

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

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July 8, 2021

## Abstract

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 paper 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 effects of training members and/or leaders with respect to commercialization on intra-group 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 non-costly interventions such as a group training appear to positively affect trust within producer organizations.

**Keywords:** Rural Producer Organizations, Trust, Senegal

**JEL Classification:** D71, O12, Q13

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# 1 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 not only a question 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 (Markelova et al., 2009; Rondot and Collion, 2001; The World Bank, 2008). 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 (Devaux et al., 2009; Poulton et al., 2010; Stockbridge et al., 2003). 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 (Bernard et al., 2008, 2010; Fafchamps and Hill, 2005; Markelova et al., 2009). 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 to 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 (Hill et al., 2014; Shiferaw et al., 2011). 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 to individual farmgate sales (Fafchamps and Hill, 2005). Second, farmers need to have sufficient trust in their leaders' mo-

tives and competences. The sales processes of collective commercialization are typically executed by 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 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—which 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 (Collier, 2002; Ostrom and Ahn, 2003; Putnam, 1993). “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 towards 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, i.e., 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 et al.,

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 non-invited individuals. This enables 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 non-treated 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, results suggest a strong spillover effect on trust in leaders of non-treated members, i.e., 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 non-costly 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.

## **2 Background: RPOs in Senegal**

### **2.1 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 decades. Between 1982 and 2002, the percentage of villages with RPOs rose from eight 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 or-

ganizations (Bernard and Wouterse, 2015).<sup>1</sup>. 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 time of harvest, producers are now visited by private collectors and traders. This has led to important side-selling, 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 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).

## **2.2 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 part of their gains from selling their rice (privately or collectively) for financing irrigation systems.

For collective commercialization of any type of produce, the RPO’s leaders

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<sup>1</sup>Bernard et al. (2015) provides additional background information and further statistics. For historical background information see (Bernard et al., 2014; Bernard and Wouterse, 2015; Mercoiret, nd; 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 et al. (2008), Shiferaw et al. (2008) and Wollni and Zellner (2007)

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 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; Bernard and Wouterse, 2015; Markelova et al., 2009). In those RPOs that engaged in collective commercialization, only 44 percent of the farmers delivered 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 to 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 A.4). 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 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 A.5). Moreover, they are more likely to be literate than those who did not contribute, less likely to be a member of an 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 A.6). 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 towards collective commercialization.

### **2.3 Trust and Collective Action: Theory and Hypotheses**

Ostrom and Ahn (2003) provide a theoretical framework for analyzing issues of collective action which 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 which 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 (Collier, 2002; Putnam, 1993). Applied to the context of collective commercialization in RPOs,

### *Forms of Social Capital*

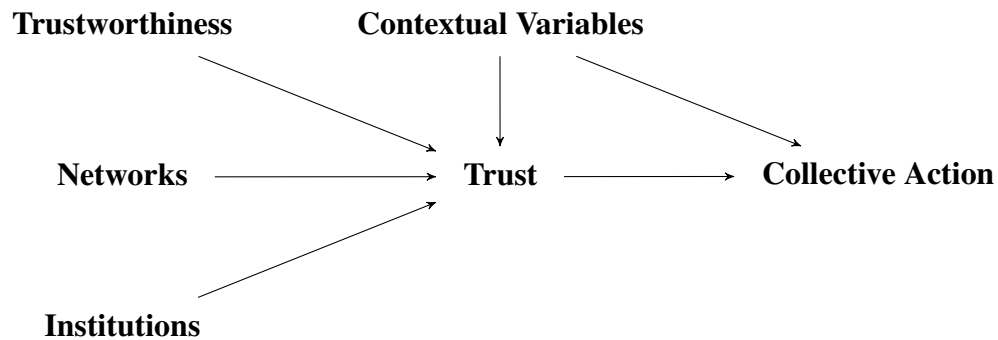


Figure 1: **Social capital, trust, and collective action.**  
(Ostrom and Ahn, 2003, p. xvii)

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 and potentially other collective endeavors in treated RPOs. Putnam (1993) distinguishes between horizontal networks bringing together individuals of equivalent status, e.g. fellow members or fellow leaders, and vertical networks bringing together individuals from different hierarchical levels, e.g. 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, i.e., increase non-participants' trust in leaders and members. Participants may convey their newly acquired understanding of leaders' and members' role and position to non-participants 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.

## 2.4 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 which 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.

### 3 Trust-Building Intervention

Overall, 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 towards 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. 73 RPOs belonging to 7 federations satisfied this criterion.

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

- 23 RPOs served as pure control group, they were not invited to participate in the training intervention
- 50 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 non-participants. To be able to consider both direct as well as spillover effects, we interviewed both invitees as well as non-invited individuals. In each RPO, 10 non-invited individuals were randomly selected for interviewing purposes.

The intervention consisted of a three-day training. During the training, all participants were treated the same, i.e., members were not treated differently from leaders. The purpose of the training was to create awareness of the (potential) advantage of working together towards 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 put on sharing information and increasing transparency. Participants were encouraged to communicate the message they took away from the training to non-trained 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.<sup>2</sup> An endline survey was conducted 2 to 4 weeks after the training.

In this paper we focus on estimating immediate effects of the intervention on intra-group 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 is

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<sup>2</sup>The complete training manual is available from the authors upon request.

indeed independent of average baseline trust levels, see Bernard et al. (2015).

## 4 Empirical results

We conducted the empirical analysis at two level: 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 variable 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 find 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 increase to 12 to 15 percentage points when considering the effect of the training itself, i.e. the IV estimates.

### 4.1 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 permitting us to disentangle the effect of having personally been invited from a potential spillover effect on non-invited 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  $\tau_{ig}$  is a random disturbance term for individual  $i$  in RPO  $g$ . Hence, the estimated coefficient  $\widehat{\alpha}_1$  captures any potential spillover effects while  $\widehat{\alpha}_2$  captures the effect of having personally been invited.

Again, we also 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  $\widehat{\theta}_1$  captures any potential spillover effects while  $\widehat{\theta}_2$  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, i.e., 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  $RPO\_invitation\_OL_g$ ,  $RPO\_invitation\_OM_g$ ,  $RPO\_invitation\_LM_g$  and  $personal\_invitation_i$ . The highly significant correlation coefficients range between -0.2863 and 0.9021.

## 4.2 Regression results

In Table 1 we report estimated treatment effects on individual trust. We present intention-to-treat effects based on reduced form regressions as specified in equation (1), and results from instrumental variable estimations as specified in equation (2). 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.<sup>3</sup> 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 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). 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 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 as well as 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, 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). 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).

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<sup>3</sup>The 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)
	$\Delta$ negotiation	$\Delta$ integrity	$\Delta$ information	$\Delta$ efficiency	$\Delta$ general	$\Delta$ farming	$\Delta$ trust_sum	$\Delta$ trust_factor
<i>Reduced form regressions</i>								
spillover_invitation	0.1109 (0.0686)	0.1221* (0.0692)	0.1097 (0.0702)	0.0604 (0.0778)	0.0915 (0.0649)	0.0833 (0.0721)	0.5779 (0.3792)	0.2451 (0.1618)
personal_invitation	0.0767 (0.0765)	0.1710** (0.0723)	0.1581** (0.0753)	0.1314* (0.0786)	0.2047** (0.0786)	0.1698** (0.0811)	0.9117** (0.3946)	0.3892** (0.1682)
<i>Instrumental variable regressions</i>								
spillover_training	0.1289 (0.0792)	0.1362* (0.0795)	0.1220 (0.0808)	0.0643 (0.0887)	0.0970 (0.0735)	0.0894 (0.0820)	0.6378 (0.4332)	0.2703 (0.1849)
personal_training	0.0743 (0.0852)	0.1891** (0.0782)	0.1754** (0.0829)	0.1516* (0.0841)	0.2365*** (0.0873)	0.1948** (0.0890)	1.0217** (0.4248)	0.4364** (0.1808)
N	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).  
\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

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

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	$\Delta$ negotiation	$\Delta$ integrity	$\Delta$ information	$\Delta$ efficiency	$\Delta$ general	$\Delta$ farming	$\Delta$ trust_sum	$\Delta$ trust_factor
<i>Reduced form regressions</i>								
spillover_invitation	0.1614** (0.0709)	0.1575** (0.0701)	0.1508** (0.0694)	0.0979 (0.0823)	0.0805 (0.0667)	0.0849 (0.0710)	0.7330* (0.3758)	0.3118* (0.1605)
personal_invitation	0.1351 (0.0977)	0.1881** (0.0806)	0.2020** (0.0843)	0.1342 (0.0967)	0.1838** (0.0801)	0.1778** (0.0848)	1.0211** (0.4289)	0.4351** (0.1830)
<i>Instrumental variable regressions</i>								
spillover_training	0.1873** (0.0831)	0.1801** (0.0817)	0.1714** (0.0808)	0.1111 (0.0945)	0.0879 (0.0762)	0.0934 (0.0813)	0.8311* (0.4338)	0.3535* (0.1852)
personal_training	0.1381 (0.1165)	0.2075** (0.0917)	0.2271** (0.0973)	0.1514 (0.1093)	0.2196** (0.0923)	0.2108** (0.0965)	1.1545** (0.4817)	0.4921** (0.2055)
<i>Reduced form regressions</i>								
spillover_invitation_OL	0.1677* (0.0850)	0.1859** (0.0810)	0.1414 (0.0915)	0.0747 (0.0934)	0.0626 (0.0764)	0.1172 (0.0796)	0.7495* (0.4222)	0.3181* (0.1806)
spillover_invitation_OM	0.1829** (0.0832)	0.1844** (0.0880)	0.1771* (0.0920)	0.1193 (0.1018)	0.1072 (0.0830)	0.0839 (0.0830)	0.8549* (0.4717)	0.3639* (0.2017)
spillover_invitation_LM	0.1429* (0.0814)	0.1225* (0.0732)	0.1382* (0.0743)	0.0967 (0.0864)	0.0727 (0.0747)	0.0667 (0.0750)	0.6397 (0.3978)	0.2723 (0.1696)
personal_invitation	0.1351 (0.0979)	0.1881** (0.0807)	0.2020** (0.0844)	0.1342 (0.0968)	0.1838** (0.0803)	0.1778** (0.0849)	1.0211** (0.4296)	0.4351** (0.1833)
<i>Instrumental variable regressions</i>								
spillover_training_OL	0.2000* (0.1054)	0.2217** (0.1013)	0.1687 (0.1086)	0.0892 (0.1080)	0.0747 (0.0878)	0.1398 (0.0903)	0.8940* (0.4939)	0.3795* (0.2112)
spillover_training_OM	0.3245* (0.1690)	0.3279** (0.1515)	0.3307* (0.1809)	0.2105 (0.1800)	0.2197 (0.1466)	0.1780 (0.1567)	1.5914* (0.8499)	0.6769* (0.3630)
spillover_training_LM	0.1282 (0.0876)	0.1030 (0.0737)	0.1113 (0.0780)	0.0834 (0.0859)	0.0434 (0.0775)	0.0382 (0.0764)	0.5075 (0.4039)	0.2162 (0.1720)
personal_training	0.1306 (0.1153)	0.2008** (0.0904)	0.2176** (0.0958)	0.1446 (0.1078)	0.2113** (0.0910)	0.2080** (0.0944)	1.1129** (0.4756)	0.4743** (0.2028)
N	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  $personal\_invitation$  respectively. For 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).

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



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 is scarce in our data set. 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 only included 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 non-invited 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 to overcome hindrances that they encounter when selling individually.

**Table 3: Perception of RPO at endline by intended treatment status**

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

## 5 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 paper, 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 towards successful collective commercialization. The 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 non-participants.

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, results suggest a strong spillover effect on non-treated members for trust in leaders, i.e., 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 non-costly interventions such as a group training appear to be able to positively affect intra-RPO trust and the farmer's perception of coordination towards successful collective action. Furthermore, social capital is often thought to increase with use, i.e., 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.

## **Acknowledgments**

We are grateful to FONGS, GRET and PINORD for a fruitful collaboration.

## **Funding Statement**

We gratefully acknowledge financial support from the German Science Foundation SFB 884 and the German Federal Ministry for Economic Cooperation and Development through the funding initiative for International Agricultural Research Centers and from the International Food Policy Research Institute Mobile Experimental Economics Laboratory.

## **Conflicts of Interest**

None.

## **Data availability statement**

Replication materials are available in the supplementary materials section of the article.

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# Appendix

## A Descriptive statistics

Table A.4: **Descriptive statistics by collective commercialization activity on RPO level (RPO characteristics and RPO averages of individual characteristics)**

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
<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 <sup>a</sup>	55.50	10.44	57.33	51.16	6.18**
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 <sup>b</sup>	11.94	18.56	12.08	11.58	0.51
groundnut	0.41	0.49	0.31	0.65	-0.34***
hectares <sup>b</sup>	3.56	2.88	2.91	5.30	-2.40***
heterogeneity	0.36	0.48	0.31	0.50	-0.19
household size <sup>b</sup>	12.71	4.09	12.58	13.05	-0.46
literate <sup>b</sup>	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 <sup>b</sup>	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 <sup>a</sup>	31.83	8.28	31.73	32.05	-0.32
vehicles	0.09	0.19	0.09	0.12	-0.03
year of creation <sup>a</sup>	1996.70	10.30	1996.40	1997.42	-1.02
year joined <sup>b</sup>	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.

<sup>a</sup> Information 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.

<sup>b</sup> Information 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 A.5: Descriptive statistics by collective commercialization activity on 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 <sup>a</sup>	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 <sup>b</sup>	14.32	24.24	14.22	15.00	-0.78
groundnut	0.47	0.50	0.42	0.82	-0.40***
hectares <sup>b</sup>	4.27	5.27	3.85	6.88	-3.02***
heterogeneity	0.35	0.48	0.31	0.58	-0.27***
household size <sup>b</sup>	12.97	7.02	12.96	13.06	-0.10
literate <sup>b</sup>	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 <sup>b</sup>	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 <sup>a</sup>	31.49	6.54	31.56	31.09	0.47
vehicles	0.06	0.33	0.05	0.11	-0.06
year of creation <sup>a</sup>	1997.14	10.49	1997.32	1995.99	1.34
year joined <sup>b</sup>	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.

<sup>a</sup> Information 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.

<sup>b</sup> Information 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 A.6: **Correlation between trust and collective commercialization**

<b>Panel A (N=538):</b> 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***	
<b>Panel B (N=69):</b> 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.

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