West A&B, Micheweni, Wete, Chake Chake and Mkoani) and 253 shehias (administrative division in Zanzibar, it is composed of two or three villages, approximately 2,000 inhabitants). These FFSs were established in four "batches" with 300 FFSs established in each batch over the lifetime of the projects. When the project was extended from August 2015 until September 2017, a fifth batch of 300 additional FFS was started. The FFSs in the fifth batch incorporated both trainings for farming and livestock. By December 2015, it was estimated that 28,145 different households participated in FFS across these 1,500 FFSs (IFAD, 2015). It was also estimated that an additional 12,954 farmers were spill-over farmers at the end of 2015 (IFAD, 2015). Therefore, a total of 41,682 households were reached through the project, accounting for 29% of all rural households in Unguja and Pemba[1].

[1] An estimated 142,020 households are in rural areas of Unguja and Pemba out of the population of total 253,608, HBS 2014-2015.

To support the expansion of FFSs, build a sustainable farmer-to-farmer extension and empower farmers, both ASDP-L and ASSP projects promoted farmer-led FFSs together with extension-led FFSs. Typically, FFSs projects initially being with extension-led FFS, during which extension facilitators identify farmers that can serve as the facilitators of the next generation farmer-led FFSs. ASDP-L and ASSP projects followed the same process in establishing the 1500 FFSs. In the first extension-led FFSs season, the public extension workers led the FFSs with help of the Programme District Officer (PDO). Once the farmer knew what to do the extension workers only offered guidance when needed. At the same time, the public extension workers selected farmers that have requisite skills and expertise to serve as the next generation FFSs facilitators and trained them. Then, in the following two farmer-led FFSs seasons, the trained farmer facilitators conducted the FFS sessions and led the training of FFS participants. This whole process took three years.

As part of the project interventions, DFF were also established to represent FFS members and lobby in favour of farmers' interests. Once established, the DFF were intended to gradually take over the major role from local district governments to decide on the content and nature of the annual District Agriculture Development Plan (DADP). The DADP was the annual work plan developed by the local project staff members in each district to design the curricula offered by the FFSs in each district during each year of the project duration.

2.3. Research Questions

Number of testable hypotheses can be derive from the project's TOC outlined in Figure 1. Based on those hypotheses, the following research questions have been formulated for the impact assessment of the ASDP-L and ASSP projects to inform the design of the impact assessment surveys.

Question 1: Have the FFS participating farmers and livestock keepers acquired new farming and livestock knowledge?

Question 2: Have the FFS participating farmers and livestock keepers adopted improved practices (including climate adaptive practices) and improved technologies?

Question 3: Have the FFS participants experienced greater resilience to economic and climate-related shocks? Are they empowered and more connected to the market? Do they exhibit higher yields, improved agricultural productivity and increased incomes?

Question 4: Have the FFS participants shared their knowledge acquired as part of the FFS training sessions with their neighbours and if so, to what extent?

Question 5: Do the FFS participants exhibit better outcomes (resilience, empowerment, marketing ability, increased agricultural productivity, income and upward economic mobility) compared to FFS non-participants?

Question 6: Through the empowerment channel - have the FFS participants diversified their livelihoods so much so that the highest share of their income comes from more profitable off-farm income sources? Can we put forward the hypothesis that the FFS participants through diversification might be encouraged to move out of agriculture?

Question 7: To what extent the length and the frequency of training and sessions received influences the knowledge and uptake of improved farm and livestock practices of the FFS participants?

Question 8: What are the key features of the FFSs that are linked to positive impacts on improved farm practices, technology adoption, productivity, and marketing strategies of the FFS participants?

3. Impact Assessment Design: Data and Methodology

3.1. Data

The impact assessment of ASDP-L and ASSP is based on a quantitative household survey conducted in 2018. The cross-sectional quantitative survey collected data from 2082 beneficiary and control households sampled using a quasi-experimental design. To inform the design and interpretation of the quantitative data, the impact assessment also drew information from a qualitative study conducted by the project staff as part of the project completion process, i.e. the Participatory Impact Assessment (PIA). The qualitative study was conducted for the purpose of understanding the impact of the programme at household, FFS group and community level, with a particular focus on farmers empowerment.

A common challenge in conducting an ex-post impact assessment of a project is establishing a valid counterfactual, e.g. determining what would have happened to the beneficiaries in the absence of the project intervention. To estimate the impact of a project, ideally one would compare the state of the beneficiaries on a given outcome with and without the project. However, since the beneficiary farmers cannot be observed simultaneously in two states, impact assessments rely on a selected counterfactual group of non-beneficiary farmers against which the beneficiaries will be compared, to estimate the project's impacts. To qualify as a valid counterfactual, the selected group of comparison farmers need to be identical to the project beneficiaries apart from not having participated in the project. In this way, the observed difference in the outcome can be taken as the impact of the project (Winters et al., 2010).

Identifying an appropriate counterfactual group that will provide a valid comparison for project beneficiaries is however a challenge, especially for ex-post impact assessments with no baseline data. The impact assessment design for ASDP-L and ASSP faced additional design related challenges to identify a proper counterfactual group.

First, the establishment of FFS had reached a saturation point in all of the ten rural districts of Zanzibar. Over the life of the project, 1500 FFS were established in 253 shehias out of the 313 shehias in Zanzibar. Therefore, finding comparison shehias that are not targeted by the project, but that have similar characteristics as the project shehias was not possible. Also, the variety of the FFS activities introduced by ASDP-L and ASSP projects further complicates the identification of the counterfactual. While there are seven major types of FFSs delivered as part of the two projects (dairy cow, dairy goats, banana, cassava, vegetable, vegetable, and paddy rice), project data reveal that there are a total of 57 different types of FFS activities that took place across the five batches of FFSs from the two projects.

Second, the participatory approach that the project followed to establish FFSs is likely to generate non-random program placement and selection bias. The villages in which FFSs were introduced were non-randomly selected by the project management unit staff based on a needs assessment of each targeted village. The participation in FFSs was also voluntary where farmers self-selected into participation, depending on their observable and unobservable characteristics that may affect participation. For example, if villages that had no market access were selected, the impact estimates would have been underestimated given that better market conditions might lead to for instance higher yields and income among the non-participants. Also, if more educated farmers for instance self-selected into FFSs participation, the impact estimates would instead have been overestimated given that more educated farmers tend to perform better in agricultural production regardless of FFS participation.

Third, the project intended to have spillover effects. By design, agricultural projects like ASDP-L and ASSP encouraged farmers to share knowledge on improved agricultural practices and marketing to other farmers in order to have a broader impact on the local economy. Thus farmers that did not participate in FFSs might

indirectly benefit from the project via farmer-to-farmer diffusion of knowledge. The selection of such farmers into the comparison group would contaminate the counterfactual and bias the estimates of the project impact. The contamination of the counterfactual can result in an underestimation or overestimation of the project impact since the average observed outcome for the non-beneficiary farmers is not the average potential outcome in the absences of the project intervention. To tackle the problem of contamination and selection bias, one potential identification strategy is to randomly select the comparison group from villages that are sufficiently distant from the treated villages with selection-on-observables design (Winters et al., 2010). However, randomization at the village level was not possible in this case due to the saturation of the project at the shehia level, the lack of village-level frame and the incomplete documentation of the location of the FFSs at the village level.[2]

Given that randomizing geographically was not possible, the beneficiary farmers and control farmers were both randomly selected from the same shehias where the project was implemented. The selection of both beneficiaries and control group was carried out in two stages. In the first stage, half of the program shehias that had the seven major types of FFSs were randomly selected out of the total 234 project shehias.[3] Initially, the shehias in the two islands were stratified into tertiles by FFS intensity to ensure the representativeness of the sample according to the project intensity and impact thereof. The FFS intensity tertiles groups for Pemba and Unguja were 1-4, 5-7, 8-10 and 1-2, 3-4, 5-10 FFS respectively. The 122 sampled shehias were roughly equally distributed across the tertiles[4]. Table 3.1 provides the tertile groups and the distribution of sampled shehias across the tertile groups in the two islands.

Table 3.1: Distribution of sampled program shehias by FFS intensity

	Intensity of FFS in the shehias			Total
	First tertile (Low)	Second tertile (Medium)	Third tertile (High)	
Pemba	21	19	15	55
Unguja	24	24	19	67
Total	45	43	34	122

After the shehias were selected, an M&E dataset provided by the project management unit was used as the sampling frame for randomly selecting the beneficiaries at the second stage. The dataset contained detailed information on the FFS (name of the FFS, the FFS activity, the batch in which the FFS was established and the location of the FFS at the shehia level) and information on the FFS participants (name and gender of the FFS participants). Using this dataset, two FFS participants were randomly selected from each FFS in the sampled shehias by gender, given that women empowerment is one of the prominent expected impacts of the project.

In addition, to ensure robustness of the identification strategy, and obtain a valid counterfactual, this impact assessment relied on an experimental approach that mimicked the phased-in selection design (pipeline approach) during this second stage. Strictly following the phased-in selection design was not possible given that the project implementation was already completed, all batches of the FFS had been established and all FFS participants received training. In a phased-in selection design, eligible beneficiaries selected to participate in the project, but scheduled to receive the intervention in the later stages, are chosen as the

[2] The main bottleneck of the impact assessment has been the difficulty to construct a village-level frame given the fact that administrative boundaries of shehias change frequently as well as the naming conventions of both shehias and villages. According to a Tanzanian Statistics Office staff, village level information for each shehia is not available in Tanzania since villages are not officially the principal enumeration unit of population censuses but rather the shehias.

[3] Sheias that did not have FFS with the seven major FFS activities (dairy cow, dairy goats, banana, cassava, vegetable, vegetable, and paddy rice) were dropped, reducing the number of shehias from 253 to 239.

[4] Shehias with only one FFS were dropped from the sample.

control group to avoid selection bias and therefore represent a valid counterfactual. The assumption is that since both the beneficiary and control group have been selected to receive the project intervention, there are no systematic differences between the two and therefore there is no selection bias. Closely following this approach, the identification of eligible beneficiaries as the counterfactual group was done in the form of a quasi-experiment whereby project district officers (PDO) provided a list of 100 potential FFS participants by shehia, mirroring the targeting of a hypothetical 6th batch of ASDP-L and ASSP FFS participants. To ensure that there were no systematic differences between the potential lists of the hypothetical 6th batch ASDP-L and ASSP FFS participants and the beneficiaries, the same PDOs that implemented the project were used and the PDOs were instructed to use the same selection/targeting criteria as in the previous project targeting phases. The PDOs were also instructed to target farmers outside of the locality of the FFS and to identify farmers who did not qualify as spillover farmers to avoid contaminating the counterfactual. Using the list of the 100 potential FFS participants as the sampling frame for the counterfactual group, the same number of female and male potential FFS participants as the beneficiary farmers were randomly selected from each sampled shehia in the second stage. The final data collection covered 2082 households (1050 beneficiary and 1032 control households) from 516 FFS in 108 shehias. The sampling methodology ensured a very robust determination of the counterfactual

3.2. Questionnaire and Impact indicators

The quantitative household questionnaire for the ASDP-L and ASSP impact assessment was designed to collect detailed information on household socio-demographic characteristics, adoption and diffusion of improved agricultural practices, agricultural and livestock production, food security, resilience and women's empowerment using the IFPRI/PRO-WEAI tool. Pro-WEAI is an adaptation of the Women's Empowerment in Agriculture Index (WEAI), originally developed in 2012 by IFPRI, the United States Agency for International Development (USAID), and OPHI.

This detailed household and individual level information is used to put together the key impact indicators identified following the casual path discussed in the theory of change.

i. Knowledge, adoption and diffusion of improved practices

In agricultural projects with a knowledge and technology transfer component, a good starting point to measure the effectiveness of the project is to assess the change in farmers' knowledge of improved practices (Zilberman and Waibel, 2007). Also using knowledge as an indicator has the advantage that it is independent of other factors that vary over time and geographic locations, such as prices or input supplies. To measure farmers' knowledge, data was collected on farmers' awareness of improved practices depending on the agricultural activity that the farmers were involved in. For instance, for farmers that engage in rice production, data was collected on the knowledge categories of land preparation, farm production record keeping, planting of crop, efficient farm management, crop pest and disease control, agribusiness, post-harvest handling, crop processing and basic knowledge on nutrition.

The adoption of improved practices was also assessed as one of the intermediate impacts of the project. Farmers' adoption of improved practices was measured as the number of improved practices adopted by the farmers. To assess the diffusion of improved practices, data was collected on the number of individuals the FFS participants shared knowledge with. To measure the value of the diffusion of knowledge, the quality of training was assessed based on the length and type of training conducted by the farmers that shared knowledge.

ii.Agricultural production, productivity and diversification

The most commonly used agricultural production indicators are those pertaining to production of crops or livestock. For crop production, crop yields usually defined as the output per unit of land (kg/ha) are used. Additionally, crop land allocation and crop sale value are used as an alternative indicator for crop production. For livestock production, household livestock ownership, the number of livestock units owned and the amount of animal products produced by the household are used. As a measure of livestock units owned, the tropical livestock unit (TLU) was constructed by assigning weights to each livestock type based on their weight. To measure agricultural productivity, the rate of production for given inputs such as seeds, fertilizers, and pesticides are used.

Agricultural diversification is a concept of allocating resources to an increasing number of agriculture activities. Diversification can be measured using different types of indices that could range from the simple count index to more complex indices such as the Shannon index. In this impact assessment, the simple count index will be used to construct the diversification indicators.

iii.Agricultural income and household wealth

Amongst economic indicators, agricultural and rural household income indicators are considered key in assessing the impact of developmental policies. In the same vein, agricultural income and net household income indicators were used to evaluate the impact of the project on household welfare. Net household income was defined as the total amount generated from agricultural and non-agricultural activities net of expenses. This includes income generated from sales of crops, livestock, and poultry, products from crops, livestock and poultry, other farm income (e.g. hiring out of livestock for drafting and letting farm property to others) and non-farm income (e.g. cash gifts, cash transfers, remittance, wage and self-employment income). Net agricultural income was defined as the income earned from agricultural products sold, such as field crop products, animals and animal products. Additionally, agricultural revenues and margins were used to assess how much the household earned in a given year from the sales of crops, livestock animals and their sub-products.

To measure long term impact on household's welfare, asset based indicators are considered better indicators. Hence, three asset indices, i.e. durable, productive, and livestock assets indices are additionally used to evaluate the welfare effect of the project. The asset indices aggregate household stocks with different units into a single measure using aggregating weights from PCA or MCA. For livestock assets, the TLU was also constructed as noted above.

iv.Dietary diversity and food security

A qualitative measure of food consumption that reveals household access to a variety of food is dietary diversity, which also proxies for nutrient adequacy of an individuals' diet. To measure dietary diversity, the household dietary diversity score is used. A household dietary diversity scores (HDDS) is a simple count of food groups that a household or an individual has consumed over the preceding 24 hours.

To measure food security, the Coping Strategies Index (CSI) is used. The CSI takes an experiential approach to measure food security based on the behavioural coping strategies used by households to manage food shortages. The CSI is constructed as a weighted average of the frequency and severity of various behavioural coping strategies (Carletto, Zezza, and Banerjee 2013).

v.Resilience

Given that there are several methodological approaches to build an indicator variable to explain resilience, the impact assessment relied on various indicators to measure resilience. Among others, a common approach developed as part of a household survey conducted in Ethiopia - the Pastoralist Areas Resilience

Improvement and Market Expansion (PRIME) project (Frankenberger, 2015) - is to use polychoric factor analysis (PFA) to combine different sub-indices to form a single resilience index. A second approach is to use a conditional moment-based econometric approach to compute household-level resilience index (Cissé and Barrett, 2016; Phadera et al., 2017). The first approach is used to measure resilience in this impact assessment.

vi. Women's Empowerment

The empowerment of women is a continuum, which is assessed according to how much improvements are made in terms of women's decision making over time. Common indicators of decision making power are women's income, education, and assets (Malapit and Quisumbing 2014). To measure women's empowerment, the Project-Level Women's Empowerment in Agriculture Index (pro-WEAI) was used. Pro-WEAI is a new survey-based index for measuring empowerment, agency, and inclusion of women in the agriculture sector. Developed jointly by the International Food Policy Research Institute (IFPRI), the Oxford Poverty and Human Development Initiative (OPHI), and thirteen partner projects in the GAAP2 portfolio[5], the tool helps agricultural developmental projects assess women's empowerment in a project setting, diagnose areas of women's disempowerment, design strategies to address deficiencies, and monitor project outcomes. Pro-WEAI is an adaptation of the Women's Empowerment in Agriculture Index (WEAI), uses the A-WEAI as a starting point, and adds specialized project-relevant modules, designed and tested by the WEAI team. Standardized components of the survey will be comparable across all projects using the pro-WEAI, and specialized project-relevant modules will be comparable within clusters of projects addressing similar pathways to empowerment in the agricultural sector. We fielded the standardized version of the index.

Pro-WEAI is composed of 12 indicators of women's empowerment in agriculture: autonomy in income, self-efficacy, attitudes about domestic violence, input in productive decisions, ownership of land and other assets, access to and decisions on credit, control over use of income, work balance, visiting important locations, group membership, membership in influential groups, and respect among household members. These indicators are organized into three domains: intrinsic agency (power within), instrumental agency (power to), and collective agency (power with).

A respondent is considered adequate in a particular indicator if she or he reaches a certain threshold. For example, a respondent is adequate in group membership if she or he is an active member of at least one group in the community. The indicators are weighted equally, and a respondent is considered empowered if she or he is adequate in at least 75 percent – or at least 9 out of 12 – of the indicators. The Three Domains of Empowerment score (3DE) is calculated from these 12 indicators, and reflects how many respondents are empowered across the three domains (intrinsic, instrumental and collective agencies) and the extent of their empowerment. Pro-WEAI is therefore a composite index that tells us how empowered the women surveyed are as a group. Pro-WEAI combines the 3DE score with the Gender Parity Index (GPI), which assesses how empowered women are in comparison with the men in their households.

vii.Market access and other impacts

Market access is mainly assessed in terms of accessibility to infrastructure e.g. households' proximity to markets. Information on market participation of the households, simply defined as whether or not a farmer sells its crops or livestock products for money, will be mainly used as a proxy for market access. For

[5] The Gender, Agriculture, and Assets Project (GAAP), led by the International Food Policy Research Institute (IFPRI) is currently in its second phase. Working with a portfolio of agricultural development projects, GAAP2 will adapt and validate a measure of women's empowerment for use by agricultural development agencies and project implementers to diagnose key areas of disempowerment, design appropriate strategies to address deficiencies, and monitor project outcomes related to women's empowerment. GAAP2 will also develop evidence-based strategies to target, engage and empower women through agricultural development projects.

participation in processing and marketing activities, the level of investments in crop and livestock processing and marketing activities by households is used.

3.3. Impact Estimation

As noted, in order to accurately estimate the impact of ASDP-L and ASSP activities on farmers' welfare, it is necessary to explicitly account for selection on observables. In other words, beneficiaries' participation in FFS schools is not randomly assigned. Therefore, in order to estimate the project impact, a simple comparison between beneficiaries (treatment) and non-beneficiaries (control) households leads to unreliable estimates due to the presence of selection bias. In fact, systematic (observable and unobservable) differences between treatment and control households are likely to exist even in absence of project participation. In other words, farmers with better cognitive ability as well as learning and knowledge sharing attitudes are more likely to participate in FFS and are also more likely to obtain higher agricultural productivity regardless of the actual project intervention provided. In this case, differences in agricultural productivity between treatment and control farmers are not entirely due to project participation, but rather to unobservable farmers' characteristics that may also include entrepreneurial activity and personality traits. More formally, under the potential outcome framework (Roy 1951, Rubin 1974), the binary treatment indicator D_i is equal to 1 if the individual i receives the treatment and equal to 0 otherwise, with $i = 1, \dots, N$. The potential outcomes are defined as $Y_i(D_i)$. The most common parameters of interest in the evaluation literature are the average treatment effect on the treated (ATT) and the average treatment effect (ATE), which are defined as:

$$\tau_{ATT} = E[Y(1)|D = 1] - E[Y(0)|D = 1] \quad (1)$$

$$\tau_{ATE} = E[Y(1) - Y(0)] \quad (2)$$

The ATT gives the effect on those who actually received the treatment, while the ATE represents the average treatment effect on the whole population. The counterfactual mean for beneficiaries $E[Y(0)|D = 1]$ should be observed for the ATT estimation and the two counterfactual means for beneficiaries $E[Y(0)|D = 1]$ and non-beneficiaries $E[Y(1)|D = 0]$ should be observed for the ATE estimation. However, this is impossible in reality and, therefore, feasible substitutes of the counterfactual means must be used.

In non-experimental impact assessments, using the mean outcome of non-beneficiaries, $E[Y(0)|D = 0]$, instead of $E[Y(0)|D = 1]$ leads to biased estimates of the ATT:

$$E[Y(1)|D = 1] - E[Y(0)|D = 0] = \tau_{ATT} + E[Y(0)|D = 1] - E[Y(0)|D = 0] \quad (3)$$

The difference between the left hand side of equation (3) and τ_{ATT} is the self-selection bias.

In order to obtain unbiased estimates of the ATT and the ATE, we normally employ Propensity Score Matching (PSM) with five nearest neighbours as our starting estimator. Then, the ATT and the ATE are estimated using the following different models in order to ensure the robustness of the results: regression adjustment (RA), covariate matching with five nearest neighbours (NN), inverse probability weighting (IPW), and IPW with regression adjustment (IPWRA).

The matching strategy relies on two conditions: the common support condition and the conditional independence condition (CIA). The common support condition can be defined as:

$$0 < p(X) = Pr(D = 1 \mid X) < 1 \quad (4)$$

This condition requires that each treatment observation has comparison control observations with similar propensity score and that each control observations have comparison treatment observations with similar propensity score. The propensity score, $p(X)$, is the probability to participate in the project given a set of observable characteristics X. The ATT and the ATE can be identified only on the area of the common support and observations off the common support region should be dropped.

The CIA requires that the potential outcomes must be independent on the treatment conditional on the propensity score:

$$Y(1), Y(0) \perp D| \, p(X) \quad (5)$$

In order to have this condition satisfied, we should choose a set of control variables that are not influenced by the treatment and that simultaneously influence the participation decision to the project and the outcome variables. Omitting important control variables can seriously lead to biased estimation results (Heckman, Ichimura and Todd 1997).

To be noted that, the ATT identification requires a weaker common support condition and a weaker CIA: $p(D = 1 \mid X) < 1$ and $Y(0) \perp D| \, p(X)$. The weaker common support condition requires only that each treatment observations have comparison control observations with similar propensity score. The weaker CIA refers only to the potential outcome $Y(0)$.

If the two conditions are satisfied, the ATT can be estimated as follows:

$$\tau_{ATT}^{PSM} = E\{E[Y(1)|p(X), D = 1] - E[Y(0)|p(X), D = 0]|D = 1\} \quad (6)$$

Our estimation strategy can be therefore summarized in four steps. In the first step, we analyse the descriptive statistics and the quality of the counterfactual by looking at the t-test on the equality of means of control variables between beneficiaries and non-beneficiaries prior to matching. This test shows whether control variables, defined as variables that should not be affected by project participation, are balanced between the two groups.

In the second step, we compute the propensity score, through probit regression, to examine whether the common support condition is satisfied. We show the Kernel density of the estimated propensity score of all observations by treatment status. Such graphs are useful visuals for examining the distribution of propensity score across treatment and control groups and the quality of the counterfactual. The common support region is determined by dropping all observations whose propensity score is smaller than the minimum and larger than the maximum in the opposite group.

Last, we run the PSM with five nearest neighbours and its performance is analysed looking at the Rosenbaum and Rubin (1985) reduction bias statistics.[6] Even though there is no clear successful threshold of the reduction bias, in most empirical studies a reduction bias below 5% indicates a good performance of the PSM procedure.

[6] The Rosenbaum and Rubin (1985) reduction bias is the difference between the standardised bias before and after the matching, i.e. the difference between: $SB_{before} = 100\frac{(\bar{X}_1 - \bar{X}_0)}{\sqrt{0.5(V_1(X) - V_0(X))}}$ and $SB_{after} = 100\frac{(\bar{X}_{1M} - \bar{X}_{0M})}{\sqrt{0.5(V_{1M}(X) - V_{0M}(X))}}$, where $X_1(V_1), X_0(V_0)$ are the mean (variance) in the treatment and control group respectively before the matching and $X_{1M}(V_{1M}), X_{0M}(V_{0M})$ are the mean (variance) in the treatment and control group respectively after the matching.

Before proceeding to the third step, and in order to improve the impact estimation, the sample is restricted to the households on the common support region. The common support region is also trimmed at the lowest and highest 2% of the propensity score.

In the third step, we proceed with the impact estimation of the ATT and the ATE using the PSM with 5 nearest neighbours and we compare its results to estimates of impact obtained with RA, NN with 5 nearest neighbours, IPW and the IPWRA.

In the fourth step we conduct a sensitivity analysis to assess the presence of hidden bias, or selection of unobservables. The CIA implies that self-selection is based only on observed characteristics. If unobserved characteristics influence both the participation decision in the projects and the potential outcomes, the matching strategy will fail. Specifically, considering the quasi-experimental design of the ASDP-L and ASSP impact assessment design, it is possible that unobservable factors such as farmers intrinsic motivation and specific preferences might affect their FFS participation decision. To examine if the impacts estimated with the PSM are influenced by unobserved factors, we adopt the Rosenbaum (2002) bounds approach for the ATT in the presence of unobserved heterogeneity. In particular, we look at the Mantel-Haenszel (1959) tests statistics for binary outcome variables, which give bound estimates of significance levels at given levels of hidden bias under the assumption of either systematic over- or underestimation of treatment effects. This approach is based on the fact that if there is no hidden bias, the odds of receiving the treatment is 1, where $\Gamma = 1$, and the sensitivity analysis evaluates how the inference changes by changing the value of Γ. If, by increasing the value of Γ, the bounds move apart, there is uncertainty about the tests statistics in the presence of unobserved heterogeneity (Caliendo and Kopeing 2005).

The estimators presented above only give an estimate of the direct impact of the projects. However in the context of this study, the presence of indirect effects or "interference" - or spillover effects - from FFS treated to untreated units is highly likely, therefore the estimation model needs to take into account the possibility that there are correlated effects (considered here exogenous or driven by the FFS context) which depend on the predetermined characteristics of individuals in the neighbourhood of the FFS participants, e.g. the actual control farmers.

Therefore in this setting, the following assumptions are made (Cerulli, 2017):

i) The unit potential outcome depends on its own treatment and other units' potential outcome.

ii) The assignment is mean conditionally unconfounded.

iii) The treatment is binary (participating to FFS schools).

iv) Potential outcomes have a parametric form.

The essence of the model is to estimates ATEs under CMI (conditional mean independence) when neighbourhood interactions may be present. It incorporates such externalities within the traditional Rubin's Potential Outcome Model (POM). As such, it provides an attempt to relax the stable unit treatment assumption (SUTVA), a frequent assumption that is made in observational studies.

In order to estimate ATEs, the following will be implemented. Given an independent and identically distributed sample of observed variables for each household i,

$\{y_{i,}w_{i,}x_{i,}\}$ with i= 1, . . . ,N

1. A weighting matrix Ω = [ω_{ij}] measuring some type of distance between the generic unit i (untreated) and unit j (treated) will be estimated;

2. Using OLS, a regression model of $y_{i,}$on $\{1_{,}w_{i,}x_{i,}w_{i}(x_{i,}-\bar{x}),z_{i}\}$ will be fit

3.Then, $\{\widehat{\beta_0},\hat{\delta},\hat{\gamma},\widehat{\beta_1}\}$ is obtained and put into the formulas of $\widehat{ATE}$s.

By comparing the formulas of the ATE with ($\gamma \neq 0$) and without ($\gamma = 0$) the neighbourhood effect, the estimated **neighbourhood bias** is define as

Bias = $|ATEwithout - ATEwith| = |\gamma\mu_1 + \bar{v}\lambda|$

This is the bias arising when one neglects peer effect in assessing treatment effects in observational studies: it depends on the weights employed, the average of the observable confounders considered in x, and the magnitude of the coefficients γ and β_1. Such bias may be positive or negative. Furthermore, by defining $\gamma\beta_1 = \lambda$ it is also possible to determine whether this bias is statistically significant by simply testing the following null hypothesis:

$H0: \lambda_1 = \lambda_2 = \cdots = \lambda_M = 0$

If this hypothesis is rejected, it would mean that neighbourhood effects are in place, thus significantly affecting the estimation of the causal parameters' ATEs. In a similar way, it is also possible to obtain an estimation of the neighbourhood bias for ATET and ATENT (average treatment effect on the untreated).

It is of policy relevance to estimate the neighbourhood bias – as this will lead to potential underestimation of the impact of the projects. Intuitively, if there is contamination, e.g. or indirect effects, control farmers would have heard or even adopted the FFS practices, and they will have the same outcomes. In this context the impact, defined as the difference in the outcomes of treatment and control – will be small.

4. Profile of the project area and sample

This section present a description of the sample collected, to understand the distribution and the main characteristics of treatment and comparison farmers. Note how out of a total sample of 2082 households, the latter are balanced across treatment and control, and the number of shehias sampled is proportionally distributed to the district size in the two islands of Zanzibar (Unjuja and Pemba, respectively).

Table 4.1: Sample distribution by district, number of shehias, treatment and control group after the data collection

Island	District	Number of Shehias sampled	Treatment	Control	Total
			Number of HHs	Number of HHs	
Pemba	Chake Chake	15	128	129	257
	Micheweni	13	119	120	239
	Mkoani	12	119	119	238
	Wete	12	120	122	242
	Total	52	486	490	976
Unguja	Central	14	104	105	209
	North 'a'	12	126	117	243
	North 'b'	10	111	99	210
	South	10	111	109	220
	West 'a'	4	44	42	86
	West 'b'	6	68	70	138
	Total	56	564	542	1106
Total		108	1050	1032	2,082

In table 4.2, demographic, socio-economic characteristics as well as variables related to cognitive skills of treatment and comparison farmers are presented. In the table below, note the differences that are statistically significant between treatment and control farmers averages before and after propensity score matching (PSM). PSM allows the analyst to obtain a more balanced sample – across treatment and control.

For instance, treatment and control farmers seem to differ in terms of average age of households heads, with the control group on average 5 years younger, marital status, and education of the secondary decision maker in the household and household size. These differences disappear after running PSM, which has the function of creating a more balanced sample and generating a more robust counterfactual.

As far as cognitive skills are concerned, these are key variables as a possible significance might have indicated a potential selection bias, with FFS farmers more likely to have better cognitive and learning potential outcomes compared with their control farmers counterparts. The table shows that there are no systematic differences ex-post across the various proxies for cognitive ability[7] between the two groups, and that the targeting experiment had succeeded in choosing comparable farmers.

[7] With the objective of measuring different aspects of adult farmers' cognitive ability, four different cognitive tests were selected: i) The Raven Colored Progressive matrices, measuring visual processing and analytical reasoning; ii) The digit span forwards and backwards, measuring short term memory and executive functioning; iii) A written and timed test of basic math skills; and iv) A reading comprehension test.

Table 4.2: Summary statistics before, after matching and bias reduction

	Before matching				After matching				Reduction in Bias (%)
	Treat. Mean/SE	Control Mean/SE	p-value	Bias	Treat Mean/SE	Control Mean/SE	p-value	Bias	
Age of primary decision maker	45.98	40.84	0.000***	34.05	45.86	46.02	0.81	1.21	96.44
	0.41	0.45			0.41	0.439			
Squared age of primary decision maker	2 286.15	1 853.13	0.000***	30.65	2 272.10	2 280.37	0.90	0.66	97.84
	39.55	40.53			40.11	43.157			
Gender of primary decision maker (1=male)	0.46	0.47	0.698	0.77	0.45	0.454	0.92	0.50	34.81
	0.02	0.02			0.02	0.017			
Education of primary decision maker (1= Elementary)	0.27	0.26	0.835	2.42	0.27	0.288	0.57	3.01	-24.16
	0.01	0.01			0.01	0.016			
Education of primary decision maker (1=Secondary and higher education)	0.50	0.47	0.109	5.82	0.49	0.468	0.37	4.58	21.31
	0.02	0.02			0.02	0.017			
Ravens test score	-0.02	0.01	0.415	2.79	-0.02	-0.020	0.96	0.30	89.16
	0.03	0.03			0.03	0.034			
Reading subjective score	-0.00	0.00	0.849	0.73	0.00	-0.012	0.73	1.79	-144.27
	0.02	0.02			0.02	0.026			
Numeracy score	0.01	-0.01	0.232	5.57	0.01	0.006	0.91	0.58	89.51
	0.01	0.01			0.01	0.009			
Reading test score	3.46	3.48	0.840	1.42	3.45	3.436	0.79	1.35	5.43
	0.04	0.05			0.04	0.048			
Digit span score (forward)	0.38	0.38	0.433	2.19	0.38	0.379	0.83	1.15	47.22
	0.01	0.01			0.01	0.008			
Digit span score (backward)	0.31	0.31	0.973	0.44	0.31	0.311	0.81	1.25	-180.07
	0.01	0.01			0.01	0.007			
Math fluency score	-0.01	-0.00	0.506	1.36	-0.01	-0.009	0.87	0.97	28.99
	0.01	0.01			0.01	0.015			
Marital status of head (1=married)	0.80	0.73	0.001***	11.73	0.80	0.816	0.40	3.95	66.36
	0.01	0.01			0.01	0.013			
Education of secondary decision maker (1= Elementary)	0.25	0.25	0.985	0.83	0.25	0.235	0.44	3.87	-363.67
	0.01	0.01			0.01	0.015			
Education of secondary decision maker (1=Secondary and higher education)	0.40	0.35	0.013**	8.73	0.40	0.390	0.82	1.21	86.10
	0.02	0.02			0.02	0.017			
Household size	6.23	5.95	0.023**	7.85	6.21	6.257	0.71	1.86	76.37
	0.08	0.09			0.08	0.093			
Dependency ratio	1.18	1.16	0.510	1.23	1.18	1.193	0.86	0.90	26.65
	0.03	0.03			0.03	0.032			
Number of cows owned	0.87	0.91	0.593	2.57	0.88	0.905	0.81	1.40	45.55

(baseline)	0.05	0.07			0.05	0.081			
Number of goats owned (baseline)	0.70	0.57	0.147	2.53	0.63	0.655	0.81	1.30	48.61
	0.07	0.06			0.07	0.068			
Number of chickens owned (baseline)	7.35	7.07	0.677	2.75	7.31	7.166	0.88	0.95	65.58
	0.44	0.51			0.45	0.607			
Improved wall (baseline)	0.04	0.04	0.690	1.86	0.04	0.043	0.89	0.76	59.32
	0.01	0.01			0.01	0.007			
Improved roof (baseline)	0.67	0.63	0.097*	7.52	0.66	0.646	0.44	3.92	47.83
	0.01	0.02			0.01	0.016			
Improved floor (baseline)	0.58	0.54	0.052*	7.29	0.57	0.557	0.48	3.65	49.92
	0.02	0.02			0.02	0.017			
Number of rooms: two (baseline)	0.28	0.24	0.064*	6.63	0.27	0.281	0.70	2.06	68.85
	0.01	0.01			0.01	0.015			
Number of rooms: three (baseline)	0.22	0.21	0.494	4.13	0.23	0.226	0.99	0.06	98.50
	0.01	0.01			0.01	0.014			
Number of rooms: four (baseline)	0.21	0.25	0.081*	6.42	0.21	0.195	0.45	3.67	42.86
	0.01	0.01			0.01	0.014			
Modern source of lighting (baseline)	0.19	0.15	0.030**	8.92	0.18	0.185	0.99	0.09	98.95
	0.01	0.01			0.01	0.013			
Travel distance to next district town (km, log)	2.66	2.68	0.721	2.69	2.66	2.657	0.95	0.33	87.62
	0.04	0.04			0.04	0.041			
Travel distance to the market (minutes, log)	3.29	3.28	0.794	0.85	3.28	3.290	0.79	1.36	-60.20
	0.03	0.03			0.03	0.034			
No. of observations	1 049	937.00			1 011	897			

Notes:

1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.
2. Point estimates are sample means. Standard errors are reported below.
3. Asterisks represent level of statistical significance of t-test/chi-squared test of difference in means.

Table 4.3 presents the distribution of treatment and control households after matching. A number of observations are lost, due to the fact that we could not find a suitable twin for some treatment farmers. The final sample for analysis amounts to 1908 households distributed across treatment and control groups as displayed in table 4.3.

Table 4.3: Treatment sample distribution by district after matching

Island	District	Number of Shehias sampled	Treatment	Control	Total
			Number of HHs	Number of HHs	
Pemba	Chake Chake	15	123	115	238
	Micheweni	13	119	109	228
	Mkoani	12	114	102	216
	Wete	12	118	107	225
	Total	52	474	433	907
Unguja	Central	14	99	92	191
	North 'a'	12	119	96	215
	North 'b'	10	107	85	192
	South	10	103	96	199
	West 'a'	4	43	36	79
	West 'b'	6	66	59	125
	Total	56	537	464	1001
Total		108	1011	897	1908

The peculiarity of this impact assessment requires assessing the distribution of treatment households by type of FFS activity, and by gender of the FFS trained participant. According to the sample drawn, note how farmers are more prevalent in the poultry and vegetable FFS categories followed by bananas, cassava, dairy cows, paddy rice and goat keeping. Female beneficiaries are more prevalent in the category of FFS for vegetables (63% vs 37% men); paddy rice (60%); followed by poultry and goat keeping (56%).

Table 4.4: Distribution of the treatment sample by type of FFS activity and gender of the participant

FFS activity	Female and male beneficiaries		Total (%)
	Female (%)	Male (%)	
Vegetable	63	37	24
Bananas	51	49	17
Cassava	47	53	14
Paddy rice	60	40	9
Poultry	56	44	29
Dairy Cows	47	53	10
Goat Keeping	56	44	8
Total	54	46	100

In addition, table 4.5 presents the distribution of the sample by batch, e.g. the cohort of FFS – recall that this is not mutually exclusive, as FFS participants may have participated to more than one batch. Looking at the totals, note how the largest percentages of the farmers sampled occur in the 4th and 5th.

Table 4.5: Distribution of the treatment sample by district and FFS batch

Island	District	Number of treated HHs	First batch (%)	Second batch (%)	Third batch (%)	Four batch (%)	Fifth batch (%)
Pemba	Chake Chake	128	20	12	14	41	17
	Micheweni	119	22	16	27	25	13
	Mkoani	119	18	17	29	23	15
	Wete	120	20	13	26	28	18
Unguja	Central	104	15	13	11	29	36
	North 'a'	126	20	6	13	34	35
	North 'b'	111	23	16	19	31	27
	South	111	20	16	22	33	25
	West 'a'	44	20	18	14	25	34
	West 'b'	67	12	9	15	24	54
Total		1049	**19**	**13**	**19**	**30**	**25**

A key aspect of the project was also the extent of knowledge sharing from treated farmers to their neighbours, and friends, e.g. the extent of spillovers. Table 4.6 presents descriptives on the extent of knowledge sharing. A question was asked to beneficiaries farmers asking them to list up to 12 people with whom they shared the learning from the FFS training. Out of the total sample, 73 per cent stated that they did not share the knowledge learned, and only 24% stated that they did share the learning up to 3 people.

Table 4.6: Distribution of the treatment sample by level of knowledge sharing

	Number of spillover farmers									
	0	1	2	3	4	5	6	10	12	Total
Treated	765	95	93	69	8	10	6	2	1	1049
%	73	9	9	7	1	1	1	0	0	100

In terms of numbers, the estimated spillover sample from the sample of direct beneficiaries interviewed is about 638, according to the table below. This table indicates the total number of farmers to which primary beneficiaries shared the knowledge with.

Table 4.7: Distribution of the spillover farmers by district

Island	District	Number of treated HHs	Number of spillovers farmers
Pemba	Chake Chake	128	66
	Micheweni	119	52
	Mkoani	119	79
	Wete	120	80
Unguja	Central	104	56
	North 'a'	126	69
	North 'b'	111	75
	South	111	65
	West 'a'	44	47

	West 'b'	67	49
Total		1049	638

FFS training should lead to improved knowledge which according to the TOC, should translate into adoption of practices by FFS participants.

Table 4.8 shows the distribution by extent of adoption of FFS practices. For each curricula (e.g. by activity, notably vegetables, cassava, bananas, cows, goats and rice), a number of practices were taught grouped by topic (e.g. land preparation, agribusiness, treatment of pest and diseases etc.). Given that these are local practices and given the likelihood of spillovers at shehia level, also comparison farmers were asked whether they knew, had ever adopted and whether they were currently adopting the practices and whether they were taught these practices by FFS trainers, friends and or neighbours. Therefore, we computed tertiles of adoption between treatment and control, according to the total number of practices adopted divided by the number of activities the farmer was engaged in.

Intuitively, there should be more adopters in the high or third tertile of adoption in the treatment group – as opposed to the control group where contamination should not be the rule but rather the exception. Note how the percentage of low adopters is roughly equal within treatment and control group, while the control presents a higher number of medium adopters.

Table 4.8: Distribution of the sample by level of adoption of practices promoted by the FFSs

	Level of adoption				Total
	No adoption	First tertile (Low)	Second tertile (Medium)	Third tertile (High)	
Treated	0	352	268	429	1049
%	0	34	25	41	100
Control	43	325	360	209	937
%	5	35	38	22	100
Total	43	677	628	638	1986
	2	34	32	32	100

We now turn to the distribution of crops grown. Note how the distribution is very similar between treatment and control.

Table 4.9: Sample distribution by major types of crops grown within the two islands

	Treatment	Control	Total
Major crops (%)			
Cassava	49	50	49
Paddy rice	33	35	34
Banana	26	28	27
Upland rice	9	8	8
Tomato	7	7	7
Maize	6	6	6

Table 4.10 present the distribution by gender of the primary respondent. Recall that the questionnaire identified a primary and secondary respondent – relative to the beneficiary status - e.g. the primary respondent was either the man or woman in the household targeted by the FFS program, or in the case of a control group, the "type" of man or woman targeted by the FFS training program. The secondary respondent was typically the spouse of the target FFS beneficiary, or if the spouse was not available, another adult household member of the opposite sex who was primarily responsible for making both social and economic decisions related to agriculture. By design, the strategy aimed at selecting 1 male and female FFS participant across each sampled FFS. Hence the sample is balanced across sexes, by number of FFS.

Table 4.10: Sample distribution by the gender of the primary respondent across the districts

Island	District	Treatment			Control			Total		
		Number of HHs	Female %	Male %	Number of HHs	Female %	Male %	Number of HHs	Female %	Male %
Pemba	Chake Chake	128	54	46	117	51	49	245	52	48
	Micheweni	119	59	41	112	57	43	231	58	42
	Mkoani	119	45	55	108	50	50	227	48	52
	Wete	120	53	47	116	53	48	236	53	47
Unguja	Central	104	52	48	94	52	48	198	52	48
	North 'a'	126	58	42	105	59	41	231	58	42
	North 'b'	111	48	52	90	52	48	201	50	50
	South	111	57	43	99	59	41	210	58	42
	West 'a'	44	47	53	36	52	48	80	50	50
	West 'b'	67	58	42	60	60	40	127	59	41
Total		1049	53	47	937	54	46	1986	54	46

In appendix 12, additional descriptive results are presented on FFS participants awareness of the existence of District Farmer Foras (DFFs) and of their perceived benefits and technical competency. Results show that only 16% of the farmers are aware of the existence of a DFFs within their districts (see table 12.1A). Based on perception of the FFS participants, this study found little to no role of the DFFs in improving various outcomes, including increasing yield, access to production inputs and services, technical capacity, linkages to market (see table 12.2A).

Additional results are also presented on support provided by Community Animal Health Workers (CAHW) for livestock producers. As can be seen on table 12.4A, only 27% of FFS participants and 20% of non-participants mention receiving support from a CAHWs. Overall, the results show that less than 50% of the farmers receive any form of support from the CAHWs (12.4A).

5. Results

In order to unpack the impact of FFS, results are presented for the following samples in the tables that follow: 1) the **whole sample** of treatment and control farmers; 2) the sample of **crop producers** in both groups[8]; 3) farmers engaged in **agriculture and livestock** production (crop & livestock); 4) **livestock producers** 5) **high adopters** of practices in the treatment versus **the entire control sample**; 6) **high adopters** of practices in the treatment versus **high adopters in the control** sample (the latter constitutes the "high spillover" group).

It is important to stress what the treatment effects mean in the various groups. Results for the whole sample would indicate the overall impact of having participated in any FFS regardless of the adoption status and farmers livelihoods. Such results may be confounded by the heterogeneity of farmer's livelihoods and also by the adoption status (treatment farmers may have adopted practices to different extent, and may have experienced different benefits contingent on their main livelihood activity).

This is the reason why the results are presented for crop producers, which would isolate the impact of having participated in any FFS for those who are engaged in crop production activities. Results for crop and livestock producers would instead indicate the impact for those that are engaged in *both* livelihoods activities. The fifth group – high adopters of FFS practices in the treatment versus the entire control sample - would give instead an estimate of treatment effects, e.g. the impact of having participated in any FFS, conditional on being a high adopter of FFS taught practices in the treatment group, comparing them to the entire control sample (which include high, medium and low adopters of FFS taught practices – in the control). Note that there was contamination or spillover effects e.g. the control group adopted FFS taught practices to different extents.

The last group – which effectively compares high adopters in the treatment versus high adopters in the control sample, would give the impact estimate of being an FFS participant contingent on the high adoption status of both groups – in other words, it would compare high adopters in the treatment to high adopters in the control (e.g. the high spillover group) – and give the impact estimate purged of the spillover effect for the high adopters group. Ideally, the treatment effect in this case would be expected to be zero – i.e. the same level of adoption in both groups should lead to the same outcomes – but nevertheless we explore this hypothesis in the following tables. Note that only the doubly robust estimator is presented here for all groups, in other words the IPWRA estimator[9].

5.1. Intermediate outcome indicators: current adoption of practices promoted by FFSs

We first start by examining impacts on intermediate outcomes such as adoption of the FFS practices. According to the project TOC, training as part of FFS should generate improved knowledge which in turn should lead to behavioural change and adoption of improved practices, which ideally should also be disseminated from beneficiaries farmers to neighbours and friends. According to the theory of change, spillover effects were supposed to be an intended consequence of the FFS model in Zanzibar. Given the nature of this ex-post and the high context specificity of the interventions – it is reasonable to expect contamination and have high adoption even within the neighbours or friends e.g. the spillover group within shehias.

[8] Results for households that exclusively produce either crops or livestock is presented in Apendix 6.

[9] Note that the interpretation of the treatment effect coefficient is in percentages when the outcome variable is in logarithmic form. When the outcome variable is not in logarithmic form, the coefficient needs to be divided by the control mean and multiplied by 100, to have an estimate in percentage terms.

Adoption has, therefore a special role in the impact pathway as it is effectively an impact mediator, in the causal chain; therefore the impact of treatment on adoption is examined, for the various samples above. Table 5.1 presents results for the four samples, looking at high adoption as an outcome versus the rest of the sample. For the last sample, the impact of treatment is examined comparing high versus low adopters in both groups by excluding the medium adopters, since the latter may dilute estimates of impacts.

Note how the impact of FFS training does indeed increase adoption of the promoted practices by 70% for the treated relative to the control sample (0.165 statistically significant coefficient for the full sample, Col. 1).

Table 5.1: Results on adoption of agricultural practices promoted by FFSs

	(1)	(2)	(3)	(4)	(5)	Control mean full sample
	Full sample	Crop producers	Crop & Livestock Producers	Livestock Producers	High & low adopters (full sample)	
	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	
High adoption of practices (1=high adopters)	0.165***	0.183***	0.244***	0.226***	0.119***	0.23
	(0.0220)	(0.0240)	(0.0316)	(0.0299)	(0.0298)	
No. of observations	1943	1650	937	1077	1315	937

Notes:
1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

5.2. IFAD10 indicators

5.2.1 Agricultural production, intensification and input indicators

Next, a series of results are presented for the main impact indicators. Starting with the agricultural production, results show how crop area only increased for high adopting beneficiaries and crop and livestock producers (only significant at 10% level). As far as expenditures on inputs are concerned, it is evident that seed expenditures are higher for treatment crop producers and high adopters only (significant at 10% and 5% levels, respectively). Once the spillover effect is taken into account by only comparing high adopters in the treatment group with high adopters in the control, i.e. the high spillover group), we expect to see the same economic behaviour in both groups – which leads to an underestimation of the impact – which is fully captured by column five. This is the reason why the significance fades away in column 5.

As can be seen in table 5.2, expenditure on fertilizer is higher for all beneficiary groups (except the full sample) regardless of the status – and the livelihoods, and particularly high for the high adopters. High adopters seem to devote a larger amount of resources to expenditures on inputs, including pesticides and, particularly on labour inputs. Consistent with higher expenditure on inputs, high adopters also use higher amount of inputs per hectare compared to the non-beneficiary households. However, only a marginal number of households use inputs if at all. Overall, these results suggest that FFS participation is encouraging the adoption of good agricultural practices in combination with a reasonable amount of input use.

Table 5.2: Results on agricultural production indicators: crop input use

	(1)	(2)	(3)	(4)	(5)	Control mean full sample
	Full sample	Crop producers	Crop & Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)	
	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	

Crop inputs use						
Crop area (ha)	-0.00460	0.0296	0.104*	0.0985*	0.0396	0.92
	(0.0496)	(0.0577)	(0.0582)	(0.0594)	(0.0776)	
Seed expenditure (TSH, log)	0.220	0.371*	0.236	0.652**	0.373	8461.73
	(0.194)	(0.219)	(0.298)	(0.264)	(0.401)	
Inorganic fertilizer expenditure (TSH, log)	0.271	0.416**	0.601**	0.791***	0.368	6844.59
	(0.184)	(0.212)	(0.300)	(0.253)	(0.355)	
Pesticide expenditure (TSH, log)	0.161	0.296	0.220	0.744***	0.214	7504.16
	(0.177)	(0.203)	(0.284)	(0.247)	(0.337)	
Labour expenditure (TSH, log)	-0.0126	-0.00785	-0.0577	1.184***	-0.0704	2488.79
	(0.0564)	(0.0656)	(0.122)	(0.312)	(0.145)	
No. of observations	1986	1676	942	1366	638	937

Notes:

1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 5.3 presents results on the impact of the project on quantities harvested and crop yields. Given the strong focus of FFS on vegetables –a higher impact on vegetables harvest and yields is expected– which in fact is particularly high for adopters, and this effect still remains after controlling for the spillover effect (last column). Results are also positive and significant for cash crop yield for households that exclusively produce crops and oilseed crop yield for high adopters. On the negative side, beneficiaries exhibit a decline in root crops harvest and yield, for the entire sample, and particularly among high adopters. Crop and livestock producers, also exhibit a decline in cash crops harvest and yields.

Table 5.3: Results on agricultural production indicators: crop yield (harvest)

	(1)	(2)	(3)	(4)	(5)	
	Full sample	Crop producers	Crop & Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)	Control mean full sample
	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	
Crop yield						
Grain crop harvest (kg, log)	-0.00590	0.121	-0.00897	0.316	-0.231	2145.49
	(0.148)	(0.162)	(0.221)	(0.204)	(0.286)	
Cereal crop harvest (kg, log)	-0.0230	0.0953	-0.103	0.206	-0.142	1971.44
	(0.147)	(0.162)	(0.221)	(0.202)	(0.290)	
Vegetable crop harvest (kg, log)	0.133	0.207*	0.239	0.506***	0.399*	92313.29
	(0.109)	(0.125)	(0.173)	(0.161)	(0.224)	
Root crop harvest (kg, log)	-0.364**	-0.245	-0.168	-0.512**	-0.537*	19294.19
	(0.152)	(0.162)	(0.222)	(0.204)	(0.297)	
Pulses crop harvest (kg, log)	-0.0217	-0.0189	-0.00593	0.0204	0.0163	108.56
	(0.0296)	(0.0331)	(0.0383)	(0.0400)	(0.0682)	
Oilseed crop harvest (kg, log)	0.0350	0.0494	0.111	0.159*	-0.0126	65.49
	(0.0559)	(0.0660)	(0.0906)	(0.0835)	(0.139)	
Cash crops harvest (kg, log)	-0.0456	-0.0483	-0.274**	0.0147	-0.229	379.45
	(0.0685)	(0.0804)	(0.119)	(0.0920)	(0.173)	

Fruit crop harvest (kg, log)	0.00729	0.128	0.220	0.186	-0.166	4933.56
	(0.144)	(0.164)	(0.219)	(0.188)	(0.306)	
Perennial crop harvest (kg, log)	0.0127	0.134	0.220	0.186	-0.166	4933.61
	(0.144)	(0.164)	(0.219)	(0.188)	(0.306)	
Grain crop yield (kg/ha, log)	0.0383	0.193	0.0474	0.403*	-0.134	11031.08
	(0.175)	(0.191)	(0.258)	(0.242)	(0.328)	
Cereal crop yield (kg/ha, log)	0.00453	0.147	-0.0707	0.254	-0.0532	10818.86
	(0.174)	(0.192)	(0.259)	(0.240)	(0.331)	
Vegetable crop yield (kg/ha, log)	0.190	0.287*	0.319	0.652***	0.606**	155128.90
	(0.130)	(0.150)	(0.205)	(0.197)	(0.256)	
Root crop yield (kg/ha, log)	-0.363**	-0.209	-0.138	-0.512**	-0.410	31571.75
	(0.182)	(0.194)	(0.266)	(0.244)	(0.349)	
Pulses crop yield (kg/ha, log)	-0.0193	-0.0145	-0.00313	0.0281	0.0262	107.69
	(0.0350)	(0.0392)	(0.0451)	(0.0471)	(0.0790)	
Oilseed crop yield (kg/ha, log)	0.0605	0.0810	0.169	0.217**	0.0398	104.54
	(0.0661)	(0.0782)	(0.108)	(0.101)	(0.157)	
Cash crops yield (kg/ha, log)	-0.0355	-0.0353	-0.297**	0.0403	-0.232	1080.75
	(0.0784)	(0.0922)	(0.135)	(0.106)	(0.191)	
Fruit crop yield (kg/ha, log)	-0.0260	0.126	0.237	0.204	0.0899	48167.99
	(0.180)	(0.204)	(0.278)	(0.236)	(0.353)	
Perennial crop yield (kg/ha, log)	-0.0202	0.133	0.237	0.204	0.0899	48168.25
	(0.180)	(0.204)	(0.278)	(0.236)	(0.353)	
No. of observations	1986	1676	942	1366	638	973

Notes:

1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Focusing on the crops that FFSs targeted, results show that participation in FFSs significantly increased the yield from vegetable production of the beneficiaries and the yield from paddy rice for high adopters trained by lead farmers. FFS participation also significantly increased the value of banana production for participants, perhaps by improving the quality of the produce. However, FFSs participation had a negative effect on cassava production, where beneficiaries got significantly lower yield than the non-beneficiary households (see table 8.1A).

Table 5.4 presents instead results on value of crop production and total crop revenue. Consistently with quantity harvested and yield statistics, the same trends can be seen for this group of indicators. Note how the value of cash crops[10] and the value of vegetable crop produce is positively significant for households that produce crops exclusively and for treated high adopters (66% higher than the counterfactual), respectively. The value of root crop produce declined instead for beneficiaries – and this is consistent across all sub-samples, with the exception of those that produce crops exclusively. On the contrary to the crop only producers, the value of cash crop produced decrease by 43% for the sample of treated crop and livestock producers. Note also how total crop revenue – is only significant for high adopters – by 112% relative to the total counterfactual group.

Table 5.4: Results on agricultural production indicators: value of crop production

[10] See table 6.3A in appendix 6.

	(1)	(2)	(3)	(4)	(5)	
	Full sample	Crop producers	Crop & Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)	Control mean full sample
	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	
Value of crop production						
Value of grain crop produce (TSH, log)	0.000151	0.223	0.153	0.561	-0.702	223802.60
	(0.275)	(0.305)	(0.412)	(0.381)	(0.523)	
Value of cereal crop produce (TSH, log)	-0.0791	0.162	-0.104	0.296	-0.138	324451.30
	(0.280)	(0.307)	(0.413)	(0.386)	(0.517)	
Value of vegetable crop produce (TSH, log)	0.133	0.251	0.195	0.664**	0.502	111689.80
	(0.187)	(0.214)	(0.305)	(0.266)	(0.374)	
Value of root crop produce (TSH, log)	-0.622**	-0.455	-0.305	-0.580*	-1.051**	356257.40
	(0.263)	(0.291)	(0.404)	(0.349)	(0.498)	
Value of pulse crop produce (TSH, log)	-0.0289	-0.0196	0.0205	0.0421	0.0270	193539.90
	(0.0583)	(0.0650)	(0.0737)	(0.0802)	(0.136)	
Value of oilseed crop produce (TSH, log)	0.0330	0.0547	0.171	0.320*	-0.0588	30697.59
	(0.114)	(0.134)	(0.190)	(0.175)	(0.271)	
Value of cash crop produce (TSH, log)	-0.0354	-0.0201	-0.433**	0.0876	-0.220	40556.53
	(0.114)	(0.136)	(0.202)	(0.157)	(0.259)	
Value of fruits crop produce (TSH, log)	0.0122	0.233	0.415	0.378	0.0901	97801.19
	(0.257)	(0.289)	(0.398)	(0.342)	(0.503)	
Value of perennial crop produce (TSH, log)	0.0239	0.247	0.415	0.378	0.0901	97929.25
	(0.257)	(0.289)	(0.398)	(0.342)	(0.503)	
Crop revenue (TSH, log)	-0.0443	0.239	0.51	1.112***	0.0784	229452.00
	(0.281)	(0.308)	-0.425	(0.372)	(0.528)	
No. of observations	1986	1676	942	1366	638	973

Notes:

1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Turning now to livestock production indicators, note how the results are strong and significant across the various samples and sub-samples. Total livestock expenditure on feed is higher for treated beneficiaries when compared to the control farmers, and it is particularly substantial for those that produce livestock exclusively and high adopters. Extremely high and positive results can be seen on expenditures on livestock vaccinations – which are high across all samples, and the latter remains high and significant when we even compare high adopters of FFS practices versus their equivalent spillover farmers. Expenditures on veterinary services are also particularly high among beneficiaries. This might be a consequence of the project – which trained farmers on specific practices related to animal health and prevention and treatment of diseases, and sensitized farmers towards the need to invest on animal health. Interesting to note, how livestock revenue is statistically significant for the full sample – (66% gain, irrespective of adoption status and livelihood) and for the sample of high adopters, where the effect remains strong and significant even when we compared with the spillover farmers. If we don't take into account adoption - this finding, intuitively so, becomes statistically not significant for the sample of livestock producers, in other words – the adoption levels may confound the overall treatment effect, with low and medium adopters possibly exhibiting a much lower livestock revenue.

Interesting to note how revenue from livestock products is statistically significant for most of the samples and particularly for the high adopters of FFS practices[11].

Table 5.5: Results on agricultural production indicators: Livestock expenditure and revenue

	(1)	(2)	(3)	(4)	(5)	
	Full sample	Crop & Livestock Producers	Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)	Control mean full sample
	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	
Livestock production						
Livestock expenditure on feed (TSH, log)	0.936***	0.892**	1.017***	1.377***	0.231	136787.30
	(0.313)	(0.370)	(0.348)	(0.401)	(0.541)	
Livestock expenditure on Vaccination (TSH, log)	1.194***	1.243***	1.219***	1.707***	1.966***	17467.33
	(0.288)	(0.337)	(0.322)	(0.366)	(0.485)	
Livestock expenditure on veterinary services (TSH, log)	0.760**	0.621*	0.703**	1.055***	0.694	43791.21
	(0.306)	(0.352)	(0.337)	(0.385)	(0.549)	
Livestock expenditure on labour (TSH, log)	-0.0257	0.0164	0.0231	0.258	0.0586	8859.06
	(0.0497)	(0.0483)	(0.0451)	(0.176)	(0.0631)	
Livestock revenue (TSH, log)	0.657***	0.578	0.608	1.296***	1.063**	78187.31
	(0.244)	(0.403)	(0.380)	(0.339)	(0.471)	
Livestock product revenue (TSH, log)	0.387**	0.534*	0.491*	0.632**	0.415	41186.13
	(0.170)	(0.307)	(0.286)	(0.249)	(0.317)	
No. of observations	1302	942	1085	1366	635	937

Notes:

1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

5.2.2 Economic mobility indicators

As far as economic mobility indicators are concerned – note how results corroborate the hypothesis of sample heterogeneity. Total crop income is only statistically significant for the whole sample and negative (indicating a decline of 47% of gross total crop income for beneficiaries relative to comparison farmers) – this finding might be due to the fact that crop portfolio might be different between treated and control samples. Turning to livestock income, this now becomes strongly positive and significant and this is consistent across all samples – and particularly substantial for high adopters of FFS practices. The effect is still strong even when netting out the effect of spillovers.

Income from off-farm wage employment is strongly significant at 5% level - only for those that produce livestock (61% more than their control counterparts), implying that they might diversify their sources of income - while mildly significant (at 10% level), but still positive for those that are both crop and livestock producers.

[11] However, the postive significant impact on livestock revenue disappers when the sub-sample of households that exclusively produce livestock are considered, possibly due to low statistical power given the fact that there are only few households that exclusively produce livestock in the sample.

Interesting to note, how income from self-employment is positive and significant (albeit only at 10% level) for the full sample. This indicates that participation in FFS might have prompted beneficiaries' farmers to be more engaged in trading, retail services (including transportation and construction) and processing of agricultural products, possibly generating a higher return for them. It can be assumed that increased income from livestock production has enabled beneficiary households to invest in other income generating activities, despite(albeit) the lack of financial services. The result is however muted by the spillover effect as can be seen in the last column where we compare high adopters of FFS practices versus their equivalent spillover farmers.

Table 5.6: Results on economic mobility: income and savings indicators

	(1)	(2)	(3)	(4)	(5)	(6)	Control mean full sample
	Full sample	Crop producers	Crop & Livestock Producers	Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)	
	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	
Income indicators							
Crop income (TSH, log)	-0.469**	0.0826	0.155	-	0.102	-0.251	1232101
	(0.214)	(0.102)	(0.128)	-	(0.279)	(0.383)	
Livestock income (TSH, log)	0.699***	-	0.694*	0.654*	1.414***	1.083**	89266
	(0.257)	-	(0.410)	(0.385)	(0.356)	(0.496)	
Off farm wage income (TSH, log)	0.284	0.415	0.593*	0.614**	0.327	0.332	1343308
	(0.233)	(0.296)	(0.338)	(0.312)	(0.314)	(0.445)	
Self-employment income (TSH, log)	0.469*	0.240	0.543	0.589	-0.227	0.927**	361552
	(0.269)	(0.249)	(0.413)	(0.380)	(0.340)	(0.417)	
Total household income (TSH, log)	0.110	0.191*	0.222*	0.0617	0.298	0.143	3026227
	(0.180)	(0.0999)	(0.127)	(0.201)	(0.231)	(0.323)	
No. of observations	1986	1676	942	915	1366	638	937

Notes:

1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Turning to an analysis of asset-based indicators, table 5.7 reports the treatment effect results on assets for the different sub-groups. Note how only productive asset -based indices and livestock- based indices are positive and statistically significant. Treated high adopters have higher productive assets compared to the whole counterfactual, but this effect fades out while we compare high adopters with their equivalent spillover group. High adopters in the treatment also have significantly larger and smaller livestock assets than the whole sample of control farmers, and 60% more of large livestock than their equivalent counterparts (high adopters in the counterfactual), indicating a strong effect which is still present even after netting out the spillovers impact.

Table 5.7: Results on economic mobility: asset indices

	(1)	(2)	(3)	(4)	(5)	(6)	Control mean full sample
	Full sample	Crop producers	Crop & Livestock Producers	Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)	
	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	

Asset indicators							
Durable assets index	5.188	6.233	0.0483	0.0468	12.76	12.53	1.02
	(5.150)	(6.187)	(0.0684)	(0.0670)	(12.58)	(12.58)	
Productive assets index	0.0928	0.105	0.135	0.0983	0.214**	-0.0542	3.04
	(0.0625)	(0.0660)	(0.0972)	(0.0952)	(0.108)	(0.208)	
Livestock assets index	-0.00628	-	-0.0396	-0.0510	-0.0505	0.0453	0.61
	(0.0595)	-	(0.133)	(0.131)	(0.0920)	(0.0339)	
No. of large livestock (no.)	0.216	-	0.218	0.0571	7.982**	0.781***	1.57
	(0.214)	-	-0.387	(0.421)	(3.168)	(0.265)	
No. of small livestock	3.303*	-	3.524	4.408	8.166**	2.143	11.26
	(1.802)	-	-3.227	(3.103)	(3.176)	(4.617)	
Tropical livestock unit (TLU)	-0.264	-	-0.240	-0.636	-0.480	0.720*	3.57
	(0.400)	-	(0.393)	(0.567)	(0.505)	(0.435)	
Overall assets index	1.072	1.287	0.0367	0.0290	2.634	2.534	0.64
	(1.046)	(1.257)	(0.0254)	(0.0254)	(2.556)	(2.557)	
No. of observations	1986	1676	942	1085	1366	638	937

Notes:

1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

5.2.3 Poverty reduction indicators

As far as asset based poverty indicators are concerned, note how movements out of poverty are mostly statistically significant when a higher relative poverty line is considered (the one based on the 60th percentile PL). Nevertheless, these are positive – and looking at the results in the full sample, it can be seen that treated beneficiaries, are on average, more likely to move out of poverty by 31% (equivalent to the coefficient of 0.0596), when using an asset indicator based on all assets. With durables, the poverty estimate is consistent and it is also positive and significant (with beneficiaries being 20% more likely to move out of poverty equivalent to the 0.0654 coefficient).

Table 5.8: Results on economic mobility: poverty reduction indicators

	(1)	(2)	(3)	(4)	(5)	(6)	Control mean full sample
	Full sample	Crop producers	Crop & Livestock Producers	Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)	
	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	
Poverty reduction indicators							
Moving out of poverty, overall asset-based poverty line, 40th percentile	0.0410	0.0458	-0.00387	0.0199	0.0556	0.0410	0.45
	(0.0376)	(0.0413)	(0.0616)	(0.0571)	(0.0556)	(0.0376)	
Moving out of poverty, overall asset-based poverty line, 60th percentile	0.0596**	0.0635**	-0.00217	0.0101	-	0.0596**	0.19
	(0.0290)	(0.0310)	(0.0433)	(0.0420)	-	(0.0290)	

Moving out of poverty, durable asset-based poverty line, 40th percentile	0.0517	0.0599	0.00818	0.0580	0.101*	0.0517	0.49
	(0.0369)	(0.0409)	(0.0643)	(0.0553)	(0.0518)	(0.0369)	
Moving out of poverty, durable asset-based poverty line, 60th percentile	0.0654**	0.0755**	0.0542	0.0619	0.0886**	0.0654**	0.32
	(0.0286)	(0.0306)	(0.0453)	(0.0425)	(0.0415)	(0.0286)	
Moving out of poverty, productive asset-based poverty line, 40th percentile	0.0466**	0.0628***	0.0653**	0.0487	0.0659**	0.0466**	0.13
	(0.0217)	(0.0226)	(0.0320)	(0.0310)	(0.0311)	(0.0217)	
Moving out of poverty, productive asset-based poverty line, 60th percentile	0.0119	0.0277	0.0122	0.00685	0.0448*	0.0119	0.10
	(0.0169)	(0.0175)	(0.0266)	(0.0249)	(0.0251)	(0.0169)	
Moving out of poverty, livestock asset-based poverty line, 40th percentile	0.00302	-	-	-	0.0400	0.00302	0.23
	(0.0275)	-	-	-	(0.0416)	(0.0275)	
Moving out of poverty, livestock asset-based poverty line, 60th percentile	0.0349	-	0.0444	0.0649	0.0556*	0.0349	0.15
	(0.0222)	-	(0.0472)	(0.0451)	(0.0316)	(0.0222)	

Notes:

1. Number of observations dependence on the outcome variable.
2. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

5.2.4 Food security and resilience indicators

Turning to food security indicators, note how household dietary diversity is only significant for high adopters versus the whole control group, indicating a gain of about 8.5 percent (equivalent to the 0.479 coefficient in the table). Also, for the same group, we can see a reduction in the number of negative coping strategies by about 21 percent.

Table 5.9: Results on food security indicators

	(1)	(2)	(3)	(4)	(5)	(6)	
	Full sample	Crop producers	Crop & Livestock Producers	Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)	Control mean full sample
	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	
Food insecurity indicators							
Household dietary diversity score (HDDS)	0.0468	-0.0171	0.0367	0.0627	0.479***	-0.000160	5.60
	(0.117)	(0.117)	(0.158)	(0.164)	(0.179)	(0.269)	
Coping strategies index (CSI)	0.111	0.102	-0.0476	0.0317	-0.528**	0.146	2.47
	(0.225)	(0.245)	(0.321)	(0.296)	(0.269)	(0.358)	
No. of observations	1986	1676	942	1085	1366	638	937

Notes:

1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

5.2.5 Resilience indicators

Resilience indicators are not mostly significant across the different samples[12]. The only indicator that shows some significance is crop diversification, which is significant for high adopters and indicates increased crop diversification of about 10 percent.

Table 5.10: Results on resilience indicators based on treatment effects estimation

	Full sample	Crop producers	Crop & Livestock Producers	Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)	Control mean full sample
	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	
Resilience indicators							
Resilience index (based on PRIME)	0.0464	-0.0201	0.0146	0.0502	0.104	0.140	2.02
	(0.111)	(0.120)	(0.159)	(0.145)	(0.149)	(0.203)	
Ability to recover from shocks	-0.000536	-0.000578	0.00307	-0.00176	0.0101	0.00395	0.17
	(0.00883)	(0.00962)	(0.0126)	(0.0117)	(0.0124)	(0.0174)	
Crop diversification (no. of crops)	0.0169	0.113*	0.0602	-	0.193**	0.0910	1.77
	(0.0613)	(0.0612)	(0.0894)	-	(0.0841)	(0.113)	
No. of observations	1986	1676	942	1085	1366	638	937

Notes:

1. Results are based on the full sample data.
2. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

[12] Rseilience is significantly higer for the benficery household that exclusively produce livestock. However, this result should be interpreated with caution given that this finiding is based on a small number of household that exclusively produce livestock.

5.2.6 Market access indicators

Market participation is defined in terms of probability of selling the product or produce in question to the nearest market. Note how only high adopters among the beneficiaries exhibit higher market participation as far as total crop production is concerned. Market participation for vegetables is only mildly significant for high adopters (at 10% significance level) indicating, possibly that vegetables might be sold elsewhere. Market participation for fruit crops appear to be significant regardless of the extent of adoption status, although the strongest impact can be seen for high adopters. Market participation concerning livestock assets is also strongly significant for treatment beneficiaries and this finding is also present once the impact of spillovers is taken into account. This finding also applies in the case of sale of livestock products, where market participation for treated farmers is statistically significant across all samples and particularly for high adopters.

Last and interesting to note, how treatment beneficiaries, consistent with the result that indicates a higher level of engagement in the packaging and processing sector, exhibit higher packaging and processing expenditures when compared to their counterfactual farmers. Packaging expenditures are particularly substantial for high adopters – and remain positive although mildly significant once we remove the spillover effect. Regarding processing, the impact is positive and significant among livestock producers, once we compare the findings to their control counterparts.

Table 5.11: Results on market access indicators

	(1)	(2)	(3)	(4)	(5)	(6)	
	Full sample	Crop producers	Crop & Livestock Producers	Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)	Control mean full sample
	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	
Market access indicators							
Market participation for crops	-0.00558	0.0160	0.0377	-	0.0847***	-0.00558	0.39
	(0.0228)	(0.0251)	(0.0338)	-	(0.0302)	(0.0228)	
Market participation for grain crops	-0.00545	-0.00281	-0.000860	-	0.0163	-0.00545	0.05
	(0.0126)	(0.0146)	(0.0188)	-	(0.0188)	(0.0126)	
Market participation for cereals crops	-0.0103	-0.00853	-0.00502	-	0.00574	-0.0103	0.04
	(0.0118)	(0.0134)	(0.0152)	-	(0.0170)	(0.0118)	
Market participation for vegetables	0.00481	0.0114	0.0195	-	0.0357*	0.00481	0.10
	(0.0138)	(0.0162)	(0.0222)	-	(0.0200)	(0.0138)	
Market participation for root crops	-0.0199	-0.0134	0.0164	-	0.0157	-0.0199	0.17
	(0.0180)	(0.0206)	(0.0285)	-	(0.0247)	(0.0180)	
Market participation for oilseed crops	0.00529	0.00598	-0.00175		0.0139	0.00529	0.01
	(0.00653)	(0.00796)	(0.0134)	-	(0.0107)	(0.00653)	
Market participation for fruit crops	0.0233	0.0361*	0.0580**	-	0.0592**	0.0233	0.16
	(0.0176)	(0.0203)	(0.0285)	-	(0.0240)	(0.0176)	
Market participation for	0.0233	0.0361*	0.0580**	-	0.0592**	0.0233	0.16

perennial crops	(0.0176)	(0.0203)	(0.0285)	-	(0.0240)	(0.0176)	
Market participation for livestock	0.0511**	-	0.0498	0.0506	0.108***	0.0511**	0.25
	(0.0209)	-	(0.0346)	(0.0325)	(0.0290)	(0.0209)	
Market participation for livestock products	0.0325**	-	0.0489*	0.0485*	0.0518**	0.0325**	0.09
	(0.0152)	-	(0.0272)	(0.0250)	(0.0220)	(0.0152)	
Packaging expenditure (TSH, log)	0.274***	0.280**	0.273**	0.225	0.639***	0.409*	8740.66
	(0.0998)	(0.109)	(0.136)	(0.138)	(0.172)	(0.230)	
Processing expenditure (TSH, log)	0.124**	0.0708	0.129*	0.167**	0.0993	0.103	869.80
	(0.0559)	(0.0579)	(0.0758)	(0.0763)	(0.0789)	(0.0852)	
No. of observations	1986	1676	942	1085	1366	638	937

Notes:
1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

5.2.7 Empowerment indicators: PRO-WEAI indicators

The following tables present the results of a suite of empowerment indicators. Rather than calculating the overall gender empowerment index, we decided to analyse each single indicator that compose the project-level WEAI or PRO-WEAI – to examine and unpack the different dimensions of empowerment, across the three main domains, notably intrinsic agency, instrumental agency and collective agency. Recall that the questionnaire identified a primary and secondary respondent – relative to the beneficiary status - e.g. the primary respondent was either the man or woman in the household targeted by the FFS program, or in the case of a control group, the "type" of man or woman targeted by the FFS training program. The secondary respondent was typically the spouse of the target FFS beneficiary, or if the spouse was not available, another adult household member of the opposite sex who was primarily responsible for making both social and economic decisions related to agriculture.

The following table contains combined treatment level effects across the sample of primary and secondary decision makers. It is worth noting the results that are significant only at 5% or 1% level.

As far as the dimension of empowerment "*input into productive decisions*" is concerned, results indicate higher empowerment of beneficiaries in the sample of crop and livestock producers, and livestock producers only, and for high adopters. Positive results are also present as far as the dimension of empowerment "*control over use of income*" is concerned, for the samples of crop producers only and crop and livestock producers, and for the high adopters.

As far as the indicator "*visiting important locations*" is concerned, note how the latter is significant for households that produce livestock exclusively[13] and high adopters, but once we compare treatment and control high adopters, the effect becomes negative, indicating that spillover farmers in the counterfactual group might have had a higher mobility.

The strongest effect across the empowerment indicators, are present for both *group membership*, and *membership in influential groups*, possibly highlighting the collective value of the FFS participation, which therefore is more likely to empower beneficiaries in the collective agency sphere.

As for the dimension of empowerment on *"Autonomy in income"*, results also indicate higher empowerment of beneficiaries, although only for the sample of households that exclusively produce either crop or livestock.

[13] See table 6.11A in appendix 6 for results on empowerment for the sub-sample that produce livestock exclusively.

Last, beneficiaries exhibit a higher likelihood of being empowered in the sphere of "*respect among household members*" where this effect is strongly significant even after removing the spillover effect.

In the appendix 3, additional results are reported – looking at the gender of the empowered decision maker. Although, in most instances the primary decision maker is empowered thanks to the FFS participation, female decision makers are specifically empowered in the dimensions of collective agency (e.g. group membership) and to lesser extent in the dimension "*membership in influential groups*" (10% significance level).

In appendix 10 also reports additional results on the impact of FFS participation on the empowerment of women by focusing the analysis on the sample of female FFS participants (female primary decision makers). The results suggest that female FFS participants' ownership of land and other assets increase significantly. Their group membership and membership in an influential group also rises compared to the non-participating female farmers. For the high adopters of the female participants, empowerment in the domain of input in productive decision, access to and decision on credit, control over the use of income, mobility, and group membership also increases significantly (see Table 10.1A).

Table 5.12: Results on empowerment of primary and secondary decision makers: PRO-WEAI indicators

	(1)	(2)	(3)	(4)	(5)	(6)	Control mean full sample
	Full sample	Crop producers	Crop & Livestock Producers	Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)	
	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	
Empowerment of primary and secondary decision makers							
Autonomy in income	0.0101	0.0137	-0.0201	-0.0135	0.0209	0.0365	0.37
	(0.0176)	(0.0191)	(0.0260)	(0.0243)	(0.0233)	(0.0347)	
Self-efficacy	-0.0225	-0.0240	0.00864	0.00858	0.0220	0.0345	0.46
	(0.0182)	(0.0197)	(0.0263)	(0.0247)	(0.0241)	(0.0357)	
Attitudes about domestic violence	-0.0247*	-0.0227	-0.0251	-0.0262	-0.0296	-0.00336	0.80
	(0.0140)	(0.0152)	(0.0196)	(0.0182)	(0.0183)	(0.0285)	
Input in productive decisions	0.0178*	0.0188*	0.0291**	0.0254**	0.0409***	0.0271	0.89
	(0.0100)	(0.0101)	(0.0124)	(0.0119)	(0.0122)	(0.0210)	
Ownership of land and other assets	0.00165	0.00338	0.00928	0.00725	-0.0133	-0.0345	0.87
	(0.0122)	(0.0128)	(0.0172)	(0.0168)	(0.0166)	(0.0216)	
Access to and decisions on credit	0.0253	0.0192	0.0169	0.0144	0.0420*	0.0161	0.41
	(0.0177)	(0.0191)	(0.0255)	(0.0240)	(0.0236)	(0.0359)	
Control over use of income	0.0138	0.0229**	0.0352**	0.0249*	0.0283**	-0.000906	0.89
	(0.0105)	(0.0111)	(0.0154)	(0.0142)	(0.0129)	(0.0168)	
Work balance	0.00667	0.00613	-0.0137	-0.0108	-0.0382*	0.0264	0.44
	(0.0177)	(0.0190)	(0.0257)	(0.0243)	(0.0230)	(0.0325)	
Visiting important locations	-0.00361	-0.00415	-0.000806	0.00355	0.0522**	-0.0641**	0.64
	(0.0176)	(0.0191)	(0.0264)	(0.0247)	(0.0228)	(0.0307)	
Group membership	0.0748***	0.0631***	0.0788***	0.0838***	0.107***	0.0285	0.24
	(0.0166)	(0.0180)	(0.0251)	(0.0233)	(0.0224)	(0.0341)	

Membership in influential groups	0.0509***	0.0484***	0.0573***	0.0592***	0.0692***	0.0252	0.16
	(0.0143)	(0.0157)	(0.0216)	(0.0199)	(0.0192)	(0.0314)	
Respect among household members	0.0296*	0.0388**	0.0534**	0.0419*	0.0191	0.0980***	0.58
	(0.0164)	(0.0179)	(0.0244)	(0.0226)	(0.0221)	(0.0330)	
No. of observations	3407	2911	1691	1930	1633	638	1592

Notes:

1. Results are based on individual empowerment indicators of primary and secondary decision makers.
2. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

5.2.8 Results on IFAD10 indicators by FFS batch

In Appendix 4, results on IFAD10 indicators are presented by the different cohorts of FFS or batches. Specifically, the samples are split or disaggregated by FFS school training starting year and the treatment effects estimates of the impact are compared across the different FFS batch samples. The tables in appendix 4 present impact estimates across the sample of participants who belonged to the first batch (column 1), to batch 1, 2 and 3, and to batch 5 (the most recent batch in the sample). Given that the latest batch is the most recent in the sample we expect to see less impact. However, it is important to note that participants are not mutually exclusive and they might have participated to more than one batch. Also, measurement error might have crept up here, as beneficiaries self-declared to have participated to a certain batch rather than others.

In terms of agricultural production indicators, results are similar to the full sample – e.g. the decline in the crop area particularly for those who belonged to the first batch, and an increase in fertilizer expenditure for the earliest batch.

The decline in root crops production seem to be a prerogative of the latest batch along with the decline in the harvest, yield and value of cereal crops production.

Turning to livestock expenditures and revenue, it is reassuring to see that results do increase in magnitude across the batches. Interesting to note, how possibly - there was a shift in livestock revenue from sales of livestock items to sale of derived and processed products, in later batches.

In terms of economic mobility indicators, the hypothesis of diversification and a shift from relying solely on agriculture to more diversified sources of incomes (livestock and off farm employment), is particularly evident for the latest batches. This is also manifest in the fact that crop diversification is lower for treatment beneficiaries in the last batch relative to the comparison group.

As far as asset-based indicators are concerned, note how the latest batch exhibit a higher level of productive assets as well as total household assets relative to the counterfactual farmers. In terms of livestock numbers – note the how treatment only exhibits a significant increase in the number of small livestock items for the first batch.

Looking at poverty reduction indicators, movements out of poverty seem to occur more among those who participated in the earliest batches based on both relative poverty lines. This is an expected finding as poverty impacts tend to materialize over a larger period of time, and might therefore occur among earlier beneficiaries where activities should have been consolidated over time.

Indicators for market participation show instead an increase as far as livestock sales for the earliest batch and confirm the hypothesis that latest batches might engage more in selling livestock products.

Empowerment indicators across the different batches show a similar pattern to what has been seen in the results for the full sample. Treatment beneficiaries remain more empowered in the dimension of collective agency notably group membership and membership in influential groups. Empowerment vis a vis the dimension of intra-household respect seems to be only significant for earliest batches (batch 1 and participants to batch 1, 2 and 3).

5.2.9 Additional results: spillover effects

Results based on the ntreatreg estimator aimed at assessing the possible bias in the results due to the presence of spillovers effects or contamination. Focusing on the full sample, these analyses explicitly quantifies the spillovers effects on the treatment effect. For the sake of brevity, the discussion will only focus on significant results[14], and isolate the possible bias due to spillovers based on neighbourhood effects (proxied by distance).

Among the agricultural indicators, the results show that the decline in root crops harvest and yield for the beneficiary households was overestimated by 8 and 12 percent due to the spillover effect at 5% significance level. Similarly, the significantly lower crop income estimated for the beneficiary groups was overestimated by 6%. Among the livestock production indicators, the estimate for the market participation and expenditure on vaccination was biased upward by 0.04 and 6 percent due to spillover effect. Consistent with the results on spillover effect from the IPWRA estimates, we found that the impact on self-employment income was underestimated by 10 percent, significant at 10% level.

5.2.10 Additional results on IFAD10 indicators by type of FFS facilitator

In appendix 9, results on IFAD10 indicators are presented by type of FFS facilitator. Specifically, the samples are split or disaggregated by type of FFS facilitator and the treatment effect estimates of the impact are compared between the farmer-led FFS, the extension-led FFS and the non-beneficiaries households. The tables in appendix 9 present impact estimates across the sample of participants who belonged to the farmer-led FFS (column 1) and to the extension-led FFS (column 2), and high adopters among the two types of FFSs (column 3 and 4 respectively). Given that new technologies and practices had a higher adoption rate when introduced by other farmers, it was expected that the farmer-led FFS would have had a higher impact on the adoption of improved practices and thereby on agricultural productivity and livelihood security of the participants than the extension-led FFS. However, it is important to note that participants are not mutually exclusive and that they might have participated in more than one FFS type.

In terms of the adoption of training on improved practices, the results show that extension-led FFSs fared better in enhancing the adoption of improved practices among participants than the farmer-led FFS (Table 9.1A).

However, when looking at the indicators of agricultural productios, farmer-led FFS seem to have had higher impact on FFS participants than the extension-led FFS. Particularly, farmer-led FFSs had a relatively higher impact on crop area, crop revenue, livestock-related expenditure and income.

In terms of economic mobility indicators, while participation in farmer-led FFS lead to a significantly higher accumulation of durable and overall asset among the participants, participation in extension-led FFSs helped asset poor participants to escape poverty by accumulating asset over the years (see tables 9.2A; 9.5A; 9.6A; 9.7A).

[14] Results based on the ntreatreg estimator are available upon request.

6. Conclusions and Policy Implications

This study contributes to knowledge by estimating the impact of locally adapted Farmer Field Schools on a number of development objectives, namely agricultural productivity, economic mobility, food security, resilience, poverty alleviation and gender empowerment, and not just on intermediate outcomes, such as technology knowledge transfer and technology adoption. Farmer Field Schools (FFS) approach is a widely debated extension approach, and successes and challenges have been reviewed in published and unpublished literature. Commonly reported impacts of FFSs include increases in agricultural production and farm productivity, a reduction of the use of pesticides as well as empowerment in the domain of individual and collective agency. The available evidence has also pointed to the reality that few studies are methodologically rigorous, and can establish causal attribution, given the reality that FFS participants self-select into the projects and therefore have characteristics, such as ability, entrepreneurship and learning outcomes, that make them systematically different to the farmers that are parts of comparisons groups.

This study provides counterfactual evaluative evidence in an ex-post framework – and it is based on a rigorous methodology where a number of limitations pointed out in the literature, notably the identification of a valid comparison group, biases due to self-selection, observable and unobservable features are addressed. To this end, farmers´ cognitive abilities are measured across the samples of treated and control groups and by balancing the two groups in terms of this and other key characteristics, a control group is established that is effectively comparable in the extent of cognitive skills and potential learning outcomes to the likely self-selected FFS participants.

The findings of this study exhibit larger returns in terms of livestock revenue both from sales of assets and of produce, as well as higher investments in animal health, and feed for FFS participants. Given the heterogeneity of the FFS activities evaluated – which involved surveying a sample of female and male beneficiaries across the seven most prevalent types of FFS schools (dairy cows, goats, poultry, vegetables, cassava, banana and paddy rice) – this may point to a higher effectiveness of FFS with a livestock-related training component.

Results are also found, notably for higher crop revenue, expenditures on organic and inorganic fertilizers and pesticides for crop producers as well as for the sample of crop and livestock producers. Such expenditures are particularly large for high adopters of FFS practices, who also exhibit higher expenditures on fertilizers and pesticides, and other capital inputs, such as labour.

Results on poverty alleviation, suggest substantial poverty reduction – which is particularly evident regardless of whether the underlying indicators are based on overall or just durables assets – and point towards a 20 to 30% reduction, using asset-based poverty indicators.

Higher adopters of FFS practices, have also better food security as well as market access outcomes. They have better access to markets particularly for crop production, which is particularly significant as far as fruit crops are concerned and to a lesser extent, also for vegetables. Relative to livestock producers, strong and significantly positive findings are also observed.

Turning to the suite of PRO-WEAI empowerment indicators, different dimensions of empowerment were examined and unpacked, across the three main agency domains, notably intrinsic agency, instrumental agency and collective agency. Contrary to the evidence in the literature, significant results were found in the sphere of collective agency, where greater empowerment can be found for FFS participants as far as dimensions such as group membership, and membership in influential groups are concerned. This highlights the collective value of the FFS participation. Female participants were also particularly empowered in the

domain of ownership of land and other assets, input in productive decision, access to and decision on credit, control over the use of income, mobility, and group membership.

This study findings also factor in the potential presence of spillover effects, which are defined as control group contamination e.g. the fact that neighbouring farmers adopted improved practices - which in several instances lead to the underestimation of the magnitude of impact (particularly in the case of self-employment income). However, the results are robust to the presence of such spillover effects overall.

Relative to potential implications for development policy and practice, a plausible conclusion is that the collective learning approach of FFS has a value in itself particularly vis a vis enhancing the adoption of improved farming practices and stimulating empowerment in the collective, but also individual sphere. However, such an approach requires adequate technical facilitation – farmers mentoring as well as continuous monitoring - to ensure that innovation is adopted on a longer-term basis and used over time. With respect to the heterogeneity of the FFS trainings that involved many activities (spanning livestock and crop production) and the results that indicated a higher effectiveness of FFS with a livestock-related training component, a recommendation would be to have a more focused curriculum, perhaps assessing before-hand the profitability of the technology and the possible uptake, given the specificities of the agro-ecological context.

More general recommendations can be put forward as part of this impact assessment.

IFAD-supported projects distribute development efforts in such a way that might dilute impacts; this implies that a more focused and stronger type of intervention of less diversified development priorities may lead to larger and more positive impacts. To this end, IFAD could achieve a larger impact if interlinked components are focused and implemented in such a way that could generate multiplier effects at local level. In addition, combined or synergistic interventions can be more effective for those at the lower end of the income distribution.

Also, granular project level M&E data, at the level of the beneficiaries, remains a key prerogative for the successful design of impact assessments. As part of this impact assessment a huge challenge was encountered while trying to reconstruct lists of FFS beneficiaries by activity, by batch and by gender, which delayed the implementation of the study. Future projects of such kind need to establish individual databases of beneficiaries, particularly if one may wish to assess the impact of different lengths of training for instance.

Future project design might consider incorporating lasting financial support to facilitate longer term uptake of the intervention and sustainability of impacts (for instance by helping farmers access the improved but more expensive methods that some of the projects promoted). Acquiring higher quality seeds, tools, and marketing of specific products might require farmers to commit significant funds over a long period of time. Projects should therefore include reliable financial support. Without this, many farmers will return to the status quo and this may hinder longer term uptake of interventions and therefore impact.

Last, commercialization and marketing support continue to be areas of improvement and should be bundled to interventions aimed at improving agricultural production. Specifically, improving linkages between farmers and other actors in the value chain would maximise production impacts. Improving coordination of the value chain actors, especially in terms of contract terms and contractual agreements, would also support this argument.

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Appendix 1: Agricultural production and economic mobility: Asset indices

Table 1A: List of crops included in each agricultural production indicator

Crop Agricultural production indicators	Items included
Grains	Cereals, pulse, oilseed
Cereals	Barley, maize, sorghum, paddy rice, upland rice
Vegetables	Tomato, onion, pepper, eggplant, cucumber, green leafy vegetables, gourd squash, gourd squash, pumpkin
Roots	Potato, sweet potato, irish potato, yam, cocoyams, cassava
Pulses	Green French beans, chick peas, pigeon pea, field peas
Oilseeds	Groundnut, rapeseed
Cash crops	Sugarcane
Fruits	Banana, plantain, mango, pineapple, jackfruit, papaya, guava, orange, lemon, lime, apple, coconut, passion fruit, avocado, mandarin, pear, durian, star fruit
Perennials	Banana, plantain, mango, pineapple, jackfruit, papaya, guava, orange, lemon, lime, apple, coconut, passion fruit, avocado, mandarin, pear, durian, star fruit, cashew nut, bambara nuts

Table 2A: List of assets included in each economic mobility indicators: asset indicies

Economic mobility: Asset indicies	Items included
Durable assets	Numbers of kerosene stove, electric stove, bed, watch, mobile phone, TV, sofa, bicycle, motor bicycle, cart, sewing machine
Productive assets	Numbers of sickle, axe, pickaxe, hoe, traditional plough, modern plough, shovel, sprayer, pump
Livestock assets	Numbers of ox, cow, sheep, goat, horse, donkey, mule, pig, chicken, duck

Large livestock assets	Numbers of ox, cow, sheep, goat, horse, donkey, mule, pig
Small livestock assets	Numbers of chicken, duck

Appendix 2: Matching quality statistics

Figure 1A: Balance between treatment and control groups

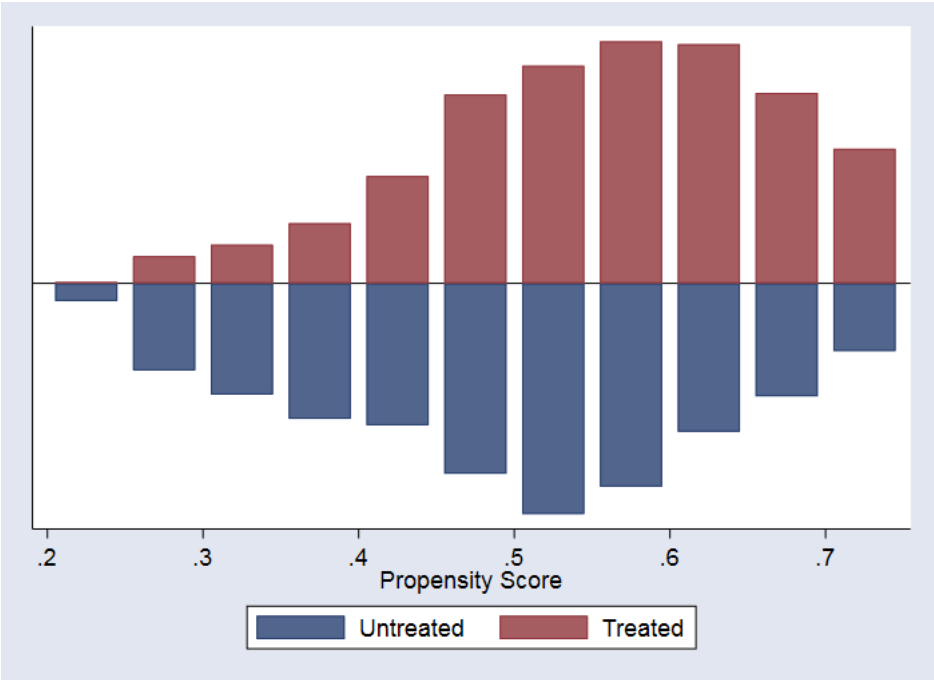


Figure 2A: Common support between treatment and control groups

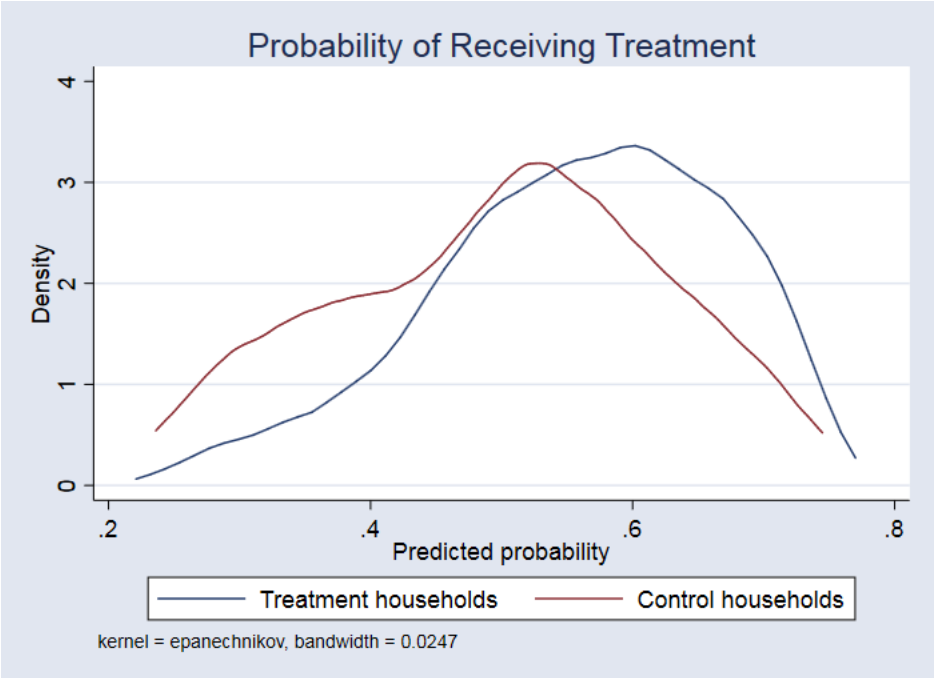
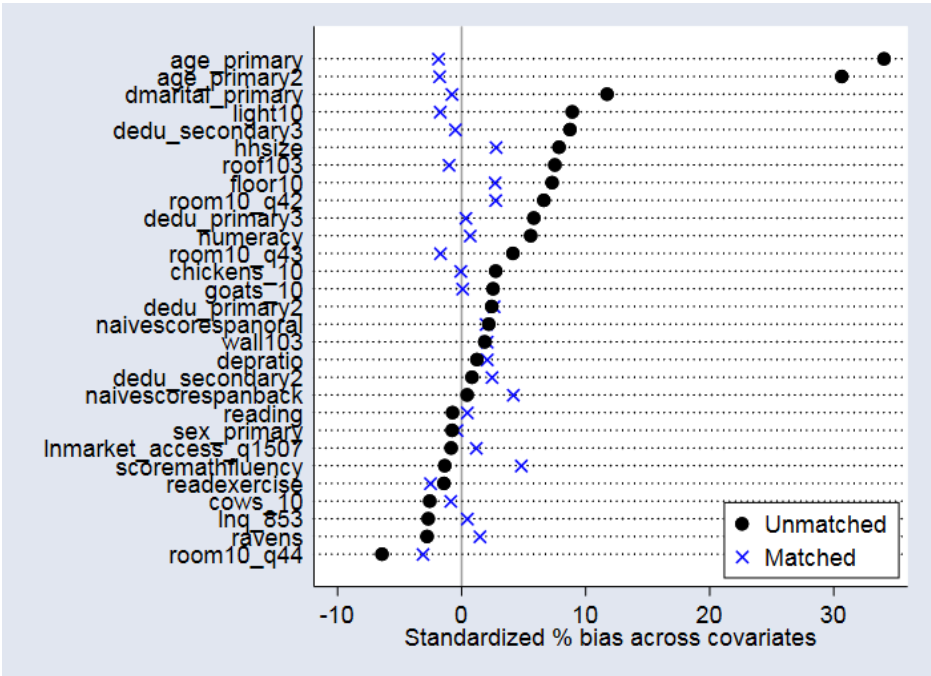


Figure 3A: Bias reduction between treatment and control groups



Appendix 3: Treatment effect results on empowerment indicators: PRO-WEAI indicators

Table 3.1A: Empowerment indicators: Autonomy in income

	(1)	(2)	(3)	(4)	(5)	(6)	Control mean full sample
	Full sample	Crop producers	Crop & Livestock Producers	Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)	
	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	
Autonomy in income							
ATET	0.0101	0.0137	-0.0201	-0.0135	0.0209	0.0365	0.37
	(0.0176)	(0.0191)	(0.0260)	(0.0243)	(0.0233)	(0.0347)	
OME: control							
Female decision maker	-0.2506***	-0.2357***	-0.0952	-0.1699	-0.2766***	-0.3491**	
	0.0771	0.0787	0.1117	0.1066	0.0812	0.1671	
Primary decision maker	-0.0211	-0.0167	0.0352	-0.0397	-0.0496	-0.4180**	
	0.0771	0.08035	0.1133	0.1079	0.0833	0.1713	
OME: treated							
Female decision maker	-0.2042***	-0.1912***	-0.1846**	-0.2028**	-0.1168	-0.1168	
	0.0635	0.0661	0.0859	0.0800	0.0958	0.0958	
Primary decision maker	0.1110**	0.0816	0.1289	0.1438*	0.1251	0.1251	
	0.0636	0.0677	0.0874	0.0815	0.0984	0.0984	
No. of observations	3407	2911	1691	1930	2338	1100	1592

Notes:
1. Results are based on individual empowerment indicators of primary and secondary decision makers.
2. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 3.2A: Empowerment indicators: Self-efficacy

	(1)	(2)	(3)	(4)	(5)	(6)	Control mean full sample
	Full sample	Crop producers	Crop & Livestock Producers	Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)	
	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	
Self-efficacy							
ATET	-0.0225	-0.0240	0.00864	0.00858	0.00798	0.0327	0.46
	(0.0182)	(0.0197)	(0.0263)	(0.0247)	(0.0232)	(0.0351)	
OME: control							
Female decision maker	-0.0218	-0.0196	0.1242	0.0713	-0.0499	-0.1449	
	0.0761	0.0777	0.1089	0.1041	0.0814	0.1615	
Primary decision maker	0.1427**	0.1558**	0.1329	0.1291	0.1343	0.3432**	

	0.0760	0.0793	0.1108	0.1061	0.0837	0.1653	
OME: treated							
Female decision maker	0.0419	0.0296	0.0738	0.0513	-0.0461	-0.0461	
	0.0624	0.0653	0.0841	0.0782	0.0948	0.0948	
Primary decision maker	-0.0354	0.0028	-0.0336	-0.0694	0.0288	0.0288	
	0.0625	0.0667	0.0853	0.0796	0.0969	0.0969	
No. of observations	3407	2911	1691	1930	2338	1100	1592

Notes:
1. Results are based on individual empowerment indicators of primary and secondary decision makers.
2. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 3.3A: Empowerment indicators: Attitudes about domestic violence

	(1)	(2)	(3)	(4)	(5)	(6)	
	Full sample	Crop producers	Crop & Livestock Producers	Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)	Control mean full sample
	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	
Attitudes about domestic violence							
ATET	-0.0247*	-0.0227	-0.0251	-0.0262	-0.0344*	-0.0535**	0.80
	(0.0140)	(0.0152)	(0.0196)	(0.0182)	(0.0176)	(0.0259)	
OME: control							
Female decision maker	-0.6846***	-0.7666***	-0.7967***	-0.7722***	-0.6795***	-0.7151***	
	0.0926	0.0927	0.1323	0.1255	0.0995	0.1972	
Primary decision maker	0.0011	-0.0685	0.0201	-0.0085	-0.0241	0.1101	
	0.0888	0.0925	0.1328	0.1268	0.0986	0.1995	
OME: treated							
Female decision maker	-0.8148***	-0.8549***	-0.9193***	-0.8725***	-0.9116***	-0.9116***	
	0.0756	0.0798	0.1029	0.0960	0.1193	0.1193	
Primary decision maker	0.1764**	0.1773**	0.1459	0.2103**	0.3066***	0.3066***	
	0.0728	0.0771	0.0991	0.0928	0.1138	0.1138	
No. of observations	3407	2911	1691	1930	2338	1100	1592

Notes:
1. Results are based on individual empowerment indicators of primary and secondary decision makers.
2. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 3.4A: Empowerment indicators: Input in productive decisions

	(1)	(2)	(3)	(4)	(5)	(6)	
	Full sample	Crop producers	Crop & Livestock Producers	Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)	Control mean full sample
	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	
Input in productive decisions							

ATET	0.0178*	0.0188*	0.0291**	0.0254**	0.0197	0.0132	0.89
	(0.0100)	(0.0101)	(0.0124)	(0.0119)	(0.0129)	(0.0146)	
OME: control							
Female decision maker	-0.3805***	-0.5538***	-0.8507***	-0.6676***	-0.3857***	0.3478	
	0.1102	0.1256	0.1879	0.1761	0.1190	0.2747	
Primary decision maker	0.8445***	0.8414***	1.0742***	1.0011***	0.8419*	1.2868***	
	0.1156	0.1288	0.1814	0.1749	0.1294	0.3322	
OME: treated							
Female decision maker	-0.1597*	-0.1459	-0.0984	-0.1679	-0.2841***	-0.2841*	
	0.0931	0.1035	0.1449	0.1308	0.1630	0.1630	
Primary decision maker	0.6391***	0.8288***	0.9024***	0.7900***	0.7883***	0.7883***	
	0.0981	0.1168	0.1733	0.1479	0.1707	0.1707	
No. of observations	3407	2911	1691	1930	2338	1100	1592

Notes:
1. Results are based on individual empowerment indicators of primary and secondary decision makers.
2. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 3.5A: Empowerment indicators: Ownership of land and other assets

	(1)	(2)	(3)	(4)	(5)	(6)	
	Full sample	Crop producers	Crop & Livestock Producers	Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)	Control mean full sample
	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	
Ownership of land and other assets							
ATET	0.00165	0.00338	0.00928	0.00725	0.00468	0.00212	0.87
	(0.0122)	(0.0128)	(0.0172)	(0.0168)	(0.0155)	(0.0214)	
OME: control							
Female decision maker	-0.1684*	-0.0662	-0.0242	-0.1292	-0.1477	-0.4376**	
	0.0985	0.1017	0.1466	0.1425	0.1053	0.2111	
Primary decision maker	-0.0664	0.0695	0.0431	-0.0942	-0.0344	-0.2762	
	0.0982	0.1050	0.1498	0.1450	0.1085	0.2204	
OME: treated							
Female decision maker	-0.0278	-0.0506	-0.0557	-0.0555	-0.0796	-0.0796	
	0.0786	0.0846	0.1087	0.1001	0.1129	0.1129	
Primary decision maker	-0.1224	-0.0863	-0.0915	-0.0908	-0.2015*	-0.2015*	
	0.0793	0.0874	0.1116	0.1029	0.1204	0.1204	
No. of observations	3407	2911	1691	1930	2338	1100	1592

Notes:
1. Results are based on individual empowerment indicators of primary and secondary decision makers.
2. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 3.6A: Empowerment indicators: Access to and decisions on credit

	(1)	(2)	(3)	(4)	(5)	(6)	
	Full sample	Crop producers	Crop & Livestock Producers	Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)	Control mean full sample
	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	
Access to and decisions on credit							
ATET	0.0253	0.0192	0.0169	0.0144	0.00587	-0.0534	0.41
	(0.0177)	(0.0191)	(0.0255)	(0.0240)	(0.0224)	(0.0334)	
OME: control							
Female decision maker	-0.3661***	-0.3577***	-0.3078***	-0.3091***	-0.3662***	0.0271	
	0.0777	0.0790	0.1100	0.1040	0.0829	0.1648	
Primary decision maker	0.0886	0.1375*	0.3573***	0.2820***	0.0835	0.0585	
	0.0779	0.0813	0.1117	0.1060	0.0851	0.1732	
OME: treated							
Female decision maker	-0.3899***	-0.3927***	-0.4929***	-0.4759***	-0.3647***	-0.3647***	
	0.0629	0.0661	0.0852	0.0789	0.0953	0.0953	
Primary decision maker	0.0996	0.1194*	0.1365	0.1345*	0.2480**	0.2480**	
	0.0629	0.0674	0.0861	0.0801	0.0971	0.0971	
No. of observations	3407	2911	1691	1930	2338	1100	1592

Notes:
1. Results are based on individual empowerment indicators of primary and secondary decision makers.
2. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 3.7A: Empowerment indicators: Control over use of income

	(1)	(2)	(3)	(4)	(5)	(6)	
	Full sample	Crop producers	Crop & Livestock Producers	Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)	Control mean full sample
	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	
Control over use of income							
ATET	0.0138	0.0229**	0.0352**	0.0249*	0.00808	0.0437**	0.89
	(0.0105)	(0.0111)	(0.0154)	(0.0142)	(0.0131)	(0.0194)	
OME: control							
Female decision maker	-0.6136***	-0.6512***	-0.5958***	-0.5012***	-0.5475***	-0.0489	
	0.1063	0.1140	0.1528	0.1451	0.1135	0.2448	
Primary decision maker	0.6468***	0.6642***	0.7450***	0.7329***	0.6925***	1.5819***	
	0.1043	0.1103	0.1535	0.1442	0.1136	0.3135	
OME: treated							
Female decision maker	-0.5182***	-0.5152***	-0.6009***	-0.6361***	-0.4505***	-0.4505***	
	0.0928	0.1019	0.1284	0.1202	0.1507	0.1507	
Primary decision maker	-0.5182***	0.4719***	0.4287***	0.3991***	0.6880***	0.6880***	
	0.0928	0.0994	0.1240	0.1144	0.1554	0.1554	
No. of observations	3407	2911	1691	1930	2338	1089	1592

Notes:
1. Results are based on individual empowerment indicators of primary and secondary decision makers.
2. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 3.8A: Empowerment indicators: Work balance

	(1)	(2)	(3)	(4)	(5)	(6)	
	Full sample	Crop producers	Crop & Livestock Producers	Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)	Control mean full sample
	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	
Work balance							
ATET	0.00667	0.00613	-0.0137	-0.0108	-0.0212	-0.0336	0.44
	(0.0177)	(0.0190)	(0.0257)	(0.0243)	(0.0226)	(0.0339)	
OME: control							
Female decision maker	-0.4519***	-0.4249***	-0.4673***	-0.4725***	-0.4616***	-0.5646***	
	0.0777	0.0796	0.1124	0.1061	0.0814	0.1706	
Primary decision maker	-0.1393*	-0.1103	-0.0264	-0.0373	-0.1135	-0.3957**	
	0.0777	0.0813	0.1138	0.1082	0.0836	0.1798	
OME: treated							
Female decision maker	-0.3016***	-0.2327***	-0.2457***	-0.3298***	-0.3607***	-0.3607***	
	0.0634	0.0663	0.0861	0.0799	0.0971	0.0971	
Primary decision maker	-0.0041	-0.0207	0.0967	0.0779	-0.1448	-0.1447	
	0.0635	0.0677	0.0877	0.0814	0.0991	0.0991	
No. of observations	3407	2911	1691	1930	2338	1100	1592

Notes:
1. Results are based on individual empowerment indicators of primary and secondary decision makers.
2. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 3.9A: Empowerment indicators: Visiting important locations

	(1)	(2)	(3)	(4)	(5)	(6)	
	Full sample	Crop producers	Crop & Livestock Producers	Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)	Control mean full sample
	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	
Visiting important locations							
ATET	-0.00361	-0.00415	-0.000806	0.00355	-0.0100	-0.00342	0.64
	(0.0176)	(0.0191)	(0.0264)	(0.0247)	(0.0222)	(0.0344)	
OME: control							
Female decision maker	-0.0089	0.0311	0.0742	0.0638	-0.0147	0.0786	
	0.0779	0.0795	0.1131	0.1079	0.0850	0.1709	
Primary decision maker	-0.0591	-0.0611	-0.0439	-0.0062	-0.0664	-0.3127*	
	0.0781	0.0816	0.1152	0.1101	0.0871	0.1717	
OME: treated							
Female decision maker	-0.1127*	-0.0928	-0.0502	-0.0156	-0.0518	-0.0518	
	0.0636	0.0664	0.0854	0.0797	0.0993	0.0993	
Primary decision maker	0.0899	0.0891	0.1017	0.1330	0.4904***	0.4904***	
	0.0636	0.0677	0.0867	0.0812	0.1018	0.1018	
No. of observations	3407	2911	1691	1930	2338	1100	1592

Notes:
1. Results are based on individual empowerment indicators of primary and secondary decision makers.
2. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 3.10A: Empowerment indicators: Group membership

	(1)	(2)	(3)	(4)	(5)	(6)	
	Full sample	Crop producers	Crop & Livestock Producers	Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)	Control mean full sample
	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	
Group membership							
ATET	0.0748***	0.0631***	0.0788***	0.0838***	0.0772***	0.0499	0.24
	(0.0166)	(0.0180)	(0.0251)	(0.0233)	(0.0211)	(0.0335)	
OME: control							
Female decision maker	0.2341***	0.2804***	0.2986**	0.2802***	0.2487***	0.6771***	
	0.0829	0.0845	0.1180	0.1118	0.0876	0.1662	
Primary decision maker	-0.0799	-0.0438	0.0243	0.0138	-0.0648	-0.3640**	
	0.0829	0.0860	0.1211	0.1147	0.0889	0.1717	
OME: treated							
Female decision maker	0.1277**	0.2082***	0.2725***	0.2137***	-0.0496	-0.0496	
	0.0645	0.0679	0.0865	0.0806	0.0969	0.0969	
Primary decision maker	0.2775***	0.2568***	0.2487***	0.2410***	0.1850***	0.1850*	
	0.0648	0.0692	0.0876	0.0819	0.0992	0.0992	
No. of observations	3407	2911	1691	1930	2338	1100	1592

Notes:
1. Results are based on individual empowerment indicators of primary and secondary decision makers.
2. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 3.11A: Empowerment indicators: Membership in influential groups

	(1)	(2)	(3)	(4)	(5)	(6)	
	Full sample	Crop producers	Crop & Livestock Producers	Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)	Control mean full sample
	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	
Membership in influential groups							
ATET	0.0509***	0.0484***	0.0573***	0.0592***	0.0583***	0.0499*	0.16
	(0.0143)	(0.0157)	(0.0216)	(0.0199)	(0.0178)	(0.0291)	
OME: control							
Female decision maker	0.2287**	0.2640***	0.3254**	0.3150***	0.2517***	0.6057***	
	0.0901	0.0915	0.1257	0.1197	0.0936	0.1871	
Primary decision maker	-0.0305	-0.0221	-0.0096	-0.0023	-0.0156	-0.1188	
	0.0905	0.0928	0.1282	0.1226	0.0953	0.1946	
OME: treated							
Female decision maker	0.0711	0.1228*	0.1862**	0.1528*	-0.0081	-0.0081	
	0.0697	0.0728	0.0919	0.0858	0.1047	0.1047	
Primary decision maker	0.2454***	0.2359***	0.2779***	0.2737***	0.2598**	0.2598**	
	0.0703	0.0748	0.0941	0.0884	0.1078	0.1078	
No. of observations	3407	2911	1691	1930	2338	1100	1592

Notes:
1. Results are based on individual empowerment indicators of primary and secondary decision makers.
2. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 3.12A: Empowerment indicators: Respect among household members

	(1)	(2)	(3)	(4)	(5)	(6)	
	Full sample	Crop producers	Crop & Livestock Producers	Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)	Control mean full sample
	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	
Respect among household members							
ATET	0.0296*	0.0388**	0.0534**	0.0419*	0.0200	0.0386	0.58
	(0.0164)	(0.0179)	(0.0244)	(0.0226)	(0.0208)	(0.0311)	
OME: control							
Female decision maker	-0.1909**	-0.2312***	-0.1695	-0.1787	-0.1935**	-0.3225*	
	0.0794	0.0809	0.1169	0.1107	0.0835	0.1698	
Primary decision maker	0.0811	0.0294	0.2509**	0.2145*	0.1047	-0.1492	
	0.0798	0.0833	0.1191	0.1136	0.0859	0.1781	
OME: treated							
Female decision maker	-0.1540**	-0.1314*	-0.1123	-0.1369	-0.1449	-0.1449	
	0.0656	0.0689	0.0901	0.0841	0.0988	0.0988	
Primary decision maker	0.1067	0.0738	0.0895	0.0952	-0.0003	-0.0003	
	0.0658	0.0704	0.0914	0.0859	0.1010	0.1010	
No. of observations	3407	2911	1691	1930	2338	1100	1592

Notes:
1. Results are based on individual empowerment indicators of primary and secondary decision makers.
2. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Appendix 4: Treatment effect within different FFS batches

Table 4.1A: Results on agricultural production indicators: crop input use

	(1)	(2)	(3)	Control mean full sample
	FFS batch 1	FFS batch 123	FFS batch5	
	IPWRA	IPWRA	IPWRA	
Crop inputs use				
Crop area (ha)	-0.131**	-0.00661	0.0518	0.92
	(0.0602)	(0.0497)	(0.0887)	
Seed expenditure (TSH, log)	-0.211	0.228	0.399	8461.73
	(0.325)	(0.195)	(0.294)	
Inorganic fertilizer expenditure (TSH, log)	0.607*	0.272	-0.289	6844.59
	(0.333)	(0.185)	(0.251)	
Pesticide expenditure (TSH, log)	0.298	0.149	0.0145	7504.16
	(0.313)	(0.177)	(0.259)	
Labour expenditure (TSH, log)	-0.0300	-0.0108	-0.0381	2488.79
	(0.110)	(0.0570)	(0.0627)	
No. of observations	1141	1966	1203	937

Notes:
1. Results are based on the full sample data.
2. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 4.2A: Results on agricultural production indicators: crop yield (harvest)

	(1)	(2)	(3)	Control mean full sample
	FFS batch 1	FFS batch 123	FFS batch5	
	IPWRA	IPWRA	IPWRA	
Crop yield				
Grain crop harvest (kg/ha, log)	0.419	-0.0248	-0.300	2145.49
	(0.263)	(0.149)	(0.221)	
Cereal crop harvest (kg/ha, log)	0.373	-0.0452	-0.403*	1971.44
	(0.262)	(0.148)	(0.215)	
Vegetable crop harvest (kg/ha, log)	-0.0490	0.115	0.241	92313.29
	(0.168)	(0.108)	(0.191)	
Root crop harvest (kg/ha, log)	-0.245	-0.353**	-0.724***	19294.19
	(0.269)	(0.153)	(0.217)	
Pulses crop harvest (kg/ha, log)	-0.0442	-0.0208	-0.0624**	108.56
	(0.0461)	(0.0299)	(0.0313)	
Oilseed crop harvest (kg/ha, log)	0.0953	0.0322	0.129	65.49
	(0.0998)	(0.0556)	(0.102)	
Cash crops harvest (kg/ha, log)	0.0801	-0.0404	0.00683	379.45
	(0.141)	(0.0684)	(0.0967)	

Fruit crop harvest (kg/ha, log)	0.0937	0.0149	-0.171	4933.56
	(0.252)	(0.145)	(0.235)	
Perennial crop harvest (kg/ha, log)	0.0936	0.0203	-0.171	4933.61
	(0.252)	(0.145)	(0.235)	
Grain crop yield (kg/ha, log)	0.612*	0.0172	-0.383	11031.08
	(0.319)	(0.176)	(0.260)	
Cereal crop yield (kg/ha, log)	0.532*	-0.0201	-0.494*	10818.86
	(0.318)	(0.176)	(0.254)	
Vegetable crop yield (kg/ha, log)	-0.0368	0.167	0.304	155128.90
	(0.205)	(0.130)	(0.226)	
Root crop yield (kg/ha, log)	-0.192	-0.349*	-0.869***	31571.75
	(0.323)	(0.183)	(0.260)	
Pulses crop yield (kg/ha, log)	-0.0468	-0.0181	-0.0708**	107.69
	(0.0574)	(0.0353)	(0.0355)	
Oilseed crop yield (kg/ha, log)	0.126	0.0574	0.150	104.54
	(0.119)	(0.0658)	(0.117)	
Cash crops yield (kg/ha, log)	0.124	-0.0293	0.0290	1080.75
	(0.172)	(0.0784)	(0.114)	
Fruit crop yield (kg/ha, log)	0.0553	-0.0186	-0.359	48167.99
	(0.308)	(0.181)	(0.278)	
Perennial crop yield (kg/ha, log)	0.0553	-0.0126	-0.359	48168.25
	(0.308)	(0.181)	(0.278)	
No. of observations	1141	1966	1203	973

Notes:

1. Results are based on the full sample data.
2. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 4.3A: Results on agricultural production indicators: value of crop production

	(1)	(2)	(3)	Control mean full sample
	FFS batch 1	FFS batch 123	FFS batch5	
	IPWRA	IPWRA	IPWRA	
Value of crop production				
Value of grain crop produce (TSH, log)	0.601	-0.0497	-0.543	223802.60
	(0.494)	(0.276)	(0.394)	
Value of cereal crop produce (TSH, log)	0.453	-0.123	-1.036***	324451.30
	(0.496)	(0.282)	(0.390)	
Value of vegetable crop produce (TSH, log)	-0.125	0.0987	0.172	111689.80
	(0.306)	(0.186)	(0.295)	
Value of root crop produce (TSH, log)	-0.296	-0.590**	-1.162***	356257.40
	(0.480)	(0.264)	(0.378)	
Value of pulse crop produce (TSH, log)	-0.0603	-0.0273	-0.0921	193539.90
	(0.102)	(0.0589)	(0.0663)	
Value of oilseeed crop produce (TSH, log)	0.200	0.0326	0.113	30697.59
	(0.212)	(0.114)	(0.184)	

Value of cash crop produce (TSH, log)	0.263	-0.0398	0.0468	40556.53
	(0.242)	(0.113)	(0.173)	
Value of fruits crop produce (TSH, log)	0.289	0.0287	-0.632*	97801.19
	(0.467)	(0.258)	(0.372)	
Value of perennial crop produce (TSH, log)	0.289	0.0406	-0.632*	97929.25
	(0.467)	(0.258)	(0.372)	
Crop revenue	0.539	-0.0696	0.0387	229452.00
	(0.479)	(0.282)	(0.432)	
No. of observations	1141	1966	1203	973

Notes:

1. Results are based on the full sample data.
2. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 4.4A: Results on agricultural production indicators: Livestock expenditure and revenue

	(1)	(2)	(3)	Control mean full sample
	FFS batch 1	FFS batch 123	FFS batch5	
	IPWRA	IPWRA	IPWRA	
Livestock production				
Livestock expenditure on feed (TSH, log)	1.033*	0.894***	1.646***	136787.30
	(0.534)	(0.314)	(0.506)	
Livestock expenditure on Vaccination (TSH, log)	1.551***	1.152***	1.690***	17467.33
	(0.497)	(0.290)	(0.445)	
Livestock expenditure on veterinary services (TSH, log)	0.876*	0.699**	1.359***	43791.21
	(0.518)	(0.308)	(0.480)	
Livestock expenditure on labour (TSH, log)	-0.0858	-0.0235	0.00377	8859.06
	(0.0581)	(0.0500)	(0.0855)	
Livestock revenue (TSH, log)	1.580***	0.653***	0.439	78187.31
	(0.455)	(0.245)	(0.368)	
Livestock product revenue(TSH, log)	0.588*	0.356**	1.053***	41186.13
	(0.321)	(0.170)	(0.295)	
No. of observations	742	1966	1203	937

Notes:

1. Results are based on the full sample data.
2. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 4.5A: Results on economic mobility: income and savings indicators

	(1)	(2)	(3)	Control mean full sample
	FFS batch 1	FFS batch 123	FFS batch5	
	IPWRA	IPWRA	IPWRA	
Income indicators				
Crop income (TSH, log)	-0.144	-0.485**	-0.970***	1232101
	(0.370)	(0.216)	(0.363)	
Livestock income (TSH, log)	1.601***	0.684***	0.888**	89266
	(0.472)	(0.258)	(0.393)	
Off farm wage income (TSH, log)	0.0972	0.264	0.876**	1343308
	(0.430)	(0.233)	(0.377)	
Self-employment income (TSH, log)	0.756	0.431	0.425	361552
	(0.482)	(0.270)	(0.413)	
Total household income (TSH, log)	0.285	0.0905	0.134	3026227
	(0.305)	(0.182)	(0.282)	
No. of observations	1141	1966	1203	937

Notes:
1. Results are based on the full sample data.
2. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 4.6A: Results on economic mobility: asset indices

	(1)	(2)	(3)	Control mean full sample
	FFS batch 1	FFS batch 123	FFS batch5	
	IPWRA	IPWRA	IPWRA	
Asset indicators				
Durable assets	0.105	5.286	0.0463	1.02
	(0.0825)	(5.250)	(0.0664)	
Productive assets	-0.0446	0.0834	0.229**	3.04
	(0.0845)	(0.0628)	(0.101)	
Livestock assets	0.00413	-0.0147	0.0581	0.61
	(0.0857)	(0.0603)	(0.0712)	
No. of large livestock (no.)	0.758*	0.217	0.189	1.57
	(0.416)	(0.216)	(0.299)	
No. of small livestock	12.55*	3.261*	-0.762	11.26
	(6.439)	(1.820)	(1.877)	
Tropical livestock unit (TLU)	0.0317	-0.258	-0.0685	3.57
	(0.787)	(0.410)	(0.477)	
Total assets	0.0124	1.090	0.0559**	0.64
	(0.0253)	(1.066)	(0.0254)	
No. of observations	1141	1966	1203	937

Notes:
1. Results are based on the full sample data.
2. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 4.7A: Results on economic mobility: poverty reduction indicators

	(1)	(2)	(3)	Control mean full sample
	FFS batch 1	FFS batch 123	FFS batch5	
	IPWRA	IPWRA	IPWRA	
Poverty reduction indicators				
Moving out of poverty, overall asset-based poverty line, 40th percentile	0.134*	0.0329	0.0510	0.45
	(0.0702)	(0.0378)	(0.0589)	
Moving out of poverty, overall asset-based poverty line, 60th percentile		0.0460	0.0578	0.19
		(0.0304)	(0.0498)	
Moving out of poverty, durable asset-based poverty line, 40th percentile	0.159**	0.0511	0.0563	0.49
	(0.0678)	(0.0372)	(0.0563)	
Moving out of poverty, durable asset-based poverty line, 60th percentile	0.0762	0.0624**	0.0561	0.32
	(0.0554)	(0.0290)	(0.0440)	
Moving out of poverty, productive asset-based poverty line, 40th percentile	0.0534	0.0477**	0.0539	0.13
	(0.0394)	(0.0223)	(0.0380)	
Moving out of poverty, productive asset-based poverty line, 60th percentile	0.0338	0.0100	0.0213	0.10
	(0.0326)	(0.0172)	(0.0305)	
Moving out of poverty, livestock asset-based poverty line, 40th percentile	0.00946	-0.00772	-0.0251	0.23
	(0.0556)	(0.0279)	(0.0411)	
Moving out of poverty, livestock asset-based poverty line, 60th percentile	0.0410	0.0303	0.0243	0.15
	(0.0434)	(0.0226)	(0.0341)	

Notes:
1. Results are based on the full sample data.
2. Number of observations dependence on the outcome variable.
3. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 4.8A: Results on food security indicators

	(1)	(2)	(3)	Control mean full sample
	FFS batch 1	FFS batch 123	FFS batch5	
	IPWRA	IPWRA	IPWRA	
Food insecurity indicators				
Household dietary diversity score (HDDS)	-0.195	0.0566	-0.00983	5.60
	(0.192)	(0.119)	(0.187)	
Coping strategies index (CSI)	0.591	0.0928	0.353	2.47
	(0.394)	(0.225)	(0.349)	
No. of observations	1141	1966	1203	937

Notes:
1. Results are based on the full sample data.
2. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 4.9A: Results on resilience indicators based on treatment effects estimation

	(1)	(2)	(3)	Control mean full sample
	FFS batch 1	FFS batch 123	FFS batch5	
	IPWRA	IPWRA	IPWRA	
Resilience indicators				
Resilience index (based on PRIME)	0.244	0.0145	0.261	2.02
	(0.204)	(0.110)	(0.176)	
Ability to recover from shocks	0.0133	-0.00218	0.00611	0.17
	(0.0153)	(0.00886)	(0.0128)	
Crop diversification (no. of crops)	0.0424	0.00625	-0.194**	1.77
	(0.107)	(0.0612)	(0.0923)	
No. of observations	1141	1966	1203	937

Notes:
1. Results are based on the full sample data.
2. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 4.10A: Results on market access indicators

	(1)	(2)	(3)	Control mean full sample
	FFS batch 1	FFS batch 123	FFS batch5	
	IPWRA	IPWRA	IPWRA	
Market access indicators				
Market participation for crops	0.0394	-0.00591	-0.00382	0.39
	(0.0381)	(0.0229)	(0.0343)	
Market participation for livestock	0.130***	0.0519**	0.0286	0.25
	(0.0382)	(0.0209)	(0.0317)	
Market participation for livestock products	0.0515*	0.0288*	0.0928***	0.09
	(0.0296)	(0.0152)	(0.0257)	
Packaging expenditure (TSH, log)	0.510**	0.257***	0.203	8740.66
	(0.227)	(0.0995)	(0.149)	
Processing expenditure (TSH, log)	0.0866	0.105*	0.141	869.80
	(0.0943)	(0.0542)	(0.0962)	
No. of observations	1141	1966	1203	937

Notes:
1. Results are based on the full sample data.
2. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 4.11A: Results on empowerment of primary and secondary decision makers: PRO-WEAI indicators

	(1)	(2)	(3)	Control mean full sample
	FFS batch 1	FFS batch 123	FFS batch5	
	IPWRA	IPWRA	IPWRA	
Empowerment of primary and secondary decision makers				
Autonomy in income	0.0288	0.0101	-0.00195	0.37
	(0.0305)	(0.0176)	(0.0259)	
Self-efficacy	-0.0292	-0.0220	-0.0531**	0.46
	(0.0315)	(0.0182)	(0.0267)	
Attitudes about domestic violence	0.0111	-0.0246*	-0.0392*	0.80
	(0.0233)	(0.0141)	(0.0219)	
Input in productive decisions	0.0145	0.0176*	0.0108	0.89
	(0.0162)	(0.0101)	(0.0158)	
Ownership of land and other assets	-0.00468	0.00113	0.0213	0.87
	(0.0207)	(0.0123)	(0.0174)	
Access to and decisions on credit	0.0135	0.0245	0.0485*	0.41
	(0.0302)	(0.0178)	(0.0262)	
Control over use of income	0.0256	0.0137	-0.0279	0.89
	(0.0167)	(0.0105)	(0.0179)	
Work balance	0.00988	0.00707	-0.00344	0.44
	(0.0297)	(0.0177)	(0.0265)	
Visiting important locations	0.0105	-0.00463	0.0136	0.64
	(0.0300)	(0.0177)	(0.0260)	
Group membership	0.0913***	0.0732***	0.110***	0.24
	(0.0288)	(0.0166)	(0.0256)	
Membership in influential groups	0.0708***	0.0507***	0.0361*	0.16
	(0.0253)	(0.0143)	(0.0216)	
Respect among household members	0.0642**	0.0290*	-0.0263	0.58
	(0.0274)	(0.0165)	(0.0254)	
No. of observations	1955	3347	2052	1592

Notes:
1. Results are based on the full sample data.
2. Results are based on individual empowerment indicators of primary and secondary decision makers.
3. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Appendix 5: Control sample mean of IFAD10 indicators across the different samples

Table 5.1A: Control sample mean of adoption of agricultural practices promoted by FFSs

	(1)	(2)	(3)	(4)	(5)
	Full sample	Crop producers	Crop & Livestock Producers	Livestock Producers	High & low adopters (full sample)
High adoption of practices (1=high adopters)	0.23	0.23	0.22	0.22	0.39
No. of observations	937	803	431	491	534

Table 5.2A: Control sample mean of agricultural production indicators: crop input use

	(1)	(2)	(3)	(4)	(5)
	Full sample	Crop producers	Crop & Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)
Crop inputs use					
Crop area (ha)	0.92	0.96	0.96	0.92	1.00
Seed expenditure (TSH, log)	8461.73	9811.51	9882.69	8461.73	15537.42
Inorganic fertilizer expenditure (TSH, log)	6844.59	7986.78	8951.70	6844.59	10418.66
Pesticide expenditure (TSH, log)	7504.16	8743.96	9908.35	7504.16	16309.10
Labour expenditure (TSH, log)	2488.79	2904.11	3879.35	2488.79	3157.90
No. of observations	937	803	431	937	209

Table 5.3A: Control sample mean of agricultural production indicators: crop yield (harvest)

	(1)	(2)	(3)	(4)	(5)
	Full sample	Crop producers	Crop & Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)
Crop yield					
Grain crop harvest (kg/ha, log)	2145.49	2503.52	3977.82	2145.49	2011.42
Cereal crop harvest (kg/ha, log)	1971.44	2300.42	3706.86	1971.44	1834.39
Vegetable crop harvest (kg/ha, log)	92313.29	107718.00	8724.77	92313.29	411638.80
Root crop harvest (kg/ha, log)	19294.19	22513.89	12524.11	19294.19	26546.74
Pulses crop harvest (kg/ha, log)	108.56	126.68	210.28	108.56	2.15
Oilseed crop harvest (kg/ha, log)	65.49	76.42	60.68	65.49	174.88
Cash crops harvest (kg/ha, log)	379.45	442.77	758.20	379.45	1398.07

Fruit crop harvest (kg/ha, log)	4933.56	5756.85	6816.47	4933.56	7724.48
Perennial crop harvest (kg/ha, log)	4933.61	5756.91	6816.59	4933.61	7724.48
Grain crop yield (kg/ha, log)	11031.08	12871.88	10504.88	11031.08	27781.32
Cereal crop yield (kg/ha, log)	10818.86	12624.25	10199.39	10818.86	27499.01
Vegetable crop yield (kg/ha, log)	155128.90	181015.90	90366.28	155128.90	687230.00
Root crop yield (kg/ha, log)	31571.75	36840.26	25859.37	31571.75	43434.38
Pulses crop yield (kg/ha, log)	107.69	125.66	213.97	107.69	5.32
Oilseed crop yield (kg/ha, log)	104.54	121.98	91.52	104.54	277.00
Cash crops yield (kg/ha, log)	1080.75	1261.10	2207.12	1080.75	3430.87
Fruit crop yield (kg/ha, log)	48167.99	56205.98	60646.18	48167.99	27103.76
Perennial crop yield (kg/ha, log)	48168.25	56206.29	60646.75	48168.25	27103.76
No. of observations	973	803	431	973	209

Table 5.4A: Control sample mean of agricultural production indicators: value of crop production

	(1)	(2)	(3)	(4)	(5)
	Full sample	Crop producers	Crop & Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)
Value of crop production					
Value of grain crop produce (TSH, log)	223802.60	261149.50	296833.00	223802.60	464810.90
Value of cereal crop produce (TSH, log)	324451.30	378593.90	404384.00	324451.30	464301.30
Value of vegetable crop produce (TSH, log)	111689.80	130203.40	101599.30	111689.80	309671.60
Value of root crop produce (TSH, log)	356257.40	415707.50	217939.80	356257.40	1168094.00
Value of pulse crop produce (TSH, log)	193539.90	225836.80	417819.80	193539.90	797.45
Value of oilseeed crop produce (TSH, log)	30697.59	35820.22	41217.17	30697.59	63694.78
Value of cash crop produce (TSH, log)	40556.53	46265.84	38137.73	40556.53	135421.50
Value of fruits crop produce (TSH, log)	97801.19	114121.70	159617.90	97801.19	85656.05
Value of perennial crop produce (TSH, log)	97929.25	114271.10	159896.40	97929.25	85656.05
Crop revenue (TSH, log)	229452.00	266558.60	248156.10	229452.00	441397.20
No. of observations	973	803	431	973	209

Table 5.5A: Control sample mean of agricultural production indicators: Livestock expenditure and revenue

	(1)	(2)	(3)	(4)	(5)
	Full sample	Crop & Livestock Producers	Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)
Livestock production					
Livestock expenditure on feed (TSH, log)	136787.30	81762.16	158779.50	136787.30	374297.20
Livestock expenditure on Vaccination (TSH, log)	17467.33	18840.67	19153.42	17467.33	20849.81

Livestock expenditure on veterinary services (TSH, log)	43791.21	45205.48	47341.26	43791.21	64580.54
Livestock expenditure on labour (TSH, log)	8859.06	2273.78	10142.57	8859.06	32520.33
Livestock revenue (TSH, log)	78187.31	152623.00	142777.00	78187.31	64880.42
Livestock product revenue (TSH, log)	41186.13	81619.26	76108.55	41186.13	16887.08
No. of observations	937	431	491	937	209

Table 5.6A: Control sample mean of economic mobility: income and savings indicators

	(1)	(2)	(3)	(4)	(5)	(6)
	Full sample	Crop producers	Crop & Livestock Producers	Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)
Income indicators						
Crop income (TSH, log)	1232101	1436523.00	1474380.00	-	1232101	2269817.00
Livestock income (TSH, log)	89266	-	167221.40	160054.60	89266	82030.74
Off farm wage income (TSH, log)	1343308	399569.40	567278.40	531745.40	1343308	4234875.00
Self-employment income (TSH, log)	361552	1520797.00	473684.90	432134.80	361552	168253.70
Total household income (TSH, log)	3026227	3450255.00	2682565.00	2418146.00	3026227	6754976.00
No. of observations	937	803	431	491	937	209

Table 5.7A: Control sample mean of economic mobility: asset indices

	(1)	(2)	(3)	(4)	(5)	(6)
	Full sample	Crop producers	Crop & Livestock Producers	Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)
Asset indicators						
Durable assets index	1.02	1.02	1.10	1.10	1.02	1.17
Productive assets index	3.04	3.03	3.06	3.07	3.04	3.18
Livestock assets index	0.61	-	0.72	0.72	0.61	0.57
No. of large livestock (no.)	1.57	-	3.09	3.00	1.57	1.27
No. of small livestock	11.26	-	21.55	21.49	11.26	17.28
Tropical livestock unit (TLU)	3.57	-	4.17	4.13	3.57	3.38
Overall assets index	0.64	0.64	0.66	0.66	0.64	0.70
No. of observations	937	803	431	491	937	209

Table 5.8A: Control sample mean of economic mobility: poverty reduction indicators

	(1)	(2)	(3)	(4)	(5)	(6)
	Full sample	Crop producers	Crop & Livestock Producers	Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)
Poverty reduction indicators						
Moving out of poverty, overall asset-based poverty line, 40th percentile	0.45	0.44	0.44	0.43	0.45	0.37
Moving out of poverty, overall asset-based poverty line, 60th percentile	0.19	0.18	0.17	0.16	0.19	0.19
Moving out of poverty, durable asset-based poverty line, 40th percentile	0.49	0.49	0.49	0.46	0.49	0.47
Moving out of poverty, durable asset-based poverty line, 60th percentile	0.32	0.32	0.34	0.32	0.32	0.29
Moving out of poverty, productive asset-based poverty line, 40th percentile	0.13	0.13	0.12	0.12	0.13	0.15
Moving out of poverty, productive asset-based poverty line, 60th percentile	0.10	0.10	0.12	0.12	0.10	0.13
Moving out of poverty, livestock asset-based poverty line, 40th percentile	0.23	-	-	-	0.23	0.15
Moving out of poverty, livestock asset-based poverty line, 60th percentile	0.15	-	0.21	0.20	0.15	0.10

Table 5.9A: Control sample mean of food security indicators

	(1)	(2)	(3)	(4)	(5)	(6)
	Full sample	Crop producers	Crop & Livestock Producers	Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)
Food insecurity indicators						
Household dietary diversity score (HDDS)	5.60	5.53	5.52	5.54	5.60	6.27
Coping strategies index (CSI)	2.47	2.45	2.28	2.27	2.47	1.89
No. of observations	937	803	431	491	937	209

Table 5.10A: Control sample mean of resilience indicators based on treatment effects estimation

	(1)	(2)	(3)	(4)	(5)	(6)
	Full sample	Crop producers	Crop & Livestock Producers	Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)
Resilience indicators						
PRIME	2.02	2.15	2.23	2.12	2.02	2.15
Ability to recover from shocks	0.17	0.18	0.19	0.18	0.17	0.19
Crop diversification (no. of crops)	1.77	2.06	2.21	-	1.77	1.87
No. of observations	937	803	431	491	937	209

Table 5.11A: Control sample mean of market access indicators

	(1)	(2)	(3)	(4)	(5)	(6)
	Full sample	Crop producers	Crop & Livestock Producers	Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)
Market access indicators						
Market participation for crops	0.39	0.45	0.49	-	0.39	0.47
Market participation for grain crops	0.05	0.06	0.07	-	0.05	0.07
Market participation for cereals crops	0.04	0.04	0.05	-	0.04	0.05
Market participation for vegetables	0.10	0.11	0.11	-	0.10	0.12
Market participation for root crops	0.17	0.20	0.21	-	0.17	0.22
Market participation for oilseed crops	0.01	0.02	0.03	-	0.01	0.02
Market participation for fruit crops	0.16	0.18	0.22	-	0.16	0.17
Market participation for perennial crops	0.16	0.18	0.22	-	0.16	0.17
Market participation for livestock	0.25	-	0.42	0.42	0.25	0.28
Market participation for livestock products	0.09	-	0.15	0.15	0.09	0.12
Packaging expenditure (TSH, log)	8740.66	9165.63	13225.06	12281.06	8740.66	18133.97
Processing expenditure (TSH, log)	869.80	1014.94	116.01	101.83	869.80	2822.97
No. of observations	937	803	431	491	937	209

Table 5.12A: Control sample mean of empowerment of primary and secondary decision makers: PRO-WEAI indicators

	(1)	(2)	(3)	(4)	(5)	(6)
	Full sample	Crop producers	Crop & Livestock Producers	Livestock Producers	High adopters among treated vs control (full sample)	High vs high adopters (full sample)
Empowerment of primary and secondary decision makers						
Autonomy in income	0.37	0.37	0.37	0.36	0.37	0.35
Self-efficacy	0.46	0.48	0.48	0.46	0.46	0.47
Attitudes about domestic violence	0.80	0.80	0.81	0.81	0.80	0.78
Input in productive decisions	0.89	0.90	0.91	0.91	0.89	0.93
Ownership of land and other assets	0.87	0.88	0.88	0.88	0.87	0.88
Access to and decisions on credit	0.41	0.42	0.43	0.43	0.41	0.44
Control over use of income	0.89	0.89	0.87	0.88	0.89	0.92
Work balance	0.44	0.42	0.40	0.42	0.44	0.38
Visiting important locations	0.64	0.63	0.62	0.64	0.64	0.73
Group membership	0.24	0.26	0.27	0.26	0.24	0.29
Membership in influential groups	0.16	0.16	0.18	0.17	0.16	0.17
Respect among household members	0.58	0.57	0.58	0.59	0.58	0.53
No. of observations	1592	1379	765	862	1592	354

Appendix 6: Treatment effect for households that produce exclusively crops or livestock

Table 6.1A: Results on agricultural production indicators: crop input use

	Crop only producers	Control mean
	IPWRA	
Crop inputs use		
Crop area (ha)	-0.0723	0.97
	(0.120)	
Seed expenditure (TSH, log)	0.540	9702.95
	(0.330)	
Inorganic fertilizer expenditure (TSH, log)	0.118	6850.40
	(0.298)	
Pesticide expenditure (TSH, log)	0.277	7375.07
	(0.297)	
Labour expenditure (TSH, log)	0.0133	1769.44
	(0.0538)	
No. of observations	736	373

Notes:

1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 6.2A: Results on agricultural production indicators: crop yield (harvest)

	Crop only producers	Control mean
	IPWRA	
Crop yield		
Grain crop harvest (kg/ha, log)	0.286	793.25
	(0.237)	
Cereal crop harvest (kg/ha, log)	0.306	669.11
	(0.238)	
Vegetable crop harvest (kg/ha, log)	0.225	221815.50
	(0.169)	
Root crop harvest (kg/ha, log)	-0.402*	33996.68
	(0.239)	
Pulses crop harvest (kg/ha, log)	-0.0167	29.75
	(0.0543)	
Oilseed crop harvest (kg/ha, log)	-0.0140	94.40
	(0.0863)	
Cash crops harvest (kg/ha, log)	0.218**	77.10
	(0.110)	

Fruit crop harvest (kg/ha, log)	0.0440	4517.02
	(0.240)	
Perennial crop harvest (kg/ha, log)	0.0597	4517.02
	(0.240)	
Grain crop yield (kg/ha, log)	0.366	15572.43
	(0.289)	
Cereal crop yield (kg/ha, log)	0.365	15392.31
	(0.291)	
Vegetable crop yield (kg/ha, log)	0.313	285275.80
	(0.214)	
Root crop yield (kg/ha, log)	-0.373	49429.87
	(0.288)	
Pulses crop yield (kg/ha, log)	-0.00395	23.28
	(0.0649)	
Oilseed crop yield (kg/ha, log)	-0.0164	156.85
	(0.102)	
Cash crops yield (kg/ha, log)	0.275**	164.60
	(0.130)	
Fruit crop yield (kg/ha, log)	-0.0146	50924.67
	(0.295)	
Perennial crop yield (kg/ha, log)	0.00250	50924.67
	(0.295)	
No. of observations	736	373

Notes:

1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 6.3A: Results on agricultural production indicators: value of crop production

	Crop only producers	Control mean
	IPWRA	
Value of crop production		
Value of grain crop produce (TSH, log)	0.317	219217.20
	(0.457)	
Value of cereal crop produce (TSH, log)	0.330	347778.50
	(0.464)	
Value of vegetable crop produce (TSH, log)	0.383	162906.30
	(0.298)	
Value of root crop produce (TSH, log)	-0.694	643112.90
	(0.428)	
Value of pulse crop produce (TSH, log)	-0.0366	3395.71
	(0.107)	
Value of oilseeed crop produce (TSH, log)	-0.0795	29488.05

	(0.176)	
Value of cash crop produce (TSH, log)	0.413**	57812.62
	(0.191)	
Value of fruits crop produce (TSH, log)	0.0384	61244.99
	(0.415)	
Value of perennial crop produce (TSH, log)	0.0727	61244.99
	(0.416)	
Crop revenue	-0.169	289386.80
	(0.462)	
No. of observations	736	373

Notes:

1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 6.4A: Results on agricultural production indicators: Livestock expenditure and revenue

	Livestock only producers	Control mean
	IPWRA	
Livestock production		
Livestock expenditure on feed (TSH, log)	3.171***	712020.8
	(1.112)	
Livestock expenditure on Vaccination (TSH, log)	3.277***	21400
	(1.262)	
Livestock expenditure on veterinary services (TSH, log)	2.526**	62683.33
	(1.214)	
Livestock expenditure on labour (TSH, log)	0.115	66666.67
	(0.145)	
Livestock revenue (TSH, log)	-0.485	72050.15
	(1.095)	
Livestock product revenue(TSH, log)	1.456	36523.33
	(0.895)	
No. of observations	143	60

Notes:

1. ***, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.**

Table 6.5A: Results on economic mobility: income and savings indicators

	(1)	(2)	Control mean crop only producers	Control mean livestock only producers
	Crop only producers	Livestock only producers		
	IPWRA	IPWRA		
Income indicators				
Crop income (TSH, log)	-0.0526	-	1391207.00	-
	(0.162)	-		-
Livestock income (TSH, log)	-	-0.295	-	108573.5
	-	(0.969)		
Off farm wage income (TSH, log)	0.356	0.0777	312858.00	276500
	(0.429)	(0.879)		
Self-employment income (TSH, log)	0.0164	1.464	2618507.00	133666.7
	(0.354)	(1.041)		
Total household income (TSH, log)	0.155	0.680	4335441.00	518740.2
	(0.162)	(1.210)		
No. of observations	736	143	373	60

Notes:

1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 6.6A: Results on economic mobility: asset indices

	(1)	(2)	Control mean crop only producers	Control mean livestock only producers
	Crop only producers	Livestock only producers		
	IPWRA	IPWRA		
Asset indicators				
Durable assets	0.0836	-0.150	3.00	1.05
	(0.0738)	(0.175)		
Productive assets	14.96	0.164	0.93	3.19
	(14.87)	(0.209)		
Livestock assets	-	-0.0218	-	0.68
	-	(0.0800)		
No. of large livestock (no.)	-	-0.873	-	2.30
	-	(1.649)		
No. of small livestock	-	12.86	-	21.02
	-	(9.153)		
Tropical livestock unit (TLU)	-	-3.810	-	3.87
	-	(2.819)		
Overall assets	3.055	0.00257	0.61	0.68
	(3.020)	(0.0575)		
No. of observations	736	143	373	60

Notes:

3. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 6.7A: Results on economic mobility: poverty reduction indicators

	(1) Crop only producers IPWRA	Control mean crop only producers
Poverty reduction indicators		
Moving out of poverty, overall asset-based poverty line, 40th percentile	0.0250	0.44
	(0.0523)	
Moving out of poverty, overall asset-based poverty line, 60th percentile	0.0548	0.19
	(0.0473)	
Moving out of poverty, durable asset-based poverty line, 40th percentile	0.0539	0.49
	(0.0538)	
Moving out of poverty, durable asset-based poverty line, 60th percentile	0.0754*	0.30
	(0.0426)	
Moving out of poverty, productive asset-based poverty line, 40th percentile	0.0676*	0.14
	(0.0372)	
Moving out of poverty, productive asset-based poverty line, 60th percentile	0.0458*	0.07
	(0.0257)	
Moving out of poverty, livestock asset-based poverty line, 40th percentile	-	-
	-	-
Moving out of poverty, livestock asset-based poverty line, 60th percentile	-	-
	-	-

Notes:

1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 6.8A: Results on food security indicators

	(1) Crop only producers IPWRA	(2) Livestock only producers IPWRA	Control mean crop only producers	Control mean livestock only producers
Food insecurity indicators				
Household dietary diversity score (HDDS)	-0.104	-0.273	5.54	5.68
	(0.178)	(0.673)		
Coping strategies index (CSI)	0.232	1.264	2.64	2.20
	(0.383)	(0.895)		
No. of observations	736	143	373	60

Notes:

1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 6.9A: Results on resilience indicators based on treatment effects estimation

	(1)	(2)	Control mean crop only producers	Control mean livestock only producers
	Crop only producers	Livestock only producers		
	IPWRA	IPWRA		
Resilience indicators				
Resilience index (based on PRIME)	-0.0243	0.796*	2.06	1.33
	(0.184)	(0.433)		
Ability to recover from shocks	-0.00680	-0.000623	0.18	0.11
	(0.0147)	(0.0343)		
Crop diversification (no. of crops)	0.149*	-	1.88	-
	(0.0810)	-		
No. of observations	736	143	373	60

Notes:
1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 6.10A: Results on market access indicators

	(1)	(2)	Control mean crop only producers	Control mean livestock only producers
	Crop only producers	Livestock only producers		
	IPWRA	IPWRA		
Market access indicators				
Market participation for crops	-0.0155	-	0.40	-
	(0.0373)	-		-
Market participation for grain crops	-0.00283	-	0.05	-
	(0.0217)	-		-
Market participation for cereals crops	-0.0114	-	0.04	-
	(0.0207)	-		-
Market participation for vegetables	0.0110	-	0.12	-
	(0.0236)	-		-
Market participation for root crops	-0.0752**	-	0.20	-
	(0.0310)	-		-
Market participation for fruit crops	0.00518	-	0.14	-
	(0.0290)	-		-
Market participation for perennial crops	0.00518	-	0.14	-
	(0.0290)	-		-
Market participation for livestock	-	0.0170	-	0.42
	-	(0.0912)		
Market participation for livestock	-	0.0933*	-	0.15

products	-	(0.0530)		
Packaging expenditure (TSH, log)	0.310*	-0.790	4450.40	5500.0
	(0.174)	(0.661)		
Processing expenditure (TSH, log)	0.0307	0.436*	2050.94	0
	(0.0733)	(0.250)		
No. of observations	736	143	373	60

Notes:
1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 6.11A: Results on empowerment of primary and secondary decision makers: PRO-WEAI indicators

	(1)	(2)	Control mean crop only producers	Control mean livestock only producers
	Crop only producers	Livestock only producers		
	IPWRA	IPWRA		
Empowerment of primary and secondary decision makers				
Autonomy in income	0.0603**	0.112**	0.37	0.28
	(0.0294)	(0.0567)		
Self-efficacy	-0.0813***	0.0637	0.48	0.34
	(0.0304)	(0.0679)		
Attitudes about domestic violence	-0.0328	-0.0279	0.79	0.89
	(0.0238)	(0.0473)		
Input in productive decisions	-0.00346	0.0575	0.90	0.92
	(0.0171)	(0.0768)		
Ownership of land and other assets	-0.0128	-0.0294	0.88	0.84
	(0.0192)	(0.0497)		
Access to and decisions on credit	0.0249	0.0948	0.39	0.39
	(0.0296)	(0.0707)		
Control over use of income	0.0164	-0.00824	0.90	0.93
	(0.0177)	(0.0449)		
Work balance	0.0339	-0.0688	0.44	0.57
	(0.0294)	(0.0656)		
Visiting important locations	-0.00570	0.136*	0.64	0.75
	(0.0296)	(0.0731)		
Group membership	0.0158	0.0768	0.24	0.18
	(0.0276)	(0.0705)		
Membership in influential groups	0.0284	0.0164	0.14	0.11
	(0.0230)	(0.0765)		
Respect among household members	0.0236	0.0106	0.55	0.63
	(0.0279)	(0.0580)		
No. of observations	1224	293	616	97

Notes:

1. Results are based on individual empowerment indicators of primary and secondary decision makers.
2. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Appendix 7: Treatment effect on input use, crop yield and value of crop production by input use

Table 7.1A: Results on crop input use: quantity of pesticides, organic and inorganic fertilizers

	(1)	(2)
	Full sample	High adopters among treated vs control (full sample)
	IPWRA	IPWRA
Crop inputs use		
Pesticide (kg/ha, log)	0.150	0.666***
	(0.164)	(0.229)
Organic fertilizer (kg/ha, log)	-0.0254	0.365**
	(0.128)	(0.182)
Inorganic fertilizer (kg/ha, log)	0.115	0.408***
	(0.102)	(0.141)
No. of observations	1980	1365

Notes:

1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 7.2A: Results on crop yield and value of crop production by input use

	(1)	(2)	(3)	(4)	(5)	(6)
	Producers that use inorganic fertilizer	Producers that do not use inorganic fertilizer	Producers that use organic fertilizer	Producers that do not use organic fertilizer	Producers that use pesticides	Producers that do not use pesticides
	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	
Crop yield						
Grain crop harvest (kg, log)	-0.295*	0.0268	0.279	-0.0794	-0.713***	0.120
	(0.173)	(0.130)	(0.292)	(0.112)	(0.261)	(0.114)
Cereal crop harvest (kg, log)	-0.308*	0.0770	0.270	-0.0817	-0.591**	0.124
	(0.174)	(0.125)	(0.303)	(0.106)	(0.249)	(0.111)
Vegetable crop harvest (kg, log)	0.902	0.543	2.190***	-0.00751	0.577	0.581
	(1.262)	(0.399)	(0.654)	(0.371)	(0.483)	(0.649)
Root crop harvest (kg, log)	-0.367	-0.221*	-0.363	-0.128	-0.354	-0.165
	(0.242)	(0.117)	(0.408)	(0.107)	(0.338)	(0.113)
Grain crop yield (kg/ha, log)	-0.300	-0.300	0.434	-0.0362	-0.406	0.154
	(0.188)	(0.188)	(0.295)	(0.121)	(0.252)	(0.122)
Cereal crop yield (kg/ha, log)	-0.328*	-0.328*	0.479	-0.0840	-0.314	0.127
	(0.189)	(0.189)	(0.304)	(0.117)	(0.243)	(0.120)
Vegetable crop yield (kg/ha,	0.909	0.909	2.360***	0.256	1.106**	0.545

log)	(1.421)	(1.421)	(0.689)	(0.396)	(0.512)	(0.725)
Root crop yield (kg/ha, log)	-0.183	-0.183	-0.768*	-0.0518	-0.465	-0.148
	(0.228)	(0.228)	(0.408)	(0.118)	(0.362)	(0.125)
Value of grain crop produce (TSH, log)	-0.355	0.0352	0.533	-0.131	-0.750***	0.0949
	(0.247)	(0.194)	(0.355)	(0.166)	(0.272)	(0.175)
Value of cereal crop produce (TSH, log)	-0.516**	0.0623	0.189	-0.270*	-0.811***	-0.0111
	(0.231)	(0.194)	(0.377)	(0.158)	(0.271)	(0.169)
Value of vegetable crop produce (TSH, log)	0.213	-0.0982	0.692	0.204	0.0992	-0.335
	(0.682)	(0.331)	(0.464)	(0.325)	(0.327)	(0.504)
Value of root crop produce (TSH, log)	0.140	-0.0742	-0.629	0.0848	-0.659	-0.0702
	(0.289)	(0.159)	(0.573)	(0.149)	(0.735)	(0.154)

Notes:

1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Appendix 8: Treatment effect on yield and value of crop production for crops targeted by the FFSs

Table 8.1A: Results on crop yield and value of crop production by input use

	(1)	(2)	(3)	(4)	(5)	(6)
	Full sample	High adopters among treated vs control (full sample)	Participants of Farmer-led FFSs (full ample)	Participants of Extension-led FFSs (full ample)	Participants of Farmer-led FFSs (high adopters)	Participants of Extension-led FFSs (high adopters)
	IPWRA	IPWRA	IPWRA	IPWRA	IPWRA	
Yield of crops targeted by FFS						
Paddy rice harvest (kg, log)	0.00156	-0.259	0.0136	-0.0369	0.624***	0.138
	(0.113)	(0.453)	(0.154)	(0.128)	(0.226)	(0.182)
Cassava harvest (kg, log)	-0.119	0.429	-0.127	-0.137	0.202	-0.172
	(0.105)	(0.387)	(0.167)	(0.112)	(0.357)	(0.155)
Banana harvest (kg, log)	0.188	0.778	0.343	0.143	0.653	0.109
	(0.159)	(0.642)	(0.290)	(0.164)	(0.573)	(0.211)
Vegetable harvest (kg, log)	0.806**	-0.758	1.693**	0.666*	1.218*	1.246***
	(0.327)	(1.036)	(0.743)	(0.363)	(0.740)	(0.459)
Paddy rice yield (kg/ha, log)	0.0739	-0.334	0.144	0.0165	0.621**	0.178
	(0.115)	(0.520)	(0.160)	(0.132)	(0.273)	(0.201)
Cassava yield (kg/ha, log)	-0.105	0.561	-0.166	-0.0832	0.282	-0.0658
	(0.119)	(0.470)	(0.200)	(0.129)	(0.492)	(0.183)
Banana yield (kg/ha, log)	0.0908	0.733	0.352	0.0249	0.427	0.101
	(0.169)	(0.615)	(0.285)	(0.187)	(0.525)	(0.242)
Vegetable yield (kg/ha, log)	1.048***	-0.840	1.554**	1.063**	1.269	1.675***
	(0.369)	(1.066)	(0.740)	(0.417)	(0.799)	(0.558)

Value of paddy rice produce (TSH, log)	-0.186	-0.0154	-0.395	-0.182	0.251	0.188
	(0.174)	(0.481)	(0.302)	(0.194)	(0.442)	(0.265)
Value of cassava produce (TSH, log)	-0.149	0.757*	0.0659	-0.244*	0.274	-0.253
	(0.122)	(0.428)	(0.164)	(0.138)	(0.332)	(0.201)
Value of banana produce (TSH, log)	0.343**	1.167*	0.350	0.383**	1.022***	0.383*
	(0.151)	(0.685)	(0.269)	(0.160)	(0.380)	(0.228)
Value of vegetable produce (TSH, log)	0.117	-1.304	0.413	-0.0543	-0.0431	0.105
	(0.240)	(0.925)	(0.465)	(0.267)	(0.753)	(0.337)

Notes:

1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Appendix 9: Treatment effect on IFAD10 indicators by type of FFS facilitator

Table 9.1A: Results on adoption of agricultural practices promoted by FFSs

	(1)	(2)
	Participants of Farmer-led FFSs (full ample)	Participants of Extension-led FFSs (full ample)
High adoption of practices (1=high adopters)	0.0889***	0.199***
No. of observations	(0.0338)	(0.0243)

Notes:

1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 9.2A: Results on agricultural production indicators: crop input use

	(1)	(2)	(3)	(4)
	Participants of Farmer-led FFSs (full ample)	Participants of Extension-led FFSs (full ample)	Participants of Farmer-led FFSs (high adopters)	Participants of Extension-led FFSs (high adopters)
Crop inputs use				
Crop area (ha)	0.183**	-0.0868*	0.371***	0.00617
	(0.0869)	(0.0502)	(0.128)	(0.0605)
Seed expenditure (TSH, log)	-0.0843	0.377*	0.259	0.789***
	(0.262)	(0.220)	(0.429)	(0.301)
Inorganic fertilizer expenditure (TSH, log)	0.000455	0.336	0.799*	0.836***
	(0.258)	(0.207)	(0.469)	(0.282)
Pesticide expenditure (TSH, log)	-0.0997	0.282	0.870*	0.678**
	(0.245)	(0.199)	(0.464)	(0.272)
Labour expenditure (TSH, log)	0.0283	-0.0247	0.153	-0.0205
	(0.0732)	(0.0679)	(0.161)	(0.0958)

No. of observations	1214	1682	1031	1265

Notes:

1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 5.3A: Results on agricultural production indicators: crop yield (harvest)

	(1)	(2)	(3)	(4)
	Participants of Farmer-led FFSs (full ample)	Participants of Extension-led FFSs (full ample)	Participants of Farmer-led FFSs (high adopters)	Participants of Extension-led FFSs (high adopters)
Crop yield				
Grain crop harvest (kg/ha, log)	-0.0136	-0.0156	0.466	0.307
	(0.216)	(0.165)	(0.370)	(0.227)
Cereal crop harvest (kg/ha, log)	-0.207	0.0249	-0.00103	0.295
	(0.208)	(0.165)	(0.356)	(0.226)
Vegetable crop harvest (kg/ha, log)	0.230	0.150	0.705**	0.489***
	(0.174)	(0.121)	(0.324)	(0.181)
Root crop harvest (kg/ha, log)	-0.599***	-0.337**	-1.243***	-0.329
	(0.221)	(0.167)	(0.359)	(0.223)
Pulses crop harvest (kg/ha, log)	-0.0186	-0.0190	0.0421	0.0180
	(0.0471)	(0.0301)	(0.111)	(0.0371)
Oilseed crop harvest (kg/ha, log)	0.177*	-0.0172	0.445**	0.0969
	(0.105)	(0.0571)	(0.212)	(0.0852)
Cash crops harvest (kg/ha, log)	-0.0293	-0.0513	0.290	-0.0671
	(0.0935)	(0.0726)	(0.191)	(0.0970)
Fruit crop harvest (kg/ha, log)	0.166	-0.0471	0.386	0.121
	(0.237)	(0.155)	(0.368)	(0.204)
Perennial crop harvest (kg/ha, log)	0.166	-0.0395	0.386	0.121
	(0.237)	(0.155)	(0.368)	(0.204)
Grain crop yield (kg/ha, log)	0.00694	0.0382	0.504	0.416
	(0.258)	(0.195)	(0.439)	(0.269)
Cereal crop yield (kg/ha, log)	-0.219	0.0652	-0.0525	0.379
	(0.249)	(0.195)	(0.425)	(0.269)
Vegetable crop yield (kg/ha, log)	0.242	0.233	0.843**	0.645***
	(0.201)	(0.147)	(0.381)	(0.224)
Root crop yield (kg/ha, log)	-0.703***	-0.294	-1.400***	-0.249
	(0.268)	(0.201)	(0.444)	(0.269)
Pulses crop yield (kg/ha, log)	-0.0188	-0.0147	0.0416	0.0290
	(0.0540)	(0.0367)	(0.120)	(0.0463)
Oilseed crop yield (kg/ha, log)	0.223*	0.00257	0.576**	0.141
	(0.124)	(0.0684)	(0.263)	(0.103)

Cash crops yield (kg/ha, log)	-0.00997	-0.0441	0.402*	-0.0680
	(0.111)	(0.0837)	(0.240)	(0.109)
Fruit crop yield (kg/ha, log)	0.129	-0.0734	0.328	0.167
	(0.285)	(0.195)	(0.449)	(0.258)
Perennial crop yield (kg/ha, log)	0.129	-0.0651	0.328	0.167
	(0.285)	(0.195)	(0.449)	(0.258)
No. of observations	1214	1682	1031	1265

Notes:

1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 9.4A: Results on agricultural production indicators: value of crop production

	(1)	(2)	(3)	(4)
	Participants of Farmer-led FFSs (full ample)	Participants of Extension-led FFSs (full ample)	Participants of Farmer-led FFSs (high adopters)	Participants of Extension-led FFSs (high adopters)
Value of crop production				
Value of grain crop produce (TSH, log)	-0.180	0.0315	0.302	0.684
	(0.412)	(0.302)	(0.700)	(0.421)
Value of cereal crop produce (TSH, log)	-0.367	-0.00655	-0.112	0.491
	(0.411)	(0.311)	(0.687)	(0.429)
Value of vegetable crop produce (TSH, log)	0.279	0.146	0.893*	0.605**
	(0.284)	(0.209)	(0.505)	(0.296)
Value of root crop produce (TSH, log)	-0.634*	-0.765***	-1.423**	-0.385
	(0.380)	(0.291)	(0.585)	(0.390)
Value of pulse crop produce (TSH, log)	-0.0195	-0.0253	0.0713	0.0415
	(0.0910)	(0.0613)	(0.198)	(0.0808)
Value of oilseeed crop produce (TSH, log)	0.300	-0.0642	0.956**	0.190
	(0.205)	(0.117)	(0.448)	(0.179)
Value of cash crop produce (TSH, log)	0.0551	-0.0750	0.588	-0.0740
	(0.183)	(0.118)	(0.362)	(0.161)
Value of fruits crop produce (TSH, log)	0.110	-0.00939	0.648	0.292
	(0.385)	(0.284)	(0.643)	(0.377)
Value of perennial crop produce (TSH, log)	0.110	0.00721	0.648	0.292
	(0.385)	(0.284)	(0.643)	(0.377)
Crop revenue (TSH, log)	0.107	-0.154	0.911	1.124***
	(0.411)	(0.311)	(0.629)	(0.416)
No. of observations	1214	1682	1031	1265

Notes:

1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 9.5A: Results on agricultural production indicators: Livestock expenditure and revenue

	(1)	(2)	(3)	(4)
	Participants of Farmer-led FFSs (full ample)	Participants of Extension-led FFSs (full ample)	Participants of Farmer-led FFSs (high adopters)	Participants of Extension-led FFSs (high adopters)
Livestock production				
Livestock expenditure on feed (TSH, log)	1.582***	0.821**	1.867***	1.170***
	(0.475)	(0.351)	(0.712)	(0.443)
Livestock expenditure on Vaccination (TSH, log)	1.352***	1.156***	1.721***	1.776***
	(0.434)	(0.319)	(0.612)	(0.404)
Livestock expenditure on veterinary services (TSH, log)	0.814*	0.834**	0.800	1.181***
	(0.457)	(0.341)	(0.679)	(0.425)
Livestock expenditure on labour (TSH, log)	-0.0610**	-0.0359	-0.0454	-0.0281
	(0.0307)	(0.0512)	(0.0309)	(0.0533)
Livestock revenue (TSH, log)	0.788**	0.663**	1.609***	1.388***
	(0.362)	(0.273)	(0.602)	(0.384)
Livestock product revenue (TSH, log)	0.452*	0.372*	0.756	0.666**
	(0.254)	(0.196)	(0.461)	(0.286)
No. of observations	1214	1682	1031	1265

Notes:

1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 9.6A: Results on economic mobility: income and savings indicators

	(1)	(2)	(3)	(4)
	Participants of Farmer-led FFSs (full ample)	Participants of Extension-led FFSs (full ample)	Participants of Farmer-led FFSs (high adopters)	Participants of Extension-led FFSs (high adopters)
Income indicators				
Crop income (TSH, log)	-0.356	-0.547**	0.334	0.0408
	(0.345)	(0.236)	(0.530)	(0.307)
Livestock income (TSH, log)	0.892**	0.671**	1.781***	1.482***
	(0.375)	(0.291)	(0.628)	(0.403)
Off farm wage income (TSH, log)	0.209	0.334	-0.111	0.435
	(0.335)	(0.266)	(0.517)	(0.357)
Self-employment income (TSH, log)	0.192	0.482	-1.417***	0.0952
	(0.385)	(0.305)	(0.488)	(0.393)
Total household income (TSH, log)	0.0534	0.0778	0.118	0.387
	(0.284)	(0.198)	(0.460)	(0.249)

No. of observations	1214	1682	1031	1265

Notes:

1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 9.7A: Results on economic mobility: asset indices

	(1)	(2)	(3)	(4)
	Participants of Farmer-led FFSs (full ample)	Participants of Extension-led FFSs (full ample)	Participants of Farmer-led FFSs (high adopters)	Participants of Extension-led FFSs (high adopters)
Asset indicators				
Durable assets index	0.177**	7.229	0.339***	16.58
	(0.0719)	(7.250)	(0.120)	(16.45)
Productive assets index	0.119	0.0709	0.298	0.154
	(0.0793)	(0.0739)	(0.190)	(0.120)
Livestock assets index	-0.000791	-0.0251	-0.0144	-0.0679
	(0.0472)	(0.0670)	(0.0471)	(0.117)
No. of large livestock (no.)	0.213	0.138	0.235	0.233
	(0.272)	(0.241)	(0.388)	(0.346)
No. of small livestock	6.862	2.159	18.91	5.110**
	(4.340)	(1.748)	(11.89)	(2.194)
Tropical livestock unit (TLU)	-0.183	-0.383	-0.371	-0.503
	(0.437)	(0.435)	(0.530)	(0.562)
Overall assets index	0.0601***	1.482	0.129***	3.398
	(0.0228)	(1.473)	(0.0470)	(3.341)
No. of observations	1214	1682	1031	1265

Notes:

1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 9.8A: Results on economic mobility: poverty reduction indicators

	(1)	(2)	(3)	(4)
	Participants of Farmer-led FFSs (full ample)	Participants of Extension-led FFSs (full ample)	Participants of Farmer-led FFSs (high adopters)	Participants of Extension-led FFSs (high adopters)
Poverty reduction indicators				
Moving out of poverty, overall asset-based poverty line, 40th percentile	-0.0209	0.0645	0.177	0.0928
	(0.0630)	(0.0416)	(0.110)	(0.0594)
Moving out of poverty, overall asset-based poverty line, 60th percentile	0.000755	0.0998***	0.220**	0.0510

	(0.0494)	(0.0327)	(0.107)	(0.0466)
Moving out of poverty, durable asset-based poverty line, 40th percentile	-0.0762	0.0852**	0.0142	0.149***
	(0.0630)	(0.0399)	(0.0972)	(0.0550)
Moving out of poverty, durable asset-based poverty line, 60th percentile	0.0305	0.0775**	0.150*	0.0867**
	(0.0452)	(0.0316)	(0.0799)	(0.0440)
Moving out of poverty, productive asset-based poverty line, 40th percentile	0.00168	0.0638***		0.0700**
	(0.0357)	(0.0242)		(0.0344)
Moving out of poverty, productive asset-based poverty line, 60th percentile	-0.0224	0.0325*	0.0264	0.0545**
	(0.0252)	(0.0192)	(0.0511)	(0.0277)
Moving out of poverty, livestock asset-based poverty line, 40th percentile	-0.0274	0.0235	0.0752	0.0830*
	(0.0427)	(0.0313)	(0.0823)	(0.0471)
Moving out of poverty, livestock asset-based poverty line, 60th percentile	0.0286	0.0496**	0.106*	0.0797**
	(0.0323)	(0.0252)	(0.0623)	(0.0343)

Notes:

1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.
2. Number of observations depend on the outcome variable.

Table 9.9A: Results on food security indicators

	(1)	(2)	(3)	(4)
	Participants of Farmer-led FFSs (full ample)	Participants of Extension-led FFSs (full ample)	Participants of Farmer-led FFSs (high adopters)	Participants of Extension-led FFSs (high adopters)
Food insecurity indicators				
Household dietary diversity score (HDDS)	0.0936	-0.000834	0.505*	0.365*
	(0.171)	(0.133)	(0.297)	(0.206)
Coping strategies index (CSI)	0.308	-0.0424	-0.805*	-0.469
	(0.339)	(0.246)	(0.431)	(0.304)
No. of observations	1214	1682	1031	1265

Notes:

1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 9.10A: Results on resilience indicators based on treatment effects estimation

	(1)	(2)	(3)	(4)

	Participants of Farmer-led FFSs (full ample)	Participants of Extension-led FFSs (full ample)	Participants of Farmer-led FFSs (high adopters)	Participants of Extension-led FFSs (high adopters)
Resilience indicators				
PRIME	0.102	0.0596	-0.590***	0.325*
	(0.161)	(0.125)	(0.214)	(0.173)
Ability to recover from shocks	-0.00680	0.000751	-0.0571***	0.0290**
	(0.0123)	(0.00982)	(0.0160)	(0.0143)
Crop diversification (no. of crops)	-0.0327	0.0219	0.166	0.198**
	(0.0939)	(0.0679)	(0.156)	(0.0935)
No. of observations	1214	1682	1031	1265

Notes:

1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 9.11A: Results on market access indicators

	(1)	(2)	(3)	(4)
	Participants of Farmer-led FFSs (full ample)	Participants of Extension-led FFSs (full ample)	Participants of Farmer-led FFSs (high adopters)	Participants of Extension-led FFSs (high adopters)
Market access indicators				
Market participation for crops	-0.00112	-0.00943	0.0926*	0.0893***
	(0.0329)	(0.0252)	(0.0503)	(0.0335)
Market participation for grain crops	0.0146	-0.0130	0.0694*	0.00838
	(0.0185)	(0.0135)	(0.0375)	(0.0191)
Market participation for cereals crops	-0.000498	-0.0128	0.0321	0.00574
	(0.0148)	(0.0127)	(0.0301)	(0.0168)
Market participation for vegetables	-0.000447	0.0113	0.0329	0.0356
	(0.0189)	(0.0157)	(0.0343)	(0.0221)
Market participation for root crops	-0.0354	-0.0190	-0.0366	0.0311
	(0.0244)	(0.0200)	(0.0362)	(0.0278)
Market participation for fruit crops	0.0381	0.0156	0.0749*	0.0534**
	(0.0260)	(0.0195)	(0.0430)	(0.0264)
Market participation for perennial crops	0.0381	0.0156	0.0749*	0.0534**
	(0.0260)	(0.0195)	(0.0430)	(0.0264)
Market participation for livestock	0.0603*	0.0510**	0.165***	0.116***
	(0.0318)	(0.0233)	(0.0523)	(0.0319)

Market participation for livestock products	0.0309	0.0356**	0.0788**	0.0624**
	(0.0230)	(0.0172)	(0.0400)	(0.0246)
Packaging expenditure (TSH, log)	0.204	0.347***	0.646**	0.704***
	(0.141)	(0.119)	(0.314)	(0.205)
Processing expenditure (TSH, log)	0.106	0.171**	0.287	0.121
	(0.0831)	(0.0712)	(0.206)	(0.0950)
No. of observations	1214	1682	1031	1265

Notes:

1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Table 9.12A: Results on empowerment of primary and secondary decision makers: PRO-WEAI indicators

	(1)	(2)	(3)	(4)
	Participants of Farmer-led FFSs (full ample)	Participants of Extension-led FFSs (full ample)	Participants of Farmer-led FFSs (high adopters)	Participants of Extension-led FFSs (high adopters)
Empowerment of primary and secondary decision makers				
Autonomy in income	-0.0770***	0.0412**	-0.0999***	0.0496*
	(0.0248)	(0.0196)	(0.0378)	(0.0257)
Self-efficacy	-0.0229	-0.0312	-0.00524	0.0294
	(0.0267)	(0.0201)	(0.0420)	(0.0261)
Attitudes about domestic violence	-0.0168	-0.0267*	-0.0238	-0.0323
	(0.0214)	(0.0154)	(0.0315)	(0.0200)
Input in productive decisions	0.00842	0.0148	0.0386*	0.0356***
	(0.0150)	(0.0110)	(0.0203)	(0.0132)
Ownership of land and other assets	-0.0234	0.0117	-0.0659**	0.0151
	(0.0195)	(0.0132)	(0.0324)	(0.0178)
Access to and decisions on credit	0.0439*	0.0241	0.0511	0.0512**
	(0.0265)	(0.0195)	(0.0419)	(0.0257)
Control over use of income	-0.00133	0.0194*	0.00641	0.0424***
	(0.0160)	(0.0114)	(0.0250)	(0.0136)
Work balance	0.0320	0.00117	0.0262	-0.0641**
	(0.0261)	(0.0196)	(0.0409)	(0.0250)
Visiting important locations	0.0239	-0.0108	0.0980***	0.0271
	(0.0257)	(0.0195)	(0.0376)	(0.0247)
Group membership	0.0773***	0.0673***	0.0516	0.111***
	(0.0244)	(0.0185)	(0.0389)	(0.0249)
Membership in influential	0.0400*	0.0472***	-0.00508	0.0835***

groups				
	(0.0208)	(0.0160)	(0.0310)	(0.0218)
Respect among household members	0.0513**	0.0371**	0.0535	0.0451*
	(0.0233)	(0.0182)	(0.0398)	(0.0251)
No. of observations	2061	2887	1753	2165

Notes:

1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Appendix 10: Treatment effect on female FFS participants

Table 10.1A: Results on empowerment of female primary decision makers of FFSs participants: PRO-WEAI indicators

	(1)	(2)	
	Female primary decision makers (full ample)	Female primary decision makers (high adopters)	Control mean (full sample and high adopters) The observations in the control group in these two samples are the same (N=458)
Empowerment of primary and secondary decision makers			
Autonomy in income	0.0397	0.0616	0.3231
	(0.0313)	(0.0439)	
Self-efficacy	-0.0220	0.00798	0.4454
	(0.0330)	(0.0455)	
Attitudes about domestic violence	-0.0313	-0.00743	0.7489
	(0.0300)	(0.0368)	
Input in productive decisions	-0.000223	0.0304*	0.9279
	(0.0153)	(0.0177)	
Ownership of land and other assets	0.0516**	0.00874	0.8493
	(0.0255)	(0.0333)	
Access to and decisions on credit	0.0250	0.0819*	0.3296
	(0.0327)	(0.0451)	
Control over use of income	-0.00663	0.0394*	0.8995
	(0.0188)	(0.0205)	
Work balance	0.0523	-0.0416	0.3580
	(0.0320)	(0.0429)	
Visiting important locations	0.00286	0.168***	0.6331
	(0.0322)	(0.0398)	
Group membership	0.109***	0.0906**	0.2598
	(0.0316)	(0.0435)	
Membership in influential groups	0.0691**	0.0657*	0.1659
	(0.0279)	(0.0377)	
Respect among household members	0.0282	0.0592	0.4781
	(0.0295)	(0.0440)	
No. of observations	997	667	

Notes:

1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level

respectively.

Appendix 11: Treatment effect on the adoption of FFS curricula on nutrition

Table 11.1A: Descriptive results on the adoption of nutritional practices

	Adoption of nutritional practices (full sample)		Total
	Non-adopters	Adopters	
Control	208 (23.27%)	686 (76.73%)	894
Treated	200 (19.07%)	849 (80.93%)	1049
Total	408 (21%)	1535 (79%)	1943

Table 11.2A: Treatment effect results on the adoption of nutritional practices

	Adoption of nutritional practices (full sample)
Adoption of nutritional practices	0.0276
	(0.0190)
No. of observations	1943

Notes:

1. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively.

Appendix 12: Descriptive results on District Farmer Foras (DFF) established by ASDP-L and ASSP and support from a Community Animal Health Workers (CAWH)

Table 12.1A: Descriptive results on the awareness of the existence of a DFFs within the district

	Awareness of the existence of a DFFs within the district	
	Frequency	Percent
Yes	165	15.73
No	884	84.27
Total	1049	100.00

Table 12.2A: Descriptive results on the impact of DFFs based on the perception of FFS participants

		Impact of DFFs based on the perception of FFS participants	
		Frequency	Percent
Increased crop yield or livestock production			
	Yes	37	3.53
	No	1012	96.47
Improved access to production inputs and services			
	Yes	31	2.96
	No	1018	97.04
Reduced cost of production			
	Yes	11	1.05
	No	1038	98.95
Increased income from crop or livestock production			
	Yes	4	0.38
	No	1045	99.62
Improved technical capacity			
	Yes	8	0.76
	No	1041	99.24
Better access to information and linkages to the market			
	Yes	9	0.86
	No	1040	99.14
	Total	1049	100.00

Table 12.3A: Descriptive results on the technical competency of DFFs based on the perception of FFS participants

	Technical competency of DFF	
	Frequency	Percent
Very low	27	2.57
Low	32	3.05
Moderate	70	6.67
High	23	2.19
Very High	13	1.24
Not aware DFF exists	884	84.27
Total	1049	100.00

Table 12.4A: Descriptive results on Community Animal Health Workers (CAWH)

	Support from a Community Animal Health Workers (CAWH)		Total
	Frequency	Percent	
Control	917	20	937
Treated	1022	27	1049
Total	1939	47	1986

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