


RESEARCH ARTICLE

Building trust in rural producer organizations: results from a randomized controlled trial

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Trust is considered an important factor for successful collective action in groups of smallholder farmers. A prime example is collective commercialization of agricultural produce through producer organizations. While previous research has focused on trust as an exogenous determinant of participation in groups, this article tests whether trust within existing groups can be improved using a training program. We conduct a cluster-randomized controlled trial in rural Senegal to identify the effects of training members and/or leaders with respect to commercialization on intragroup trust. Our design allows identifying both direct treatment effects of having participated in the training and spillover effects on farmers who did not partake. Looking at different measures of trust in leaders' competence and motives and of trust in members, we find that participating in the training significantly enhances both trust in leaders and trust in members. For trust in leaders, we also find a strong spillover effect. Our findings suggest that relatively soft and noncostly interventions such as group training appear to positively affect trust within producer organizations.

Keywords: rural producer organizations; Senegal; trust

JEL: D71; O12; Q13

Introduction

In many African countries, smallholder farmers belong to the poorest parts of society. They often have low incomes and face volatile prices for their goods. Their situation is likely to worsen with ongoing climate change as volatility of production and prices is likely to increase. Improving their position in the market, therefore, is a question not only of efficiency but also of equity. Rural Producer Organizations (RPOs), such as cooperatives, associations, and societies, with elected leaders (The World Bank 2008, p. 154) can provide smallholders in developing countries with better access to input and output markets (Rondot and Collion 2001; The World Bank 2008; Markelova

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et al. 2009). Acting collectively within RPOs is often seen as an effective means to reduce transactions costs, to gain bargaining power, to obtain necessary market information, and to get access to new technologies and high value markets (Stockbridge, Dorward, and Kydd 2003; Devaux et al. 2009; Poulton, Dorward, and Kydd 2010). While examples of successful collective action exist, such as coffee production, grading, and export in Ethiopia (Kodama 2007), green bean exports in Kenya (Narrod et al. 2009), and cotton production and exports in Mali (Tefft 2004), many RPOs in developing countries struggle to offer the type of services that would lead to higher output prices for their members (Fafchamps and Hill 2005; Bernard et al. 2008; Markelova et al. 2009; Bernard et al. 2010). Instead of commercializing their produce collectively, smallholders frequently opt for selling it individually to traders at the farmgate (Fafchamps and Hill 2005).

Trust is an important factor at this point, and its relationship with participation in smallholder farmer groups has been investigated before (Fischer and Qaim 2014). Whether collective commercialization takes place or not depends on the ability to coordinate which is correlated with the prevalence of trust within a RPO (Shiferaw, Hellin, and Muricho 2011; Hill et al. 2014). Mistrust between farmers can even lead to the disintegration of RPOs (Masakure and Henson 2005). Typically, RPOs are member-driven organizations whose success depends on their members' participation in joint activities. Reasons for members being reluctant to participate in collective commercialization largely play out at the intra-RPO level (Bernard and Wouterse 2015). First, farmers may struggle with liquidity constraints and, hence, decide against participating in collective commercialization as it involves substantial delays in payment as compared with individual farmgate sales (Fafchamps and Hill 2005). Second, farmers need to have sufficient trust in their leaders' motives and competences. The sales processes of collective commercialization are typically executed by a few leaders and are not transparent for members. Members may fear to not be paid at all or that price increases that occur through bulking will not be shared with them fairly (Buck and Alwang 2011; Hill et al. 2014). Third, a farmer's decision to participate in collective commercialization is likely to be affected by his/her belief about the behavior of fellow farmers. Trust in fellow members and their commitment is needed to believe that the minimum number of produce will be reached for bulk sales and, hence, to decide to participate (Bernard et al. 2014).

According to the theoretical framework provided by Ostrom and Ahn (2003), success and failure of collective action is determined by a complex configuration of various forms of social capital—trustworthiness, networks, and institutions—that enhance trust. They specify which actions and outcomes are required, prohibited, or permitted and which sanctions are authorized (Ostrom and Ahn 2003). Trust is seen as the core link between social capital and collective action. It reduces opportunistic behavior and transaction costs (Putnam 1993; Collier 2002; Ostrom and Ahn 2003). 'Trust lubricates co-operation' (Pretty and Ward 2001, p. 211). We expect that a training intervention can strengthen existing horizontal and vertical networks and may even create new ones through repeated interaction of farmers. We further expect a training intervention to clarify the process of collective commercialization and the rules involved and, thus, to create a common understanding of the relevant institutions. We hypothesize that such increases in social capital will lead to a positive effect of a training intervention on trust in members and on trust in leaders.

We conduct a cluster-randomized controlled trial to test these hypotheses in the context of RPOs in Senegal. We randomly invited members and/or leaders to

participate in a three-day training to build social capital in order to induce members and leaders to coordinate toward successful collective commercialization. The training itself consisted of three days of interactive discussion on the benefits, conduct, and constraints of collective commercialization. We assess how this intervention affects trust in a sample of 798 smallholder farmers from 73 RPOs. We analyze both intention-to-treat effects, that is, the treatment effect of the invitation to participate in the training, and treatment effects of the training itself. Our main outcome variables of interest are survey measures of trust in leaders' competence and motives and survey measures of trust in members (Twyman, Harvey, and Harries 2008). We distinguish between trust in leaders' integrity, informational advantage, efficiency, and negotiation skills and general and farming-specific trust in members. In each RPO, we randomly varied the number of members and leaders invited to the training and interviewed both invited and noninvited individuals. This enabled us to analyze (i) the average treatment effect of whether or not a RPO was selected for training, (ii) the direct treatment effect of whether or not an individual was selected for training, and (iii) the spillover effect on nontreated individuals in treated RPOs.

Our results suggest a positive treatment effect of the training on measures of both trust in leaders and trust in members. For trust in leaders, the effect is especially pronounced for trust in their integrity and their informational advantage. Moreover, the results suggest a strong spillover effect on trust in leaders of nontreated members, that is, that the sizable positive average treatment effect is not to be attributed solely to personal treatment. The spillover effect is especially pronounced for trust in leaders' integrity and their negotiation skills. We show that while RPOs may face several constraints with respect to coordination towards collective commercialization, a relatively simple and noncostly group training may contribute to a substantial change in trust in leaders and trust in members and, thus, to clearing a barrier to collective commercialization and other collective endeavors. Social capital is often thought to increase with use, thus, the training may well have been the starting point for more collective endeavors to come.

Background: RPOs in Senegal

Institutional setting

Seven out of ten rural households in Senegal are members of RPOs, and RPOs have expanded rapidly in number and membership in the last few decades. Between 1982 and 2002, the percentage of villages with RPOs rose from 8 to 65 percent in Senegal (The World Bank 2008). Senegal is a country with a vast array of rural institutions in thousands of villages and with strong national-level organizations (Bernard and Wouterse 2015).¹ It has been observed, though, that these RPOs face challenges in ensuring the commitment of members. This is particularly true for activities related to collective commercialization of agricultural output. In fact, while RPOs remain active in input and credit provision, their capacity to aggregate output has been weakened considerably. At the time of harvest, producers are now visited by private collectors and

¹Bernard et al. (2015) provides additional background information and further statistics. For historical background information, see Bernard et al. (2014), Bernard and Wouterse (2015), Mercoiretnd (n.d.), Réseau des Organisations Paysannes et Pastorales du Sénégal (2008), The World Bank (2008), who also illustrate the serious commitment problems of the RPOs in Senegal. For further literature on RPO, see also Bernard, Taffesse, and Gabre-Madhin (2008), Shiferaw, Obare, and Muricho (2008), and Wollni and Zellner (2007).

traders. This has led to important side selling and produce is not marketed solely through the RPOs. As a result, RPOs are seldom able to aggregate the necessary amount of produce to trigger economies of scale and bargaining power at the time of commercialization. This is despite isolated evidence that RPOs in Senegal can, in fact, provide their members with profitable and reliable output commercialization services. In sum, in the absence of a sufficient amount of aggregated output, RPOs are not in a position to effectively obtain higher output prices, which leads to further side selling and a lack of interest of members for commercialization services offered by these organizations (Bernard *et al.* 2014).

Collective action problems of Senegalese RPOs

Generally, problems of collective action arise “whenever individuals face alternative courses of actions between short-term self-regarding choices and one that, if followed by a large enough number of individuals in a group, benefits all” (Ostrom and Ahn 2003, p. xiv). In the context of commercialization of agricultural produce, farmers who are organized in RPOs can choose between selling their produce directly at the farmgate to a local trader with immediate payment and selling it collectively through their RPO. Farmers in our sample cultivate either groundnuts, rice, or onions as their main crop. While groundnut farmers primarily sell their groundnuts either individually or collectively for private gains, onion farmers have been observed to engage in joint collection and commercialization of firewood. Rice farmers use a part of their gains from selling their rice (privately or collectively) for financing irrigation systems.

For collective commercialization of any type of produce, the RPOs’ leaders will typically negotiate with a contract buyer who offers a higher price than the local traders if a minimum amount of produce is sold. This quantity is typically too large to be reached by just one individual farmer such that complying with the contract requires coordination among the members of the RPO. Moreover, these contracts tend to be rather discrete in the sense that they are void if a certain threshold of aggregated produce is not met and payments are usually made some time after the farmers delivered their produce to the RPO for collective commercialization (Bernard *et al.* 2014). In our sample, two thirds of the farmers who report to have sold to traders in the 2010/2011 agricultural season (March 2010 to March 2011) state that they received the payment on the day of the transaction, while only one quarter of the farmers who sold through the RPO report to have received the payment on the day the transaction took place.

Senegalese RPOs appear to be facing significant constraints when it comes to collective action in the form of collective commercialization of agricultural produce. Although RPOs in our sample were selected based on collective commercialization being one of their main objectives, only roughly one third of the RPOs in our sample report to have engaged in collective commercialization in the 2010/2011 agricultural season.

While a lack of financial means and technical capacities at the RPO level are likely to be significant constraints to collective commercialization, members’ perception of collective commercialization and issues of coordination between members also seem to represent important constraints, independent of the type of crop to be sold collectively. Leadership has been shown to be a key element of successful coordination within RPOs (Agrawal 2001; Markelova *et al.* 2009; Bernard and Wouterse 2015). In those RPOs that engaged in collective commercialization, only 44 percent of the farmers delivered a part of their produce to the RPO to be sold collectively. Respondents state three main reasons for why they chose to sell individually in spot market-like transactions to local

traders rather than collectively through their RPO: most find collective commercialization to be too risky (without specifying the exact nature of this risk), some do not believe that it offers them a better price than selling individually, and for others, collective commercialization appears to be a complicated process that takes up too much time.

RPOs engaging in collective commercialization differ significantly from those who did not engage in collective sales in the 2010/2011 agricultural season (see [Table A1](#)). Their members are younger, more likely to own more motorcycles, are more likely to have savings accounts with banks and MFIs, and have larger fields. They cultivate groundnuts and rice more often than onions. Moreover, we find significantly higher average trust levels in RPOs that engaged in collective commercialization than in those that did not.

Farmers who contributed a part of their produce to collective commercialization in the season prior to the baseline data collection appear to be significantly more trusting than those who did not contribute (see [Table A2](#)). Moreover, they are more likely to be literate than those who did not contribute, less likely to be a member of a RPO, less likely to be related to a leader, more likely to have a savings account, have larger fields, are more likely to own a motorcycle, and are younger. They are also more likely to come from ethnically heterogeneous RPOs, have been members of their RPO for a shorter time period, are more likely to be cultivating groundnuts, and less likely to be cultivating onions. Looking at different measures for trust, we find a significantly positive pairwise correlation between several trust measures and an indicator for whether a RPO engaged in collective commercialization. Similarly, we find a significantly positive pairwise correlation between several trust measures and individual participation in collective commercialization (see [Table A3](#)). Overall, these results indicate that trust in leaders and in members may play a significant role in fostering collective commercialization. Aiming at enhancing trust within RPOs to encourage collective commercialization, we organized a three-day training and discussion around the potential benefits and difficulties of coordinating toward collective commercialization.

Trust and collective action: theory and hypotheses

Ostrom and Ahn (2003) provide a theoretical framework for analyzing issues of collective action that can be applied to analyzing collective commercialization as an example of collective action. Success and failure of collective action is determined by a complex configuration of various factors that they categorize as forms of social capital. They argue that the different forms of social capital—trustworthiness, networks, and institutions—enhance trust which they see as the core link between social capital and collective action. [Figure 1](#) shows the relationships between the forms of social capital, trust, and collective action.

Trust reduces opportunistic behavior and, thus, transaction costs (Putnam 1993; Collier 2002). Applied to the context of collective commercialization in RPOs, farmers who are organized in RPOs need to be trustworthy and sufficiently connected with each other, and the RPO needs to provide adequate institutions for trust to be prevalent within the RPO and for collective commercialization to be successful. Trust in leaders allows the trusting farmer to commit to commercialization despite the risk of loss if the leaders do not behave as the trusting farmer expected. Trust in members allows the trusting farmer to commit to commercialization despite the risk of loss if the fellow farmers do not participate in the joint endeavors as expected by the trusting farmer.

If the training intervention increases the different forms of social capital, it will enhance trust and ultimately lead to more successful collective commercialization

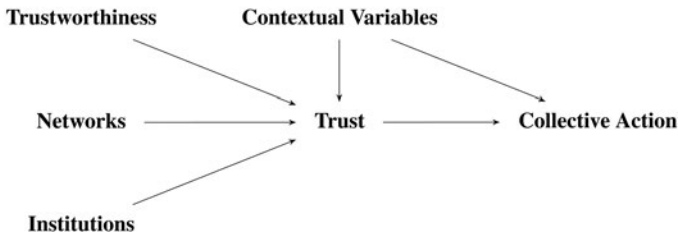
Forms of Social Capital

Fig. 1. Social capital, trust, and collective action (Ostrom and Ahn 2003, p. xvii).

and potentially other collective endeavors in treated RPOs. Putnam (1993) distinguishes between horizontal networks bringing together individuals of equivalent status, for example, fellow members or fellow leaders, and vertical networks bringing together individuals from different hierarchical levels, for example, members and leaders. Dense horizontal networks with the capability of efficiently transmitting information across individuals create incentives to behave in a trustworthy manner. Repeated interactions among individuals are seen as a sign of robust networks (Ostrom and Ahn 2003). We expect that the training intervention strengthens existing horizontal and vertical networks and may even create new ones through repeated interactions of farmers. Put differently, we expect the intervention to have a positive effect on participating leaders' trust in other leaders and on participating members' trust in other members through tightening existing bonds and creating new ones during and after the joint field trip to the training. Similarly, in RPOs where both members and leaders participate, the training may increase trust between leaders and members through strengthening and/or creating vertical networks. We hypothesize that such increases in social capital will materialize in a positive treatment effect on trust in members and on trust in leaders.

Both networks and institutions change the incentive structure of individuals with institutions creating incentives for both the trusting and the trusted party to behave in a trustworthy manner (Ostrom and Ahn 2003). We expect that the intervention clarifies the process of collective commercialization as one form of collective action and the rules involved and, thus, creates a common understanding of the relevant institutions. In other words, trained members (leaders) may obtain a better understanding of leaders' (members') role and position, which may increase members' (leaders') trust in leaders (members) even if no leaders (members) are present during the training. Further, the intervention may also create positive spillover effects, that is, increase nonparticipants' trust in leaders and members. Participants may convey their newly acquired understanding of leaders' and members' role and position to nonparticipants during the general assembly held shortly after the training. We hypothesize that such increases in social capital will again materialize in a positive treatment effect on trust in members and on trust in leaders.

Measures of trust

We consider six survey measures of trust capturing different aspects of trust within a RPO that we consider to be important for successful collective commercialization. We distinguish between trust in leaders and trust in members. Originally, all trust measures were recorded on a four-point Likert-type scale. The items to choose from are (1) "Do not agree at all", (2) "Do not really agree", (3) "Agree", and (4) "Fully agree".

However, given that the average trust levels at baseline are well above 3 for all measures of trust, we use binary variables as regressands in the empirical analysis that are equal to one if respondents chose “fully agree”. Hence, for trust in leaders, we created four binary measures: *negotiation* equal to one if the respondent fully agrees with “The RPO’s board is capable of negotiating better prices for our produce than I am capable of myself.”, and a binary variable *integrity* equal to one if the respondent fully agrees with “Board members defend the RPO’s interests and their own interests in equal measure.”, a binary variable *information* equal to one if the respondent fully agrees with “If the RPO’s board says that I can achieve better prices if I wait a little, they do so because they have adequate information.”, and finally, a binary variable *efficiency* equal to one if the respondent fully agrees with “If I invest my money or my produce in the RPO, it will be used efficiently.” For trust in members, we created two binary measures: a binary variable *general* equal to one if the respondent fully agrees with “The majority of people in my RPO are trustworthy.”, and a binary variable *farming* equal to one if the respondent fully agrees with “I can trust the people from the RPO to look after my field during an absence of two months.” Moreover, we create two comprehensive indices of trust. For *trust_sum*, we take the sum over the six binary trust measures such that values of *trust_sum* range from 0 to 6. For *trust_factor*, we run a factor analysis with the six binary trust measures. Values of the resulting index of trust range from -1.74 to 0.81 .

Trust-building intervention

Overall, the results from the previous section support the idea that trust in leaders and in members may play a significant role in fostering collective commercialization. Aiming at enhancing trust within RPOs to encourage collective commercialization, we organized a three-day training and discussion around the potential benefits and difficulties of coordinating toward collective commercialization.

We, therefore, investigate issues of intra-group coordination and trust using a sample of Senegalese village-level RPOs. The sample for which the baseline survey was conducted was drawn from a dataset of 204 RPOs from 9 federations belonging to FONGS collected in 2009 from which we selected all organizations that stated collective commercialization as one of their main purposes. A total of 73 RPOs belonging to 7 federations satisfied this criterion.

We randomly assigned an invitation to the training intervention to these 73 RPOs as follows:

- Twenty-three RPOs served as a pure control group; they were not invited to participate in the training intervention.
- Fifty RPOs received an invitation to participate in the training intervention.
 - in 12 RPOs, between one and four leaders, but no members were invited to the training.
 - in 15 RPOs, between one and four members but no leaders were invited to the training.
 - in 23 RPOs, between one and four members and between one and four leaders were invited to the training.

In each of the treated RPOs, at least two persons received an invitation. In all treated RPOs, a general assembly was convened shortly after the training to discuss its content with nonparticipants. To be able to consider both direct and spillover effects, we

interviewed both invitees and noninvited individuals. In each RPO, 10 noninvited individuals were randomly selected for interviewing purposes.

The intervention consisted of a three-day training. During the training, all participants were treated the same, that is, members were not treated differently from leaders. The purpose of the training was to create awareness of the (potential) advantage of working together toward commercialization of agricultural produce and highlight particular group dynamics that are conducive to collective action. In terms of content, role plays, simple games, and group exercises were to demonstrate the advantages of working together in terms of the benefits that can be generated and the costs that can be saved. Particular focus was placed on sharing information and increasing transparency. Participants were encouraged to communicate the message they took away from the training to nontrained fellow farmers from their RPO upon return. One part of the training was to put together a plan for how these messages can be communicated and discussed with other group members.

The training sessions were organized in three modules, one for each day: (1) the potential and pitfalls of collective commercialization, (2) coordination within organizations—the role of communication in collective commercialization, and (3) motivation for coordination—members and leaders.² An endline survey was conducted 2 to 4 weeks after the training.

In this article, we focus on estimating the immediate effects of the intervention on intragroup relations. We do not capture long-term effects which would also have been interesting considering that trust may need time to grow. To ensure that the assignment of the treatment is independent of any baseline characteristics, we examined various balancing statistics and found that the treatment allocation was indeed independent of average baseline trust levels, see Bernard *et al.* (2015).

Empirical results

We conducted the empirical analysis at two levels: The causal impacts of the (invitation to the) training on trust at the RPO level and the same analysis at the individual level. The estimates at the RPO level are discussed in more detail in Bernard *et al.* (2015). Here, we only summarize the results at the RPO level and discuss the estimates at the individual level in more detail. At the RPO level, we estimated the effects of the intervention on average trust. To account for the one-sided noncompliance, we examined intention-to-treat estimates as well as instrumental variable estimates, where the randomly allocated invitations were used as instrumental variables for participation. We found a significantly positive intention-to-treat effect of between 11 and 13 percentage points for average trust in leaders' negotiation skills, their integrity, and their informational advantage. We further found a significantly positive intention-to-treat effect of between 10 and 13 percentage points for both measures of trust in members. These positive treatment effects increased to 12 to 15 percentage points when considering the effect of the training itself, that is, the IV estimates.

Treatment effects at individual level

In the following, we now present treatment effects at the individual level, that is, the effects of the (invitation to the) training on trust based on individual-level regressions

²The complete training manual is available from the authors upon request.

permitting us to disentangle the effect of having personally been invited from a potential spillover effect on noninvited farmers within treated RPOs. To further study spillover effects and direct treatment effects, we estimate:

$$\Delta trust_{ig} = \alpha_0 + \alpha_1 spillover_invitation_{ig} + \alpha_2 personal_invitation_i + \tau_{ig} \quad (1)$$

where $\Delta trust_{ig} = trust_{ig,t=1} - trust_{ig,t=0}$ is the difference between trust of person i in RPO g at endline $t = 1$ and baseline $t = 0$, $spillover_invitation_{ig}$ is a binary variable equal to one if some member or leader from RPO g other than person i has received an invitation, $personal_invitation_i$ is a binary variable equal to one if person i has received an invitation to participate in the training intervention, and τ_{ig} is a random disturbance term for individual i in RPO g . Hence, the estimated coefficient $\hat{\alpha}_1$ captures any potential spillover effects, while $\hat{\alpha}_2$ captures the effect of having personally been invited.

Again, we estimate the causal effect of the training using an instrumental variable strategy. We estimate:

$$\Delta trust_{ig} = \theta_0 + \theta_1 spillover_training_{ig} + \theta_2 personal_training_i + \kappa_{ig} \quad (2)$$

where $spillover_training_{ig}$ is a binary variable equal to one if some member or leader from RPO g other than person i has participated in the training, and $personal_training_i$ is a binary variable equal to one if person i has participated in the training intervention. We instrument for $spillover_training_{ig}$ and $personal_training_i$ using $RPO_invitation_g$ and $personal_invitation_i$. Hence, the estimated coefficient $\hat{\theta}_1$ captures any potential spillover effects, while $\hat{\theta}_2$ captures the effect of having personally been trained.

To gain further insights into spillover effects, we also estimate regressions as specified in equation 2 separately for subsamples containing only members or only leaders. For the subsample of members, we further split the spillover effect by treatment type, that is, by whether only members were treated, only leaders, or both. In these regressions, we instrument for $spillover_training_{ig}$ and $personal_training_i$ by $RPO_invitation_g$ and $personal_invitation_i$. We instrument for $spillover_training_OL_{ig}$, $spillover_training_OM_{ig}$, $spillover_training_LM_{ig}$, and $personal_training_i$ using $RPO_invitation_OL_g$, $RPO_invitation_LM_g$, and $personal_invitation_i$. The highly significant correlation coefficients range between -0.2863 and 0.9021 .

Regression results

In Table 1, we report the estimated treatment effects on individual trust. We present intention-to-treat effects based on reduced-form regressions as specified in equation 1, and the results from instrumental variable estimations as specified in equation 2. The results hint at a significantly positive treatment effect of having personally received an invitation. In detail, we find a significant personal intention-to-treat effect of 13 to 20 percentage points for all individual trust measures but trust in leaders' negotiation skills.³ These effects increase to 15 to 24 percentage points when considering the treatment effect of the training.

To gain further insights into spillover effects and direct treatment effects, we rerun estimations as specified in equations 1 and 2 on subsamples containing only members

³The average baseline trust levels range from 0.62 for general trust in members to 0.71 for trust in leaders' integrity.

Table 1. Treatment effects at individual level

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Δ negotiation	Δ integrity	Δ information	Δ efficiency	Δ general	Δ farming	Δ trust_sum	Δ trust_factor
Reduced form regressions								
<i>spillover_invitation</i>	0.1109	0.1221*	0.1097	0.0604	0.0915	0.0833	0.5779	0.2451
	(0.0686)	(0.0692)	(0.0702)	(0.0778)	(0.0649)	(0.0721)	(0.3792)	(0.1618)
<i>personal_invitation</i>	0.0767	0.1710**	0.1581**	0.1314*	0.2047**	0.1698**	0.9117**	0.3892**
	(0.0765)	(0.0723)	(0.0753)	(0.0786)	(0.0786)	(0.0811)	(0.3946)	(0.1682)
Instrumental variable regressions								
<i>spillover_training</i>	0.1289	0.1362*	0.1220	0.0643	0.0970	0.0894	0.6378	0.2703
	(0.0792)	(0.0795)	(0.0808)	(0.0887)	(0.0735)	(0.0820)	(0.4332)	(0.1849)
<i>personal_training</i>	0.0743	0.1891**	0.1754**	0.1516*	0.2365***	0.1948**	1.0217**	0.4364**
	(0.0852)	(0.0782)	(0.0829)	(0.0841)	(0.0873)	(0.0890)	(0.4248)	(0.1808)
<i>N</i>	798	798	798	798	798	798	798	798

Notes: The number of invited/trained persons in treated RPOs ranges from 2 to 16. Hence, it is impossible to be the only invited/treated person in a treated RPO. We report coefficients from regressions using both baseline and endline data regressing changes in trust on a constant, a binary indicator for personal treatment and a binary indicator for treatment of others. For instrumental variable regressions we report coefficients from two-stage estimations using *RPO_invitation* and *personal_invitation* as instruments for *spillover_training* and *personal_training*. Standard errors are reported in parentheses (clustered at RPO level).

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

or only leaders. The results for the subsample of leaders are omitted since all estimates were insignificant, which presumably is linked to the small sample size of leaders ($N = 168$). The results for the subsample of leaders were inconclusive.

In [Table 2](#), the results are shown in the subsample of members. In [Table 2](#), we present intention-to-treat effects based on reduced form regressions on a subsample of members as specified in [equation 1](#) and the results from instrumental variable estimations on a subsample of members as specified in [equation 2](#). For members we find both a significantly positive personal treatment effect and a significantly positive spillover effect. In particular, we find significantly positive direct treatment effects of 19 to 20 percentage points for trust in leaders' integrity and their informational advantage as well as a significant personal intention-to-treat effect of 18 percentage points on general trust and farming-specific trust in members. For trust in leaders' negotiation skills, their integrity, and their informational advantages, the results appear to be indicating a significantly positive spillover effect of 15 to 16 percentage points. This may be attributed to untrained members believing that trained leaders have gained relevant skills (trust in competence) and that trained leaders are less likely to privately capture rents (trust in motives). We further split these spillover effects into spillovers in RPOs where only leaders were invited (participated), RPOs where only members were invited (participated), and RPOs where both leaders and members were invited (participated). The results presented in [Table 2](#) hint at the spillover effects in trust in leaders being most pronounced in RPOs where either only leaders or only members were invited (participated).

In [Table 3](#), we examine effects beyond trust. Besides having an impact on intra-RPO trust in both members and leaders, the training intervention may have also affected farmers' perception of their RPO. Data about the true and perceived level of information are scarce in our dataset. We have information on how well farmers know their own RPO, namely whether they believe to know how many members their RPO has. This question was included only in the endline survey. In [Table 3](#), we report the percentage of farmers stating that they know the size of their RPO by intended treatment status. On average, farmers from invited RPOs feel significantly better informed about the size of their RPO than farmers in the control group. This difference is dominated by farmers who were personally invited, but also noninvited farmers in the treatment group fare better than farmers in the control group. Apparently, the training was able to provide farmers with information they were previously lacking. In line with this, we find that farmers in invited RPOs appear better informed about the potential benefits of an efficiently working RPO and also a significant difference when looking at the evaluation of the actual RPOs (see [Table 3](#)). Farmers from invited RPOs are significantly more confident than farmers from the control group that their RPO can help overcome hindrances that they encounter when selling individually.

Concluding remarks

Although many positive examples from both developed and developing countries exist, many RPOs still struggle to offer the type of commercialization services that would lead to higher output prices for their members. In this article, we have argued that trust in leaders' motives and competence as well as trust in members are crucial for successful collective commercialization as a form of collective action.

We conduct a cluster-randomized controlled trial in the context of RPOs in Senegal. We randomly invited members and/or leaders to participate in a three-day training to induce members and leaders to coordinate toward successful collective commercialization. The

Table 2. Treatment effects at individual level—subsample of members

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Δ negotiation	Δ integrity	Δ information	Δ efficiency	Δ general	Δ farming	Δ trust_sum	Δ trust_factor
Reduced form regressions								
<i>spillover_invitation</i>	0.1614**	0.1575**	0.1508**	0.0979	0.0805	0.0849	0.7330*	0.3118*
	(0.0709)	(0.0701)	(0.0694)	(0.0823)	(0.0667)	(0.0710)	(0.3758)	(0.1605)
<i>personal_invitation</i>	0.1351	0.1881**	0.2020**	0.1342	0.1838**	0.1778**	1.0211**	0.4351**
	(0.0977)	(0.0806)	(0.0843)	(0.0967)	(0.0801)	(0.0848)	(0.4289)	(0.1830)
Instrumental variable regressions								
<i>spillover_training</i>	0.1873**	0.1801**	0.1714**	0.1111	0.0879	0.0934	0.8311*	0.3535*
	(0.0831)	(0.0817)	(0.0808)	(0.0945)	(0.0762)	(0.0813)	(0.4338)	(0.1852)
<i>personal_training</i>	0.1381	0.2075**	0.2271**	0.1514	0.2196**	0.2108**	1.1545**	0.4921**
	(0.1165)	(0.0917)	(0.0973)	(0.1093)	(0.0923)	(0.0965)	(0.4817)	(0.2055)
Reduced form regressions								
<i>spillover_invitation_OL</i>	0.1677*	0.1859**	0.1414	0.0747	0.0626	0.1172	0.7495*	0.3181*
	(0.0850)	(0.0810)	(0.0915)	(0.0934)	(0.0764)	(0.0796)	(0.4222)	(0.1806)
<i>spillover_invitation_OM</i>	0.1829**	0.1844**	0.1771*	0.1193	0.1072	0.0839	0.8549*	0.3639*
	(0.0832)	(0.0880)	(0.0920)	(0.1018)	(0.0830)	(0.0830)	(0.4717)	(0.2017)
<i>spillover_invitation_LM</i>	0.1429*	0.1225*	0.1382*	0.0967	0.0727	0.0667	0.6397	0.2723
	(0.0814)	(0.0732)	(0.0743)	(0.0864)	(0.0747)	(0.0750)	(0.3978)	(0.1696)
<i>personal_invitation</i>	0.1351	0.1881**	0.2020**	0.1342	0.1838**	0.1778**	1.0211**	0.4351**
	(0.0979)	(0.0807)	(0.0844)	(0.0968)	(0.0803)	(0.0849)	(0.4296)	(0.1833)

Instrumental variable regressions								
<i>spillover_training_OL</i>	0.2000*	0.2217**	0.1687	0.0892	0.0747	0.1398	0.8940*	0.3795*
	(0.1054)	(0.1013)	(0.1086)	(0.1080)	(0.0878)	(0.0903)	(0.4939)	(0.2112)
<i>spillover_training_OM</i>	0.3245*	0.3279**	0.3307*	0.2105	0.2197	0.1780	1.5914*	0.6769*
	(0.1690)	(0.1515)	(0.1809)	(0.1800)	(0.1466)	(0.1567)	(0.8499)	(0.3630)
<i>spillover_training_LM</i>	0.1282	0.1030	0.1113	0.0834	0.0434	0.0382	0.5075	0.2162
	(0.0876)	(0.0737)	(0.0780)	(0.0859)	(0.0775)	(0.0764)	(0.4039)	(0.1720)
<i>personal_training</i>	0.1306	0.2008**	0.2176**	0.1446	0.2113**	0.2080**	1.1129**	0.4743**
	(0.1153)	(0.0904)	(0.0958)	(0.1078)	(0.0910)	(0.0944)	(0.4756)	(0.2028)
<i>N</i>	630	630	630	630	630	630	6308	630

Notes: We report coefficients from regressions on the subsample of members using both baseline and endline data regressing changes in trust on a constant, a binary indicator for personal treatment and a binary indicator for treatment of others (binary indicators for treatment of others by group type). For instrumental variable regressions, we report coefficients from two-stage estimations using *RPO_invitation* and *personal_invitation* as instruments for *spillover_training* and *personal_training* and from two-stage estimations using *RPO_invitation_OL*, *RPO_invitation_OM*, *RPO_invitation_LM* and *personal_invitation* as instruments for *spillover_training_OL*, *spillover_training_OM*, *spillover_training_LM* and *personal_training*. Standard errors are reported in parentheses (clustered at RPO level).

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 3. Perception of RPO at endline by intended treatment status

Panel A (N = 798): Do you know how many members there are in your group (approximately)?				
treatment		control	total	p-value
52.93		33.83	48.12	0.0000
	invitees	noninvitees		
	74.67	45.64		0.0000
Panel B (N = 532): Do you think an efficient group could overcome hindrances you encounter selling individually?				
treatment		control	total	p-value
97.96		95.68	97.37	0.1493
	invitees	noninvitees		
	95.61	98.92		0.0350
Panel C (N = 533): Do you think your group could overcome hindrances you encounter selling individually?				
treatment		control	total	p-value
67.18		52.86	63.41	0.0025
	invitees	noninvitees		
	67.26	67.14		0.9827

Notes: We report the percentage of persons answering the questions affirmatively at endline as well as the p-value of two-sample t-tests with the null of equal means. Samples in panels B and C are smaller than the sample in panel A as people who stated to not be facing any constraints when selling individually did not answer these questions.

training itself consisted of three days of interactive discussion on the benefits, conduct, and constraints of collective commercialization. In all treated RPOs, a general assembly was convened shortly after the training to discuss its content with nonparticipants.

We find a positive treatment effect of the training on both trust in leaders and trust in members. For trust in leaders, the effect is especially pronounced for trust in leaders' integrity and their informational advantage. Moreover, the results suggest a strong spill-over effect on nontreated members for trust in leaders, that is, that the sizable positive average treatment effect is not to be attributed solely to personal invitation. This may be attributed to untrained members believing that trained leaders have gained relevant skills (trust in competence) and that trained leaders are less likely to privately capture rents (trust in motives). These results are robust to the inclusion of different covariates and to different specifications of the underlying model.

These findings suggest that relatively soft and noncostly interventions such as group training appear to be able to positively affect intra-RPO trust and the farmer's perception of coordination toward successful collective action. Furthermore, social capital is often thought to increase with use, that is, it is thought of as being self-reinforcing when reciprocity connects people leading to increased trust and confidence (Pretty and Ward 2001). Thus, the training may well have been the starting point for more collective endeavors to come.

Data availability statement. Replication materials are available in the supplementary materials section of the article.

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Conflict of interest. The authors declare none.

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Appendix. Descriptive statistics

Table A1. Descriptive statistics by collective commercialization activity on a RPO level (RPO characteristics and RPO averages of individual characteristics)

Variable	Mean (<i>N</i> = 69)	Standard deviation	Mean if RPO not active in collective commercialization (<i>N</i> = 49)	Mean if RPO active in collective commercialization (<i>N</i> = 20)	Difference
<i>trust outcomes</i>					
efficiency	0.69	0.22	0.66	0.77	−0.11*
farming	0.64	0.21	0.62	0.69	−0.08
general	0.62	0.23	0.59	0.70	−0.11*
information	0.70	0.21	0.67	0.78	−0.11**
integrity	0.70	0.22	0.68	0.77	−0.09
negotiation	0.64	0.21	0.61	0.71	−0.10*
trust_factor	−0.04	0.50	−0.11	0.15	−0.26*
trust_sum	3.99	1.18	3.82	4.42	−0.61*
<i>additional covariates</i>					
age ^a	55.50	10.44	57.33	51.16	6.18**

(Continued)

Table A1. (Continued.)

Variable	Mean (N = 69)	Standard deviation	Mean if RPO not active in collective commercialization (N = 49)	Mean if RPO active in collective commercialization (N = 20)	Difference
bicycles	0.17	0.25	0.14	0.22	-0.07
distance to market	10.38	29.71	11.49	7.68	3.81
distance to storage ^b	11.94	18.56	12.08	11.58	0.51
groundnut	0.41	0.49	0.31	0.65	-0.34***
hectares ^b	3.56	2.88	2.91	5.30	-2.40***
heterogeneity	0.36	0.48	0.31	0.50	-0.19
household size ^b	12.71	4.09	12.58	13.05	-0.46
literate ^b	0.42	0.31	0.40	0.47	-0.08
male	0.42	0.29	0.41	0.46	-0.06
member	0.79	0.15	0.81	0.75	0.06
motorcycles	0.16	0.21	0.13	0.23	-0.10*
onion	0.46	0.50	0.61	0.10	0.51***
phone	0.95	0.07	0.94	0.96	-0.02
related to leader ^b	0.63	0.35	0.64	0.60	0.04
rice	0.13	0.34	0.08	0.25	-0.17*
savings in bank	0.13	0.15	0.10	0.21	-0.11***
savings in MFI	0.32	0.18	0.28	0.40	-0.12***
size ^a	31.83	8.28	31.73	32.05	-0.32
vehicles	0.09	0.19	0.09	0.12	-0.03
year of creation ^a	1996.70	10.30	1996.40	1997.42	-1.02
year joined ^b	1999.53	7.54	1999.54	1999.49	0.05

Notes: Information on collective commercialization in the 2010/2011 season is only available for 69 out of 73 RPOs. We report averages and standard deviations in the sample of 69 RPOs, averages in the subsamples of RPOs that did and did not engage in collective commercialization in the 2010/2011 season and results of two-sample t-tests with the null of equal means in RPOs not having engaged and having engaged in collective commercialization.

^aInformation on these variables is only available for 64 out of 69 RPOs of which 45 did not engage in collective commercialization in the 2010/2011 season and 19 did.

^bInformation on these variables is only available for 62 out of 69 RPOs of which 45 did not engage in collective commercialization in the 2010/2011 season and 17 did.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A2. Descriptive statistics by collective commercialization activity on the individual level

Variable	Mean (N = 538)	Standard deviation	Mean if farmer not active in collective commercialization (N = 467)	Mean if farmer active in collective commercialization (N = 71)	Difference
<i>trust outcomes</i>					
efficiency	0.69	0.46	0.67	0.85	-0.18***
farming	0.64	0.48	0.63	0.70	-0.07
general	0.62	0.49	0.61	0.70	-0.10
information	0.70	0.46	0.67	0.86	-0.18***
integrity	0.71	0.46	0.69	0.83	-0.14**
negotiation	0.63	0.48	0.60	0.83	-0.23***
trust_factor	-0.04	1.03	-0.09	0.30	-0.39***
trust_sum	3.99	2.41	3.87	4.77	-0.91***
<i>additional covariates</i>					
age ^a	55.46	9.85	56.16	51.03	5.13***
bicycles	0.15	0.49	0.14	0.21	-0.07
distance to market	12.90	52.43	13.55	8.64	4.91
distance to storage ^b	14.32	24.24	14.22	15.00	-0.78
groundnut	0.47	0.50	0.42	0.82	-0.40***
hectares ^b	4.27	5.27	3.85	6.88	-3.02***
heterogeneity	0.35	0.48	0.31	0.58	-0.27***
household size ^b	12.97	7.02	12.96	13.06	-0.10
literate ^b	0.44	0.50	0.40	0.69	-0.28***
male	0.49	0.50	0.50	0.46	0.03
member	0.75	0.43	0.77	0.62	0.15***
motorcycles	0.16	0.45	0.14	0.28	-0.14**
onion	0.42	0.49	0.47	0.07	0.40***
phone	0.95	0.21	0.95	0.99	-0.04
related to leader ^b	0.65	0.48	0.67	0.53	0.13**
rice	0.12	0.32	0.12	0.11	0.00
savings in bank	0.12	0.32	0.10	0.24	-0.14***
savings in MFI	0.36	0.48	0.32	0.56	-0.24***
size ^a	31.49	6.54	31.56	31.09	0.47
vehicles	0.06	0.33	0.05	0.11	-0.06

(Continued)

Table A2. (Continued.)

Variable	Mean (<i>N</i> = 538)	Standard deviation	Mean if farmer not active in collective commercialization (<i>N</i> = 467)	Mean if farmer active in collective commercialization (<i>N</i> = 71)	Difference
year of creation ^a	1997.14	10.49	1997.32	1995.99	1.34
year joined ^b	1999.79	8.90	2000.23	1997.06	3.16***

Notes: Information on collective commercialization in the 2010/2011 season is only available for 538 of 798 farmers belonging to 69 out of 73 RPOs. We report averages and standard deviations for a sample of those 538 farmers, averages in the subsamples of farmers that did and did not engage in collective commercialization in the 2010/2011 season and results of two-sample t-tests with the null of equal means among farmers not having engaged and having engaged in collective commercialization.

^aInformation on these variables is only available for 493 out of 538 farmers of which 426 did not engage in collective commercialization in the 2010/2011 season and 67 did.

^bInformation on these variables is only available for 468 out of 538 farmers of which 404 did not engage in collective commercialization in the 2010/2011 season and 64 did.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A3. Correlation between trust and collective commercialization

Panel A (N = 538): Pairwise correlation between different measures of trust and individual participation in collective commercialization								
	negotiation	integrity	information	efficiency	general	farming	trust_sum	trust_factor
contribution	0.1609***	0.1067**	0.1362***	0.1297***	0.0685	0.0512	0.1271***	0.1271***
Panel B (N = 69): Pairwise correlation between averages of different measures of trust and collective commercialization activity on RPO level								
	negotiation	integrity	information	efficiency	general	farming	trust_sum	trust_factor
sales	0.2202*	0.1820	0.2452**	0.2327*	0.2297*	0.1709	0.2344*	0.2343*

Notes: In Panel A we report pairwise correlation coefficients between a binary indicator for individual contribution to collective commercialization in the 2010/2011 season and individual trust measures and, in Panel B, between a binary indicator for having engaged in collective commercialization at RPO level in the 2010/2011 season and averages of trust measures at baseline. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.