POLICY NOTE 6 • OCTOBER 2014

MOZAMBIQUE
Strategy Support Program

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE
IFPRI
A member of the CGIAR Consortium

LESSONS FROM AN AGRICULTURAL EXTENSION EXPERIMENT IN MOZAMBIQUE: INSIGHTS ON TEACHING MODALITIES AND GENDER REPRESENTATION IN EXTENSION AND ON PRODUCTIVITY MEASUREMENT

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Summary of three research papers:

1) **Kondylis, F., V. Mueller, and S. Zhu. 2014. *Seeing is believing: Evidence from an extension network experiment*. World Bank Policy Research Working Paper 7000. Washington, DC: World Bank.**

2) **Kondylis, F., V. Mueller, G. Sheriff, and S. Zhu. 2014. *Policy experiment in Mozambique highlights importance of gender in dissemination of sustainable land management techniques*. IFPRI Mozambique Strategy Support Program Working Paper 7. Washington, DC: IFPRI.**

3) **Kondylis, F., V. Mueller, and S. Zhu. Forthcoming. *Measuring agricultural knowledge and adoption*. Agricultural Economics. (article developed from report published as World Bank Policy Research Working Paper 7058).**

Over the last seven years, the government of Mozambique has invested in rebuilding the agricultural extension network in the Zambezi valley, an area with high agricultural potential. These investments were in the form of increasing the supply of extension agents, providing them with housing, and building their capacity through training, among others. Our research team took advantage of this project to set up an experiment to rigorously examine the limitations in a ubiquitously practiced extension model, the Training and Visit model, and the importance of gender representation in extension to reach female farmers. In doing so, we also developed survey instruments to improve measures of agricultural productivity.

TRAINING AND VISIT MODEL

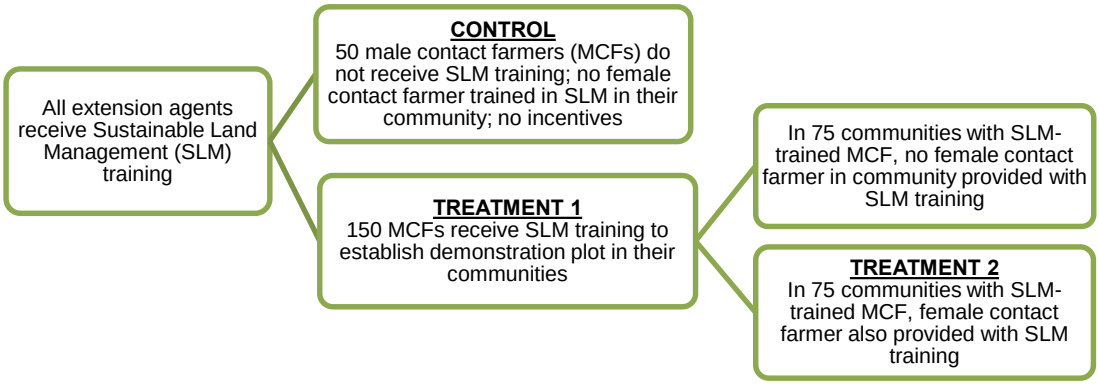
The Training and Visit (T&V) model was developed to increase the quality and coverage of agricultural extension services in the context of limited resources. Contact farmers (CFs) are selected by the farming community to serve as points-of-contact between the extension agents (EA) and the other farmers in the community. The CFs receive periodic trainings and other resources provided by the EA. Quality of extension services is guaranteed through monthly trainings of EAs and requiring EAs to visit all of the CFs in the extension area for which they are responsible twice a month. Globally, both tasks under the T&V model have proved to be financially unsustainable (Gautam, 2000; Anderson and Feder, 2004). Extension coverage remains constrained by the distances needed to reach isolated communities. Moreover, the diffusion of information to other members of the community hinges on the CFs' accessibility and their willingness to share knowledge with others.

The National Plan for Agricultural Extension (PRONEA 2007-2014) and the Extension Master Plan (2007-2016) of the government of Mozambique (GoM) aim to expand the T&V model to increase the access to extension services of specific target groups (women and marginal farmers) and enhance partnerships with the private sector and NGOs (Ministry of Agriculture, 2007). We took advantage of an existing GoM project to examine several potential limitations of the T&V model. The first limitation is that EAs may not reach CFs in isolated communities because of time and resource constraints. Without a clear mandate of which activities to perform, the second limitation is that EAs provide too little information or information of poor quality. The final limitation is that the information may not reach other farmers in the community especially targeted groups (e.g., women).

DOES PROVIDING SCHEDULED, DIRECT TRAINING TO CFS IMPROVE OUTCOMES?

We examine whether the T&V extension model, which relies on the EAs to conduct trainings during their community visits, is as effective in getting CFs to learn and adopt new technologies as a scheduled, direct training program in a centralized location coordinated with the Ministry of Agriculture and other project staff.

Figure 1—Multi-arm design of the experiment to examine the importance of gender in dissemination of sustainable land management techniques



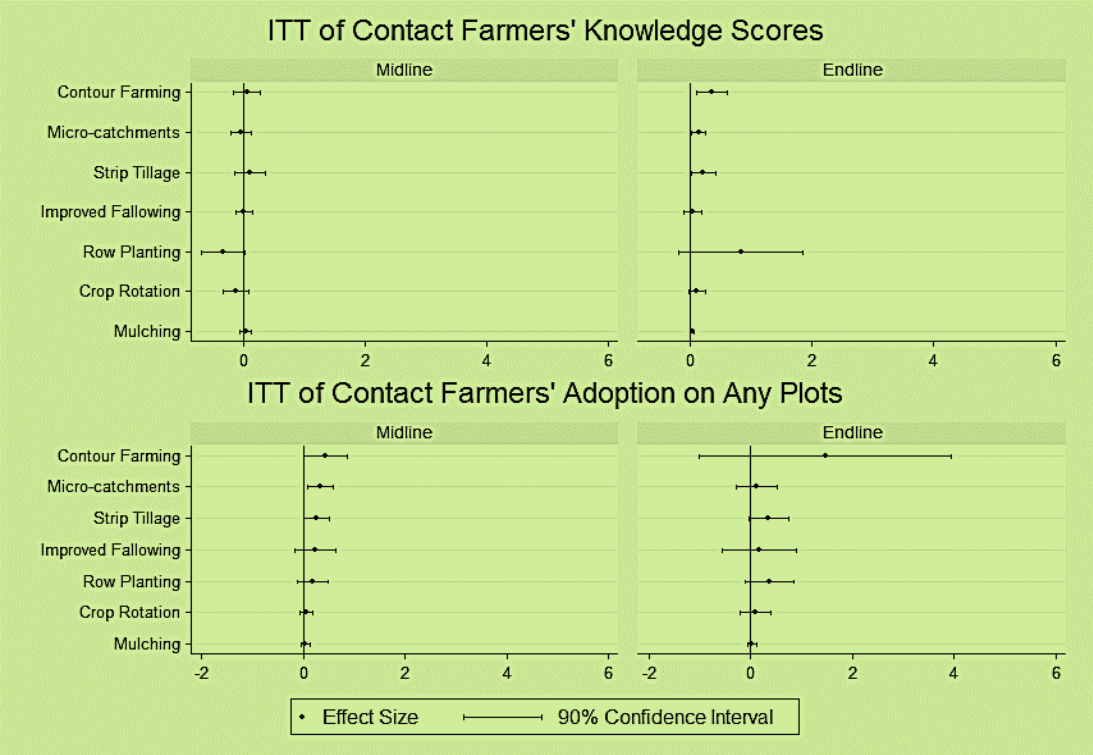
In collaboration with the government, our research team designed an experiment that trained a random subset of existing male CFs from communities in five districts in the Zambezi valley: Mutarara, Maringue, Chemba, Mopeia, and Morrumbala. Figure 1 depicts the multi-arm treatment design of the experiment. All of the communities had incumbent male CFs, from which 150 were randomly selected into Treatment 1 and 50 into the control group (no training).

In 2010 and 2012, all EAs for the five study districts received technical training on eight Sustainable Land Management (SLM) practices: mulching, crop rotation, strip tillage, micro-catchments, contour farming, row planting, improved fallowing, and intercropping. The second training in 2012 was a refresher course, during which the field demonstrations concentrated on mulching and contour farming. For each training, EAs and project staff coordinated a centralized workshop to which CFs selected into treatment 1 were invited to attend. The workshop lasted three days and was split evenly between in-class lectures and field demonstrations. Access to extension agents and infrastructure was otherwise the same between treatment and control communities. All CFs, whether trained in SLM techniques or untrained, received assistance and a toolkit to maintain a demonstration plot.

To examine the impact of the training on CFs relative to the status quo T&V model, we collected two household panel survey rounds in 2012 and 2013 (15 and 27 months after the first training) in the experimental areas. The main outcomes of interest to measure the impact of the training were SLM-related knowledge and adoption outcomes. *Knowledge* of a particular technique is represented as a binary variable based on the CF's ability to answer at least one of three questions pertaining to a given SLM technique on the exam correctly. *Adoption* binary outcomes were based on whether the farmer reported practicing a given technique on at least one of his plots.

Figure 2 graphs the relative effect sizes of the treatment (the regression-adjusted average difference in the outcomes relative to the mean of the control group) on the knowledge and adoption of seven SLM techniques. The bottom left graph of Figure 2 shows that directly training CFs increased the adoption of contour farming, micro-catchments, and strip tillage in 2012 by the time of the midline survey, while the upper right graph shows that the training increased retention of knowledge of the same techniques in 2013 at the time of the endline survey. Although formal training on its own did not appear to lift any knowledge constraint among relatively skilled CFs at the outset (upper left graph), it increased adoption (lower left graph) through adding salience to the techniques among EAs. The fact that adoption and knowledge rates increase in response to the intervention indicates a weakness of the T&V model: EAs are not as effective in getting CFs to devote time to adopting new activities as to participating in direct training. More details of this study can be found in Kondylis, Mueller, and Zhu (2014).

Figure 2—Intent-to-Treat (ITT) Estimates of the Impact of the SLM Training on Contact Farmers' Outcomes



Source: Kondylis, Mueller, and Zhu (2014)

DOES THE GENDER OF THE CONTACT FARMER AFFECT INFORMATION SHARING TO OTHER COMMUNITY MEMBERS?

As mentioned, one criticism of the standard T&V approach is that the information received by CFs may not be spread to other farmers in the community. One possible reason for the lack of information sharing may be because the CFs receive irrelevant or poor quality information. We established that this was not the case by virtue of the observation that the knowledge and adoption of SLM by CFs increased in response to the modified training model. Therefore, we next hypothesized that the degree to which other farmers in the community are affected by the intervention is due to the degree of their exposure to a more well-informed CF.

Although a substantive portion of households are female-headed (30 percent) and women in male-headed households are responsible for farming their own plots in the region, anecdotal evidence suggests that there are strong barriers for women to receive information from other men due to social norms. We therefore designed a second treatment arm to understand the extent other farmers were affected by the intervention and how sensitive the impacts were to the gender of the CF. In particular, of the 150 Treatment 1 communities, 75 were randomly selected into Treatment 2, in which the community selected a female farmer to receive the same training as the male CF (Figure 1). We tested two hypotheses regarding how well information is disseminated to others and the role of CF gender in this process:

1. Training one male CF does not increase the probability that (a) female or (b) male farmers receive information.
2. Training a second female CF does not increase the probability that (a) female or (b) male farmers receive information.

The first set of hypotheses addresses whether simply training a male CF improves access of any farmers to SLM information and whether any increase in information dissemination has a gender bias. The second set of hypotheses addresses the question of whether adding a female CF further improves dissemination and whether this effect serves to counteract gender bias. We draw on the household surveys collected in 2012 and 2013 to test these hypotheses, whereby approximately 3,600 households (excluding CF households) were sampled.

Table 1—ITT effects of gender of trained contact farmer on farmer outcomes

	Sex of farmer	Control mean	2012 β_1	2012 $\beta_1+\beta_2$	N	Adj. R2	Control Mean	2013 β_1	2013 $\beta_1+\beta_2$	N	Adj. R2
Awareness	Female	0.139	0.052	0.089***	3,423	0.015	0.172	-0.005	0.039	2,951	0.006
			(0.034)	(0.034)				(0.038)	(0.034)		
	Male	0.163	0.106**	0.106***	2,461	0.014	0.221	-0.009	0.013	2,120	0.003
			(0.042)	(0.039)				(0.049)	(0.044)		
Knowledge	Female	0.253	0.031	0.082**	3,423	0.008	0.377	-0.024	0.012	2,951	0.004
			(0.040)	(0.039)				(0.046)	(0.042)		
	Male	0.275	0.063	0.102**	2,461	0.016	0.396	0.008	0.029	2,120	0.008
			(0.043)	(0.043)				(0.045)	(0.046)		
Adoption	Female	0.041	0.019	0.027	3,423	0.003	0.084	0.035	0.047*	2,951	0.005
			(0.020)	(0.020)				(0.029)	(0.025)		
	Male	0.039	0.064***	0.049**	2,461	0.010	0.139	-0.002	0.004	2,120	0.001
			(0.023)	(0.022)				(0.034)	(0.031)		

Source: Kondylis et al. (2014)

Notes: Controls include a constant; age; indicators of primary school completion, single marital status, widowed, district, and treatment 3 status; number of children; total landholding size; and number of rooms in house. *** p<0.01, ** p<0.05, * p<0.10. Hypothesis tests for $\beta_1+\beta_2$ based on F statistics.

We estimate the intent-to-treat (ITT) effect of having a trained male messenger in 150 communities (M) and the effect of having a trained female messenger in 75 of the 150 treated communities (F) on outcome *y* for individual *i* using the following linear probability model:

$$y_i = \beta_0 + \beta_1 M_i + \beta_2 F_i + \beta_3 x_i + \varepsilon_i$$

To improve precision of estimated treatment coefficients, the vector *x* includes characteristics of individuals (age, completion of primary school, marital status), their households (number of children, total landholdings, number of rooms in the house), and indicators for their district and whether they were in a third treatment group. We cluster standard errors by community.

All tables present ITT estimates of β_1, and $\beta_1+\beta_2$ with standard errors. The ITT estimate of β_1 represents the change in the probability of a positive response for the dependent variable resulting from a single trained male messenger (Treatment 1), while $\beta_1+\beta_2$ represents the change in probability resulting from having both a trained male and trained female messenger (Treatment 2). All changes are relative to the control, a single untrained male messenger.

Table 1 shows the results of the treatments on three indicators: awareness of the existence of micro-catchments as an SLM technique, knowledge of how micro-catchments work, and adoption of micro-catchments. For all three outcomes, we cannot reject the hypothesis that the presence of a trained male CF does not increase information dissemination to female farmers. In contrast, this hypothesis is rejected for the awareness and adoption indicators for male farmers in the 2012 survey, who experience 10.6 and 6.4 percent point increases, respectively (*P*=0.012; *P*=0.006). These results suggest that female farmers suffer from a gender bias in information dissemination by lone trained male CFs in their communities. Furthermore, the awareness of micro-catchments increases for women in the presence of two CFs by 8.9 percentage points (*P*=0.010) in the 2012 survey, allowing us to reject the second hypothesis that having trained male and female CFs does not increase female farmer awareness. We can only reject the hypothesis that two CFs do not increase female adoption rates in 2013. In that year, adoption rates increase by 4.7 percentage points in the presence of both CFs (*P*=0.059).

To summarize the results of this study on the role of gender of the CF in agricultural extension, the provision of training in SLM practices to male CFs improved the quality of information on new agricultural technologies to the community. This suggests that the flow of information from CF to farmer, in some sense, is related to having a well-informed CF in the community. However, only male farmers were receptive to the information provided by these CFs. In contrast, female farmers were more likely to learn about micro-catchments in communities exposed to female CFs

ARE THERE COST-EFFECTIVE SURVEY INSTRUMENTS TO IMPROVE MEASURES OF SLM KNOWLEDGE AND ADOPTION?

In a third manuscript developed from this research, we exploited the 2012 household survey to examine how the collection of objective measures of SLM knowledge and adoption improved the precision of outcomes, and how cost-effective the survey instruments were to implement in the field. To demonstrate the incidence of false reporting in knowledge measures, we compared outcomes obtained from an objective knowledge exam relative to self-reported awareness and learning outcomes. We replicated the analysis for SLM adoption measures comparing objective measures of adoption measured on field plots by trained enumerators to standard self-reported measures of adoption.

We find that men are more susceptible to recall bias for knowledge outcomes. Thus, implementing a simple knowledge exam is a relatively cost-effective way of improving agricultural knowledge measures on surveys. Costlier objective adoption measures are recommended in areas with heterogeneous farm sizes since farm size was associated with poor quality responses.

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This Policy Note has been prepared as an output of the Mozambique Strategy Support Program (MozSSP) of IFPRI, which is facilitated through funding from the United States Agency for International Development (USAID) mission in Mozambique, and has not been peer reviewed. Any opinions stated herein are those of the author(s) and do not necessarily reflect the opinions of IFPRI or USAID/Mozambique.

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