ORIGINAL ARTICLE

Do private consultants promote savings and investments in rural Mozambique?

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Abstract

Advice from managementprofessionals can help small- and medium-sized firms reach complex financial goals in low- and middle-income countries. We apply lessons learned in the firm literature to determine the degree in which farmer associations face constraints to management and planning capacity that can be alleviated by the provision of advice from external consultants. In particular, we conducted a randomized control trial in 42 water user associations (WUAs) in Mozambique to examine whether more intensive attention from financial consultants through repeated follow-up visits prompts households to save and invest in agricultural equipment. All WUAs received a financial literacy training and were eligible to receive a matching grant. Twenty-one WUAs were randomized into the treatment group that additionally were visited by private consultants quarterly, who tailored their advice to meet individuals' own savings and investment objectives. We find the follow-up visits increase 'hidden savings' in the form of new capital investments on farmers' own account. Thus, the visits may have changed savings' habits by leading farmers to invest in technologies that were not directly subsidized. Our ability to detect an additional effect on the type of investments farmers targeted through the matching grant and, hence, the savings for the respective investments is limited given the power of our study design. Although the proportion of households saving increased, the intervention was likely less cost-effective than other modalities aimed to enhance the proclivity to save.

KEYWORDS
agriculture, financial literacy, investment, matching grant, Mozambique, savings

JEL CLASSIFICATION
D14, O13

1 | INTRODUCTION

Promotion of economic growth in Africa will rely on a combination of interventions that bolster within-sector productivity and structural change (Diao et al., 2019; McMillan et al., 2016). As the agricultural sector remains a primary employer of African workers (Filmer & Fox, 2014; Mueller et al., 2019), enhancing profitability through

the diffusion of new technologies as well as the dissemination of best farming and management practices is crucial (Otsuka & Muraoka, 2017). An emerging literature has begun to examine how extension programs may be modified to increase technological adoption in the region (Beaman et al., 2021; BenYishay & Mobarak, 2019; Kondylis et al., 2017). Public provision of training and the necessary equipment to implement new techniques is often restricted to key members of the community to keep program costs low. Program efficacy, thus, hinges on the ability of the few beneficiaries to convince others that the benefits warrant the costs of the new technology through demonstration of their own success. The continuation of customary farming in these settings suggests that information is unlikely the sole deterrent to modernizing agriculture (Kondylis et al., 2017; Magnan et al., 2015).

Professional management advice can help small- and medium-sized firms achieve complex financial goals in low- and middle-income countries (LMICs) (see McKenzie & Woodruff, 2014, for review). Managers are often unaware of the specific practices that can be adopted to improve productivity (Drexler et al., 2014), or require evidence that current practices may inhibit returns (Bloom et al., 2013; Hanna et al., 2014). Managers also focus on daily operations rather than develop long-term goals for the future (Bruhn et al., 2018). The myopic vision, in part, is driven by constraints on managerial capital. Managers with low human capital may require simple rules of thumb to update operational activities, such as accounting protocols (Drexler et al., 2014). Additionally, firm owners often entrust family members to manage their businesses, who must allocate their time over several competing activities (Bloom et al., 2013; Valdivia, 2015).

We apply lessons learned from the firm literature to test whether farmers are receptive to advice from private consultants. In particular, we conducted a randomized control trial (RCT) in 42 water user associations (WUAs) in Mozambique to examine whether more intensive attention from financial consultants, through repeated follow-up visits to assess progress and update collective savings plans, prompts households to save and invest in agricultural equipment. Twenty-one WUAs each were randomized into the treatment and control groups. In both groups, we provided a financial literacy training.[1] Farmers were taught how to calculate profits generated from sales and translate those earnings into tailored savings plans over a time horizon. At the financial literacy trainings, farmers were additionally incentivized in both groups to save

by showcasing the agricultural equipment available for purchase through a matching grant program offered by the Ministry of Agriculture.[2] The matching grant program served to relieve the financial barriers to investment. Farmers in all WUAs were eligible to submit a proposal of items they were interested in buying. The government would effectively subsidize 85% of the equipment costs, once the individuals raised 15% of the funds required for the proposal. Given the high matching rate, the gains to successfully meeting the fixed costs are potentially high if farmers can overcome the coordination and planning challenges associated with raising the fixed matching contribution over a long time horizon in a stochastic environment. Individual savings plans were designed to ensure the individual or group proposal objectives were met in order to attain the award.

The goal of the RCT was to test the effectiveness of having financial consultants continue to visit the treated WUAs. The follow-up visits aimed to solve two inherent constraints to savings formalized in the literature. First, individuals who discount future utility may be more inclined to save before time-sensitive expenses through quarterly reminders (Karlan et al., 2014, 2016; Rodriguez & Saavedra, 2019). Second, having the consultants review and update the savings plans on a quarterly basis could refine accounting behavior in the long run (Schaner, 2018). This potentially enhances the saliency of the reminder, which has been deemed more effective than distributing a greater number of reminders (Karlan 2014, 2016). Unfortunately, given the small number of associations affected by the intervention that we can include in the experiment and the likely importance of spillovers of these interventions across members within associations, we were only able to implement a single treatment arm. Therefore, we will be unable to disentangle which of these features was most effective at pressuring farmers to save.

In implementing the RCT, the majority of individuals were inclined to submit group proposals with members from their WUAs. This offers an additional feature to consider when providing advice to farmers. A core hypothesis may be that farmers are unable to anticipate their own and other members' ability to keep up with the savings plan. Consultants potentially solve this additional coordination problem, by ensuring the savings plans of all contributing farmers are revised to meet the group objective. Furthermore, consultants create social penalties for defaulting on one's commitment by announcing individuals' quarterly savings contributions in a public forum (Breza & Chandrasekhar, 2019; Brune et al., 2016; Karlan et al., 2014; Kast

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[1] The purpose of the RCT was not to test the effectiveness of financial literacy programs. In the absence of other interventions, the benefits from these programs have been otherwise mixed, particularly among low-income groups in LMICs (Kaiser & Menkhoff 2017).

[2] Matching grants are commonly administered by extension offices in developing countries as a way of promoting capital accumulation among poor farmers (Mullally & Chakravarty 2018; Mullally & Maffioli 2015).

et al., 2018). Since we did not randomly offer WUAs to submit individual versus group proposals, we are unable to test the effect of this social penalty explicitly.

Our experiment yields interesting insights on the benefits of having consultants provide tailored advice to meet individuals' own savings and investment objectives. The follow-up visits increase 'hidden savings' in the form of new capital investments made by households on their own account separately from the matching grant process. The changed savings habits led farmers to invest in riskier, non-subsidized technologies that were potentially complementary to the inputs being acquired through the matching grant program. We are unable to provide conclusive results on the extent the follow-up visits inclined farmers to collectively save and invest in more expensive equipment through the matching grant program. Although the proportion of households saving increased, the intervention was likely less cost-effective than other modalities aimed to enhance the proclivity to save.

2 | INTERVENTIONS DISTRIBUTED TO ALL WUAS

We conducted an experiment within the broader World Bank-financed PROIRRI Sustainable Irrigation Development Project, which sought to boost smallholder productivity through two main interventions: (1) the rehabilitation and building of irrigation infrastructure, and (2) the provision of cost-sharing grants for investment in machinery and post-harvest activities. The project supported the rehabilitation and development of 2,588 hectares of irrigated farmland in three central provinces of Mozambique: Manica, Sofala and Zambézia. The project focused on medium-scale rice irrigation schemes (100 to 200 ha) and small-scale irrigated horticulture (15 to 100 ha), some of which were covered under outgrower arrangements with wholesalers who provided inputs and purchased crops. All activities described in this paper are undertaken among farmers who are members of WUAs sharing the management of this infrastructure.[3] The focus of the evaluation is the components related to investments in machinery and post-harvest activities through matching grants.

There were several interventions given to farmers in the WUAs under the PROIRRI project. The timing of all activities and data collection described in this section are summarized in Table 1. In what follows, we briefly discuss each intervention that was distributed to both the control and treated WUAs (Figure A1).

2.1 | Matching grants

The matching grant offered during our study period could be used to purchase durable agricultural equipment with larger fixed costs such as tractors, multi-cultivators, and post-harvest equipment. Since these items can be shared by multiple farmers or households, the members of the associations were encouraged to apply together, and the subsidy rate was generous. To receive this grant, an association was required to make a 15% co-payment of the market value of the items in the proposed grant with the remaining 85% covered by the project. Each piece of equipment has a maximum co-payment from PROIRRI of the Mozambican Metical equivalent of USD 10,000. Associations would be allowed to benefit from the matching grant twice over the course of the program.

2.2 | Financial education

Prior to the financial literacy training in early 2017, participating farmer associations had predominantly opted to apply for individual input packages of seeds and fertilizer, rather than equipment investments.[4] This motivated discussions on the constraints that farmer associations were facing to overcome collective action problems associated with the equipment matching grant. In an attempt to catalyze applications for shared grants for larger equipment, the members of all WUAs were invited in February and March 2017 to a 2-day financial literacy training course (held by consultants of Ernst and Young) that would take place at the meeting facilities at the association or in a nearby community (Table 1).[5] The training covered topics such as money management, credit management, cash-flow decisions, financial literacy, management skills, and farming input/output production accounting. The training was conducted by a private consulting firm with materials tailored to smallholder farmers with market opportunities. A training session was limited to 35–40 members.[6]

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[3] All treatment and control WUAs were formal agricultural associations registered with the government prior to the project establishment. The associations were shortlisted by the project to receive irrigation infrastructure either to improve their current irrigation system or install a new irrigation system in the case there was none. Those that received the irrigation infrastructure received project support to strengthen the functioning of the WUA, with each governance structure adapted to the circumstances of the WUA.

[4] We do not study this matching grant in this paper, which focuses on the collective savings features of the association level grants.

[5] The training was initially planned to take place in early 2016, however civil conflict in the project area delayed the events until February-March 2017.

[6] Each training session would accommodate 35-40 people. Assuming not all members would participate, associations with up to 80 members

TABLE 1 Timeline

	Interventions	Assignment	Data collection
February-March 2017	Financial literacy trainings	T&C	Association census, base-line survey and saving plans
May 2017			Admin. savings data
June 2017	Follow-up visit 1	T	
August 2017			Admin. savings data
September 2017	Follow-up visit 2	T	
November 2017			Admin. savings data
December 2017	Follow-up visit 3	T	
April 2018			Admin. savings data
May 2018	Final support visit	T&C	Association endline survey
June-August 2018			Household endline survey
July-October 2018	Applications received and processed	T&C	
November 2018			Project admin. data received

Notes: T = Treatment; C = Control; Admin. = Administrative.
All data collected in control and treatment WUAs.

2.3 | Investment proposal and savings plan

On the final day of the training, the participating association members developed a savings plan for an individual or group investment. The groups were guided by the consultants on investments that the group could achieve through the PROIRRI matching grant. The investment proposals consist of equipment items (e.g., farm machinery, materials for constructing a greenhouse) and value chain development activities (e.g., product processing, storage, marketing, transportation) eligible for subsidization through the matching grant program. The intended value of the savings proposed by the association did not differ across treatment and control WUAs (Table A1).[7]

Figure A2 illustrates the popular items acquired through the matching grant proposal: land preparation equipment, cattle, a tractor, tools for crop cultivation, post-harvest equipment, transportation equipment, and seeding equipment. The majority of associations were interested in acquiring animal traction: 73% of the associations were saving to purchase cattle, while 88% were saving to access machinery for land preparation, such as an animal cart. Fewer associations expressed an intention to save for

expensive items like a tractor (23%) or equipment to transport goods (15%).[8] Associations were often purchasing a bundle of these items. The most common bundles consisted of cattle and land preparation equipment (69%).

Individual members could choose to participate (or not) in the saving for any specific type of equipment. Association members that did not attend the training could also be part of the savings group.[9] The participants jointly developed a savings plan for their proposed investment. The plan specified contributions at the individual level and a monthly timeline of contributions from February 2017 to March 2018, taking into account the periods farmers typically have more cash at hand.

Each savings group was provided with a ledger and a receipt book to record each contribution from each member. Two appointed leaders (e.g., treasurer, lead farmer, producer organization head, or someone chosen by the association) were trained in financial planning and bookkeeping to keep track of the savings contributions. Receipts were given to the association member for each

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would receive one training, 80 to 120 members would receive two training sessions, and those with more than 120 members would receive three training sessions. The participants in each training session formed a savings group, meaning that in associations with more than 80 members there were typically multiple savings groups from the same association.

[7] Among those associations that had multiple trainings due to size, there is no variation in the savings plan investments. Although the savings plans were prepared initially in separate trainings, they were coordinated and led by the same treasurer in those associations and therefore were made to be identical.

[8] Concerns over the use rights of the communal items may justifiably affect contributions. A limitation of our analysis is that we are unable to explore the extent these arrangements affect the efficacy of the intervention due to a lack of information surrounding these conditions.

[9] Although only 1,214 out of the 3,081 farmers in the association census were at the training, 2,739 members have saving plans. The farmers who were absent from the training were added at the start when the plans were being formulated. The remaining 342 households did not possess a savings target. This did not limit their participation in a plan, since 94 of these households offered savings contributions even without the savings target. Our analytical sample includes all 3,081 farmers. Missing a savings target is not correlated with treatment nor are the intent-to-treat estimates on the savings' contributions sensitive to the exclusion of the sample of households missing a savings target.

contribution after being authenticated (stamped) by the treasurer, who also retained a copy in a treasury box.

Treasurers were responsible for the safe keeping of the group contributions. At the time of the training, only 46% of associations had a formal bank account (with 35% having made a deposit in the prior 12 months). Therefore, contributions were often stored under informal arrangements, such as being stored in the treasury box – itself in the house of the treasurer or association head, or other unsecured locations. Farmers were able to withdraw contributions if they desired. Due to the informal arrangements often employed at the association and household level, we are unable to monitor several dynamics effectively, such as withdrawals of previously made deposits and cases where members preferred to save themselves and make a one-off payment outside of the monitoring period.

Applications were received by the project from May 2018 to September 2018, with subsequent processing and approval ensuring that successful associations received equipment before November 2018 (Table 1). Administrative procedures to apply for the matching grant were relatively complex, with farmer associations requiring support with paperwork from the project service providers, extension agents or private sector partners. Matching grant applications are written proposals on behalf of the association that justifies the advantages of the equipment, provides three quotations from suppliers, and lists the association members that will benefit. Once a proposal has been submitted and approved centrally by the project, the association deposits the 15% co-payment with the chosen supplier and sends the receipt to the project, which then transfers the remaining 85%.

2.4 | Final support visit

The final support visit took place in all WUAs in May 2018 (Table 1). At this visit, the consultants presented the status of planned individual contributions and the level of attainment to the overall savings target in each association, as well as reviewed the procedures to apply for the matching grant in each community. During this final visit, the consultants worked with the associations and provincial project teams to ensure that those who had saved the target values would have the necessary support to make the application for the desired equipment.

3 | INTERVENTIONS DISTRIBUTED ONLY TO TREATED WUAS

There are several operational programs within the World Bank and elsewhere, which, like the PROIRRI project,

provide a wide range of resources to bolster agricultural productivity. Many programs feature financial literacy training (Kaiser & Menkhoff, 2017), business development services (Anderson & Feder, 2004), and formalized savings through the opening of bank accounts (Brune et al., 2016). However, banking institutions remain readily inaccessible to remote communities (Table 1) and the lack of savings behavior continues to pose a significant barrier to technological adoption (Carter et al., 2016). We therefore test whether providing consultant advice on a quarterly basis encourages farmers to save. The rationale for incorporating private consultants is to improve the mental accounting of farmers and generate savings habit formation through the process of revising individual savings' plans.

To test the effectiveness of the follow-up visits, we randomly assigned 21 of the 42 associations in the PROIRRI project to the treatment group.[10] The purpose of these visits was to review the individuals' savings plans, mediate a discussion of challenges faced, and facilitate a process of readjusting the savings plan to meet the final objective by a certain timeline (Table 1).

The consultant revealed a list of each members' intended and actual contributions in a prominent location for all members to observe. Based on the status of the savings, groups were encouraged to review their savings plan and make changes to the group and individual planned contributions. This could include changing the date of expected contributions, if some payments were missed; changing the equipment that the group was saving for, if the total value appeared unobtainable or new preferences emerged; or dropping or adding members and updating expected contribution values. The consultants also reinforced knowledge about the procedures for applying for the matching grant and troubleshooted any other difficulties shared by the group, such as the deposit accounting system.[11]

4 | DATA

We collected several sources of data to assess the impact of the follow-up visits on farmers' saving behavior and

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[10] Pre-specification of primary outcome variables was filed in a trial registration in the AEA RCT Registry (Christian et al., 2015). Project funding was only available to rehabilitate the irrigation systems of 40 associations (of the original 95). We include all of these associations in our study. After randomization, 1 association was removed and 3 were split for administrative reasons, resulting in 21 treatment associations and 21 control associations, all of whom complied with their original assignment.

[11] In the larger associations, follow-up visits were held at the association level in spite of spreading the initial training over more than one savings group. The savings plans were combined by the treasurer, as the goods they all wanted and applied for were the same.

final outcomes. During the financial literacy training, we gathered an association-level baseline and member census, and, throughout the year, quarterly savings data for individual members. We further administered an endline survey of households just before the closing of the PROIRRI project and draw on administrative data from the project on the matching grant applications. These various sources of information allow us to track progress and final outcomes – both at the association and household level.[12]

4.1 | Association census and baseline data

Basic association characteristics and a census of association members were compiled by the president and treasurer in each of the 42 associations during the financial literacy training sessions. This first phase of data collection took place in February and March 2017. The association baseline collects data on irrigated and communal land, main cultivated crops, whether the association participated in any previous financial literacy or agricultural practice training, whether the associations applied to (and received) any other PROIRRI matching grants before the financial literacy program, access to formal banks, membership fee system (if any), and presence of equipment and infrastructure.

The member census includes the names and gender of all members, regardless of participation in the training ($N = 3,081$). Basic socio-economic data such as age, education, household size, as well as individual information on irrigated and rainfed irrigated land, were collected among members who attended the training ($N = 1,214$).

4.2 | Savings plan and individual contributions

During the financial literacy training each group developed a savings plan. The savings plan records which members of the association expect to participate, the total investment values, and the intended contribution for each member in each month. The objective of each savings plan was to raise the full value contributions within 13 months, therefore they ran from February 2017 to February 2018.[13]

Saving targets were recorded also for members who were not present at the training sessions, but were nominated by the training group led by the treasurer or president. A total of 2,739 members were included in the savings plans.[14]

The treasurer provided a receipt to the farmer for each contribution made at the time of contribution. A copy of the receipt was then deposited in a lock box. Individual contributions were then also recorded by the treasurer in a ledger provided by the research team. The receipts and ledger recorded the ID of the contributing association member, the contribution value, the day and month of the contribution – with each entry being auto-assigned a unique deposit ID.[15]

The data from the receipts and the ledger were reconciled during the quarterly collection of the administrative savings data in both treatment and control communities.[16] During each visit, a short survey was given to the association treasurer and president about the development of the matching grant application. The treated associations also answered questions about discussions and activities performed during the previous follow-up visit by the consultant. These quarterly data collection visits (May 2017, August 2017, December 2017, and April 2018) took place in both treatment and control associations and were separate from the revisits undertaken by the consultants to review plans. The data collectors were from a different firm than the consultants responsible for conducting the progress review meetings.

The contribution data was submitted to the research team following each visit, which allowed us to prepare the materials for the follow-up visits in the treated

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[12] Descriptive statistics on the outcomes used in the main text of the paper are provided in Table A2.

[13] The project desired all applications for processing by March 2018, ensuring time for equipment acquisition before the project closed in June 2018. Subsequently, the project was granted an extension to December 2018 in order to finalize the completion of the last irrigation schemes, granting the associations more time to submit proposals. The justification for the extension was unrelated to the matching grant program.

[14] As a result, some of the members may not have been aware of contributions planned on their behalf for the following quarters. In the robustness section, we restrict the analysis to the households who participated in the training to confirm whether attendance played a role in the final saving decision.

[15] A SMS system was also established to register contributions in real time so that the project could continuously monitor group progress towards their savings target without field visits. Unfortunately, poor mobile network coverage, low levels of technological literacy, and the bankruptcy of the SMS aggregation provider limited the adoption of this monitoring mechanism.

[16] One limitation of using a savings measure that is based on the administrative data is that we will only observe the amount given to the treasurer of the WUA. This vastly differs from the prevailing measure in the literature which focuses on variations in savings observed in formal bank accounts (Ashraf et al., 2006; Brune et al., 2016; Dupas & Robinson 2013; Dupas et al., 2018; Karlan & Zinman 2018; Karlan et al., 2016; Somville & Vandewalle 2018). In our context, a farmer would have no reason to deposit savings' amounts that exceeded their goal for the matching grant with the treasurer of the association, especially given the rules for withdrawal were idiosyncratic to the association. This suggests that we may potentially underestimate total savings and will need to evaluate the effects of the program on other investments to try to capture savings outside of the jurisdiction of the treasurer.

associations. In treated associations, the quarterly data collection visit was shortly followed by a visit from the financial consultant. During these visits, the consultant records any updates to the saving plans and takes the attendance, which were then submitted to the research team.

A final visit by the financial consultants occurred in each of the 42 associations (treatment and control) in May 2018. The attendance of the meeting was recorded as well as qualitative responses about the application process and likelihood of a matching grant proposal being submitted.

4.3 | Endline survey data

An endline survey was administered to all associations and a sample of households was interviewed ($n = 1,784$) at the end of the savings period between May and August 2018 as part of the final PROIRRI project evaluation survey (Table 1). Because the timing of this survey was determined by the harvest and irrigation construction timelines, it took place before the extended matching grant deadline. As a first step, the membership census recorded during the baseline was updated, with departed members removed and any new members added. Members who were in fact from the same household were also identified and their listing IDs combined to finalize the sampling frame. The household endline sample included all association members that were part of any savings plan, all treasurers and presidents, and a sample of the remaining members.[17] This produced a sample of 2,002 households for the main analysis: 940 treated households (857 on savings plans) and 1,062 control households (897 on savings plans). The sampling process and the distribution of the association sizes in result of randomization resulted in more households to be surveyed in the control group than the treated group. Sample weights are applied to account for these differences in the probability of sampling. Below we test for imbalance on other observable characteristics across data sources.

The household survey contains modules on socio-demographic attributes, asset ownership, labor time, credit

access and investment decisions, plot characteristics, agricultural inputs and outputs on irrigated and non-irrigated plots, livestock, irrigation practices, social networks, and shocks.[18] In the treatment group, we also asked about the activities carried out during the follow-up visits.

4.4 | Project administrative data

Administrative data on the matching grant applications in each association ($N = 42$) were made available by the project team in November 2018. This data shows which associations made an application, the details of the proposed investment, including type of equipment and value, and whether the application adhered to the criteria set by the project and whether financing was granted.

4.5 | Descriptive statistics and balance on observable characteristics

We compare the average attributes of treatment and control associations (Panel A) and their members (Panels B and C) to validate the interpretation of the experimental effects as causal (Table A3). Tests of covariate balance are displayed, using standard t statistics and randomization inference which is robust to assignment of treatment (Athey & Imbens, 2017). Baseline data collected immediately prior to the initial meeting are used to perform covariate balance tests to compare the characteristics of associations (Panel A) and their members (Panel B). The tests based on the t statistics and randomization inference consistently indicate there are four differences between treatment and control associations at the 10% critical level. Treatment associations tend to have fewer members in their organization, less irrigated land, a lower proportion of members with a multi-cultivator, and younger heads of household. Tests using the baseline survey data also indicate that households within treatment associations cultivate more rainfed land.

We further compare the demographic and wealth characteristics of households on average by treatment status using data from the endline survey (Panel C). We draw on variables that are unlikely to change meaningfully over the period between baseline and endline. The results suggest that household heads in treated associations are slightly younger, more educated, and have a greater proportion of durable roofs. Variations in the composition of the

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[17] Within an association, we sampled all members if the association had fewer than 27 members. In larger associations, we sampled all households who participate in matching grant proposals, all presidents and treasurers, everyone who provided a mobile phone number during the initial census (to facilitate possible follow-up by phone), and a random 20% of remaining members. These sampling rules imply that members of small associations, leaders, and those with phones are over-represented in the raw sample relative to the population, so we weight the survey data using inverse probability weights so that reported descriptive statistics and results are representative of the population of association members during the census. The inverse probability weights are constructed from the ratio of members of type j in the population relative to the sample, N_j/n_j, where j is mutually exclusive group defined by variables sampled, farmers groups, members, etc.

[18] The agricultural activities refer to the 12-month period prior to the survey, specifically covering the principal harvest (rainy season, October 2017 - May 2018), and the secondary harvest (dry season, May 2017 - October 2017). All surveys were performed on tablet devices.

TABLE 2 Cumulative impact on household savings

	1st quarter		2nd quarter		3rd quarter		4th quarter	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A – Probability to Save								
Treatment	0.080	0.033	0.155*	0.053	0.188*	0.073	0.293**	0.205*
	(0.053)	(0.048)	(0.086)	(0.069)	(0.098)	(0.076)	(0.111)	(0.117)
Number of observations	3081	3081	3081	3081	3081	3081	3081	3081
Adjusted R-squared	0.021	0.096	0.041	0.233	0.055	0.277	0.115	0.242
Mean dep. var. control group	0.047		0.100		0.111		0.114	
SD dep. var. control group	0.211		0.300		0.314		0.318	
Province fixed effects		X		X		X		X
Panel B – Savings per Household								
Treatment	179	36	485	−229	1101	21	1686*	654
	(174)	(145)	(587)	(500)	(912)	(749)	(979)	(873)
Number of observations	3081	3081	3081	3081	3081	3081	3081	3081
Adjusted R-squared	0.007	0.062	0.007	0.203	0.010	0.125	0.023	0.120
Mean dep. var. control group	138		761		1111		1136	
SD dep. var. control group	738		2496		5440		5455	
Province fixed effects		X		X		X		X

Notes: *Significant at 10%. **Significant at 5%. ***Significant at 1%. Unit of observation: household. Data source: box pick-up data. Values in Panel B are in Mozambican Meticais (1 MZN = 0.016 USD). All regressions are OLS without and with strata (i.e., province) fixed effects. Standard errors clustered at the WUA level in parentheses.

associations may lead us to underestimate the true treatment effect of the intervention, if scheme size, reliance on irrigation, asset ownership, and farmer experience are positively associated with the proclivity to achieve savings objectives. We therefore verify whether the estimated effect of the intervention varies upon the inclusion of association-level and household-level variables in our regression model.

5 | EMPIRICAL STRATEGY

We apply the following regression model to estimate the intent-to-treat (ITT) effect of the aforementioned intervention on savings and investment outcomes Y:

$$Y = \alpha + \delta_p + \beta\, Treatment + \varepsilon. \quad (1)$$

In (1), β is the estimate of the ITT effect, which measures the change in outcomes attributable to the intervention. We provide estimates of the ITT effects from model (1) with and without the province fixed effect δ_p in all tables of results.

We rely on multiple sources of data to demonstrate the effectiveness of the intervention, which allows for the application of (1) using two units of analysis. The first unit of analysis is at the association level. When applying (1) using outcomes at the association level, we report robust

standard errors. The second unit of analysis is at the household level. For regressions using household outcomes, we report standard errors clustered at the association level to account for the correlation of outcomes among members.

6 | RESULTS

6.1 | Household savings and investments

Our results indicate that members of treatment associations were more likely to deposit funds (Table 2). Controlling for province fixed effects, we observe that households increased their proclivity to deposit by 20.5 percentage points in the 4th quarter (Panel A). These figures suggest the rate of depositing funds almost doubled among members in treatment associations relative to control associations. The encouragement of financial consultants however failed to promote a difference in the amount of savings deposited (Panel B).

Thus, the financial literacy and planning support provided by the consultants changed the timing of the savings, but not the achievement of the group's ultimate goal. However, upon learning these results, we hypothesize that changing the timing may still affect investment outcomes for farmers. By meeting their group savings goals earlier, some farmers may find it easier to start making individual-level investments in their own farms, especially if these

investments have complementarities with the equipment they expect to secure through the group matching grant. We, therefore, next evaluate data collected from the end-line survey which monitors household use and ownership of equipment. We concentrate on whether the intervention affected use of mechanization rather than ownership as much of the equipment might have been acquired by the association (rather than the individual) or accessed through rental markets for capital.[19] We concentrate on assets highlighted as important investments for farmers in the initial meeting, as well as other modern inputs.

The estimates displayed in Table 3 show that the additional savings accumulated by members in treatment associations may not have been used to invest in more assets provided by the matching grant program. Instead, the follow-up visits may have changed savings habits within the communities to enable auxiliary investments.[20] Along these lines, members in associations that received the follow-up visits report an increased usage of motor and electric pumps by 4.8 and 7.8 percentage points, respectively. These investments were quite large in relative terms as few households reported using such equipment in the control group.[21]

If farmers are expanding the amount of land under irrigation, we might expect to observe an associated increase in complementary inputs to production. We first evaluate whether use of organic fertilizer, chemical fertilizer and pesticides change among members of the treatment associations at the intensive and extensive margin. The results provided in Table A6 suggest that members continued to apply the same amount of chemicals to their fields. We then evaluate whether farmers were adjusting other inputs to expand production in Table 4. We find a statistically significant ITT effect of the intervention on labor and livestock costs in the treatment group. This suggests that farmers may have used their savings to increase the allocation of labor and animal traction to expand their production. The effect sizes are rather large and similar at 16%.

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[19] Household possession of these items is rare (Table A4). While a fraction of households appears to have at least one component necessary for animal traction, few claimed to own other agricultural assets. Thus, it is less surprising that we fail to observe an ITT effect of the intervention on household asset ownership.

[20] As these outcomes were not part of our pre-specified outcomes in our trial registry, we also provide family-wise adjusted p-values for tests of the significant of the coefficient estimates in brackets using the free step-down procedure of Westfall and Young (1993).

[21] The results in Table A5 demonstrate that we are unable to document any hidden savings used for investments by observing differences in credit behavior. In other words, the intervention had no detectable effect on whether households were more likely to access credit to purchase agricultural inputs, commercial goods, or machinery.

TABLE 3 Impact on mechanization use*

	Cattle		Animal traction		Cart		Tractor		Plough		Motocultivator		Seeder		Trailer		Motorpump		Electric pump	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
Treatment	0.165	−0.037	0.013	−0.063	0.088	−0.021	−0.082	0.092	0.087	−0.008	0.006	0.006	−0.029	−0.013	0.005	0.006	0.045	0.048*	0.075*	0.078**
	(0.137)	(0.031)	(0.082)	(0.043)	(0.083)	(0.030)	(0.141)	(0.077)	(0.062)	(0.028)	(0.005)	(0.006)	(0.019)	(0.012)	(0.004)	(0.005)	(0.028)	(0.026)	(0.043)	(0.038)
	[0.234]	[0.251]	[0.879]	[0.148]	[0.299]	[0.483]	[0.564]	[0.243]	[0.169]	[0.792]	[0.241]	[0.298]	[0.131]	[0.296]	[0.217]	[0.253]	[0.115]	[0.070]	[0.090]	[0.043]
Number of observations	1784	1784	1784	1784	1784	1784	1784	1784	1784	1784	1784	1784	1784	1784	1784	1784	1784	1784	1784	1784
Adjusted R-squared	0.026	0.656	−0.000	0.168	0.009	0.268	0.006	0.290	0.011	0.218	0.002	0.001	0.005	0.023	0.000	−0.001	0.021	0.042	0.050	0.138
Mean dep. var. control group	0.377		0.262		0.242		0.415		0.174		0.002		0.036		0.006		0.007		0.000	
SD dep. var. control group	0.485		0.440		0.428		0.493		0.379		0.043		0.186		0.075		0.081		0.000	
Province fixed effects		X		X		X		X		X		X		X		X		X		X

Notes: *Significant at 10%. **Significant at 5%. ***Significant at 1% using conventional inference (i.e., not adjusting for multiple outcomes). Unit of observation: household. Data are from endline survey. The outcome variables are dummy. All regressions are OLS with sampling weights and strata (i.e., province) fixed effects. Standard errors clustered at the WUA level in parentheses. Family-wise p-values adjusted for the number of outcome variables in the family of mechanization use and ownership, credit, agricultural inputs and costs shown in Tables 3, 4, A4–A6, and estimated using 10,000 bootstraps reported in brackets. *: outcome variables were not specified in the pre-analysis plan.

TABLE 4 Impact on costs*

	Workers		Seeds		Equipment rent		Plot rent		Livestock	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Treatment	966.608	1291.297*	607.315	−329.316	−960.214	551.603	−5.351	4.720	1120.904**	778.377*
	(829.635)	(763.353)	(613.127)	(400.276)	(1150.112)	(601.484)	(8.884)	(8.920)	(515.947)	(420.819)
	[0.251]	[0.098]	[0.328]	[0.415]	[0.409]	[0.364]	[0.550]	[0.600]	[0.036]	[0.072]
Number of observations	1784	1784	1784	1784	1784	1784	1784	1784	1784	1784
Adjusted R-squared	0.001	0.007	0.003	0.095	0.006	0.174	−0.000	0.005	0.007	0.016
Mean dep. var. control group	3157.828		1544.166		3780.885		23.286		696.605	
SD dep. var. control group	8139.644		5353.123		5601.135		193.322		4911.904	
Province fixed effects		X		X		X		X		X

Notes: *Significant at 10%. **Significant at 5%. ***Significant at 1% using conventional inference (i.e., not adjusting for multiple outcomes). Unit of observation: household. Data are from endline survey. Costs are in Mozambican Meticais (1 MZN = 0.016 USD). All regressions are OLS with sampling weights and strata (i.e., province) fixed effects. Standard errors clustered at the WUA level in parentheses. Family-wise p-values adjusted for the number of outcome variables in the family of mechanization use and ownership, credit, agricultural inputs and costs shown in Tables 3, 4, and A4-A6, and estimated using 10,000 bootstraps reported in brackets.

*: outcome variables were not specified in the pre-analysis plan.

TABLE 5 Impact on total scheme cumulative savings

	1st quarter		2nd quarter		3rd quarter		4th quarter	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment	3104	3104	−8705	−8705	7396	7396	36341	36341
	(9574)	(9068)	(35313)	(31098)	(51407)	(45061)	(54269)	(49651)
Number of observations	42	42	42	42	42	42	42	42
Adjusted R-squared	−0.022	0.083	−0.023	0.206	−0.024	0.213	−0.014	0.152
Mean dep. var. control group	13131		72590		106049		108386	
SD dep. var. control group	25074		128108		171242		170013	
Province fixed effects		X		X		X		X

Notes: *Significant at 10%. **Significant at 5%. ***Significant at 1%. Unit of observation: scheme. Data source: box pick-up data. All regressions are OLS without and with strata (i.e., province) fixed effects. Robust standard errors in parentheses.

6.2 | Matching grant applications and group investments

Members of treatment associations together saved approximately 36,000 Meticais more than members of control associations (Table 5). However, our inability to detect a more precise estimate for this somewhat small difference in the average savings across groups (e.g., less than 600 USD) is likely attributable to the design of the study.[22] We additionally use information from the Ministry of Agriculture to document whether the treatment associations were more likely to receive a matching grant or raise funds for more valuable equipment. From the administrative data,

we are unable to detect a statistically significant effect of the follow-up visits on the probability of purchasing equipment listed on the matching grant proposal (Panel A, Table 6). Furthermore, there is no evidence that the follow-up visits themselves inspired associations to target more expensive equipment (Panel B, Table 6).

The lack of difference in the value of equipment purchased combined with the increased propensity to save in the later stages suggests that the treated groups may have been pulling together funds to secure equipment at the later stages rather than accumulating more valuable capital through the matching grant program.[23]

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[22] We reflect more on the power of our study in the conclusion, where we explain the experimental design was created, in part, with the intent of developing a cost-effective program.

[23] The distribution of the association-level cumulative savings suggests that the presence of heterogeneous effects may be increasing the overall variance of the outcome affecting our ability to detect a precise effect (Figure A3). There are significant densities of associations that contribute

TABLE 6 Impact on equipment

	Among all schemes		Among schemes that applied	
	(1)	(2)	(3)	(4)
Panel A – Probability to Get the Equipment				
Treatment	−0.048	−0.048	0.060	0.000
	(0.157)	(0.115)	(0.128)	(0.000)
Number of observations	42	42	26	26
Adjusted R-squared	−0.023	0.457	−0.033	1.000
Mean dep. var. control group	0.571		0.857	
SD dep. var. control group	0.507		0.363	
Province fixed effects		X		X
Panel B – Equipment Value				
Treatment	−314161			−250420
	(284578)			(205163)
Number of observations	26			26
Adjusted R-squared	0.006			0.492
Mean dep. var. control group	914108			
SD dep. var. control group	834935			
Province fixed effects				X

Notes: *Significant at 10%. **Significant at 5%. ***Significant at 1%. Unit of observation: WUA. Data source: project administrative data. Values in Panel B are in Mozambican Meticais (1 MZN = 0.016 USD). All regressions are OLS without and with strata (i.e., province) fixed effects. Robust standard errors in parentheses.

6.3 | Cost-effectiveness analysis

In this section, we provide measures of cost-effectiveness based on three sources of benefits from the follow-up visits. First, there was a greater number of households who reported saving by the fourth quarter in associations that received the follow-up visits. Approximately, 226 additional households, or 21% of the 1,077 treated households surveyed at endline (Table 2), reported saving more due to the follow-up visits. Second, in associations that received the follow-up visits, electric and motor pump usage increased. Applying the ITT estimates in Table 3, we determine that approximately 54 households and 86 households were more likely to adopt motor pumps and electric pumps, respectively. Using our calculation for the total cost of the follow-up visits (7,350 USD)[24], our indicators suggest the program costs 32 USD per additional household to save, 136 USD per additional household to use a motor

pump, and 85 USD per additional household to use an electric pump.

Since the primary analysis plan focused on savings outcomes, we contextualize our savings measure of program efficacy to others in the literature. Financial literacy evaluations often exclude costs (Kaiser & Menkhoff, 2017) and the longevity of firm training programs and the outcomes monitored differ across studies (McKenzie & Woodruff, 2014). In a recent study, Buvinic et al. (2020) examine the impact of a training and mentoring intervention on the proclivity to save among women business owners in Indonesia. The set-up of the intervention was similar in that an initial training session was provided to all participants followed by three separate sessions of mentoring. The total cost of the program was 64,120 USD.[25] The program encouraged 48 more women to save. The cost effectiveness ratio (1,335 USD) is rather high when focusing on savings encouragement, yet the training and mentoring performs relatively well when assessing profit milestones (Buvinic et al., 2020).

The costs of our program are rather high, however, when comparing them to other modalities for achieving savings. Disseminating financial education information and savings reminders via SMS may be more cost-effective than the in-person counseling provided here. In an experiment in Colombia, Rodriguez and Saavedra (2019)

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minimally to the group investment. Farmers perceive accomplishing the joint goal to be low probability. They instead may optimize by shifting away from group investments toward private investments. Low communal participation appears more prevalent in treatment associations than control associations. The figure also reveals that there are treatment associations more likely to contribute savings values at the upper tail of the distribution. In these communities, the strength of social ties may render refining savings goals a worthwhile endeavor.

[24] The average cost of the financial literacy training was 3,800 USD and 2,450 USD per follow-up visit.

[25] The intervention cost 40 USD and there were 1,603 women business owners who received it.

demonstrate that the net present value of their program combining financial education and monthly or semi-monthly reminders amounted to 1 USD per youth and 2 USD per youth, respectively. Studies that take place in Africa continue to test the value of establishing formal banking accounts in person (Brune et al., 2016; Carter et al., 2016; Dupas et al., 2018). Whether these low-cost modalities can be successful in contexts where connectivity is challenging remains an open question.

6.4 | Robustness checks

In this section, we check whether conclusions vary when using an array of alternative outcomes and regression specifications. We first estimate a version of regression (1), which pools the quarterly savings together and estimates the ITT effect of the follow-up visits on the average quarterly savings of the households. The estimates presented in Table A7 corroborate that the follow-up visits increased the frequency of household deposits. The intervention, however, did not render an effect on the average amount households saved each quarter.

We further examine the extent our ability to detect a treatment effect on absolute savings is influenced by outliers inherent in the data. We continue to investigate the ITT effect of the intervention by quarter, but provide results using a dependent variable that is winsorized or trimmed at the 95 % levels (Table A8, Panel A and Panel B). After controlling for province fixed effects, we continue to observe an ITT effect that suggests there are no differences in the savings across treatment and control groups when winsorizing or trimming the savings values at the tails of the savings' distribution.

We then estimate the ITT effect of the follow-up visits on savings outcomes, restricting the sample to households who had at least one member participate in the baseline financial literacy training. The ITT estimates are similar when focusing on the participants of the baseline training (Table A9). We continue to observe positive effects of the treatment on the tendency to save in the fourth quarter and no differences in the cumulative savings across treatment groups in each quarter.

We next provide the ITT estimates for a specification that includes covariates that were imbalanced across treatment and control groups. After accounting for the imbalances across treatment groups, the ITT estimates on the additional deposits made by treatment households (Table A10), as well as worker and livestock costs (Table A11) lose precision. In contrast, the effects on the adoption of motor and electric pumps increase slightly (Table A12).

We finally allow inferences to be based on standard errors robust to small cluster samples (Cameron et al., 2008). Our randomized design exceeds 40 clusters, which is well within the acceptable range for basing inferences on errors clustered at the unit of treatment assignment. However, we validate that our conclusions are not sensitive to the calculation of the standard errors in Table A13.

7 | MECHANISMS

The quarterly meetings held by the consultants caused members in treatment associations to increase the frequency of their deposits to the treasurer. However, we provide compelling evidence that these deposits did not manifest into overall larger effects on the cumulative savings deposited to the association nor increase the total value of investments acquired by the association through the matching grant program. Given that the deposits were more frequent among the treatment association members, it is possible that rather than deposit all of the household savings with the treasurer, members reserved savings to rent equipment to expedite their irrigation access to other parcels. This would largely explain why members of the treatment association appear to have a greater tendency to use motor and electric pumps and why their usage of other inputs complementary to irrigation increased.

In this section, we provide descriptives to rule out other possible mechanisms which may underlie the lack of observed treatment effect on savings. We interpret qualitative results to be suggestive rather than indicative of our observed outcome, since our experimental design lacked additional treatment arms to identify the precise mechanism in which influenced our results.

Our first question was whether the quality of the intervention might have affected how people behaved. As project teams were fixed across provinces, variation in their performance are accounted for implicitly in the province fixed effects in our regression model. We therefore provide additional summary statistics of the activities households in the treatment associations reported to observe throughout the program as an overview of the general quality of the consulting advice (Table A14). Seventy-one percent of the households surveyed at endline knew of the visit from the trainers. Eighty-five percent of the sample attended at least one of the visits by the consultants, and half of the sample attended all visits by the consultants. Almost all households recalled that their savings goals were discussed during the visits. Almost all households found the visits were useful in mobilizing savings and found the trainers from consulting firm to be helpful. Almost all households reported to have trusted the information that the trainer provided to the association and that the government would grant their association with the matching grant if the savings guidelines were met. Thus, there is no descriptive

evidence that the absence of an ITT effect on the amount of savings was deeply rooted in a lack of trust in the consultants or the poor quality in the educational service.

If households are engaging with the consulting service, one outcome we expect to occur in the treatment is that households will revise their savings plans in response to consultants' advice. In treatment communities, 80% of households reported at endline that they had revised their savings plan at some point. We find that the association between treatment and the probability of saving as part of the plan is not differentially higher among people who revised plans as measured by the statistical significance of an interaction between treatment and a dummy for updating the savings plan (Table A15). Households who made larger upward revisions on their savings targets did have higher savings amounts and a higher rate of savings than other treatment association members who made downward revisions, but we cannot separate whether this effect arises from over-optimistic plans from baseline being revised downward or encouragement from consultants leading to better outcomes among those who revised their targets upward.

A second constraint on savings may be related to members' perceptions regarding the potential failure of collective action. According to the household survey, the majority of households in each association were reported to have participated in a group proposal (mean = 89% and median = 92%) and household participation in a group proposal does not vary by treatment (Table A16). Participants may have reduced their savings deposits if the visits and announcements of individual achievements heightened the reality that his/her peers would be unable to achieve the collective goal. We have already demonstrated earlier that there was no ITT effect on the probability of receiving the equipment proposed on the matching grant. Thus, tendencies toward non-cooperative or cooperative strategies within the WUA remain equivalent across treatment groups.

Descriptive statistics suggest that there was little tendency for households not to cooperate within the WUA. During the visits, consultants were meant to display a poster, which ranked the contribution of each person. The highest rank was reserved for the person who made the largest contribution relative to their target and the lowest rank was reserved for the person who made the smallest contribution relative to their target. The gap in value (or value missing from the overall contribution) was also displayed. Figure A4 illustrates that 22 and 15% of households in the endline survey report having heard names of those who did not meet their goal in the meetings and report having seen names of those who did not meet their goal displayed, respectively. Twenty-four percent of the households also report that the missing values of those who

failed to achieve their goal were also displayed. We cannot rule out, however, that the low values in the statistics reported are in result of the social rewarding process not being properly implemented.

To determine whether the penalty might have played a significant role in cooperative behavior in the treatment group, we then estimate (1) adding a variable that represents the proportion of households in an association that reported witnessing one of the penalties in Figure A4 and a variable that interacts the treatment indicator with the penalty variable. We do not include a separate variable for the share of penalties reported in the scheme in (1), as this correlation can only be explored within the treatment group. The estimates indicate that the probability of savings in the final quarter increased among treated associations where social penalties were observed (Table A17). The estimated amount of savings was unaffected by the presence of social penalties in the treatment group. This, at least, qualitatively implies that the execution of social pressure protocols across all treatment associations might have induced the timing of deposits among group participants.

We also estimate the ITT effect of the follow-up visits on the tendency for individuals to contribute had they known other members would reach savings objectives. We focus on responses among households that participated in a group matching grant proposal. The ITT estimate presented in column (6) of Table A16 suggests that people in the treatment group were 9.2 percentage points more likely to contribute had they known other members would reach their savings objectives.

Taken together, these findings suggest that the follow-up visits may have increased the frequency of savings deposits by reminding farmers of what is necessary for the group to win a successful matching grant proposal. Acknowledging the contributions of members in a public forum might have led to increased deposits among the treatment group particularly in the last quarter. However, farmers who might have changed their overall savings habits, reserved additional funds for renting other equipment that would benefit their individual farm rather than encourage larger investments that would benefit the association.

8 | CONCLUSION

This paper reports results from an experiment to test the hypothesis that follow-up visits from professional consultants can help farmers' associations to solve the coordination and anticipation constraints that inhibit them from being able to collectively save. We find that farmers do face challenges in savings. Most farmers, and consequently most groups of farmers, make savings contributions less

consistently and later than originally planned when developing a proposal. Input from professional consultants to revisit and adapt plans, experimentally assigned at the association level, leads to small shifts in savings patterns. Control associations start out saving at similar rates to treated associations. However, by 6–12 months after developing the plans, savings rates are measurably higher in the treated groups, who have received input from consultants to encourage savings and adapt plans as necessary to account for unplanned conditions.

The literature on management training typically finds that management interventions appear to have positive impacts on savings, investment, and business practices for firms. Yet, given the expense of delivering technical trainings, the impacts are often not large enough to be cost-effective or statistically significant in the small sample sizes necessitated by the cost of the interventions (McKenzie, 2021). Our study, like many others in the literature on management interventions, points to the need to improve savings rates using lower cost interventions. Examples of such are standardized curricula or delivery methods that do not depend on in-person instruction.

Exploratory analysis outside of our pre-analysis plan suggests farmers in the treatment groups may have been better able to meet other expenses than control groups. Expenditures on labor, livestock, inputs, and use of irrigation pumps were higher in the treatment groups than in the control. The findings suggest that these may have been outlets for greater spending in treatment groups once savings habits changed.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.