Extended Abstract

Paper/Poster Title	What affects smallholder farmers' willingness to cooperate? Evidence from public good games with different design elements in three African countries

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Abstract	*198 words max*

Innovation adoption by small producers is key to promoting sustainable food systems in developing countries. However, some innovations require collective management and thus cooperation. Public Good Games (PGGs) are a well-established typology of experiments to assess willingness to cooperate. We ran PGGs among smallholders in Kenya, Tanzania and Tunisia. In all the three countries, the decision was repeated twice, and in Kenya and Tanzania, we changed the design between rounds. In Tanzania, we alternated different multiplication factors, corresponding to Marginal Per Capita Returns to the public good of 0.2 and 0.15, respectively. In Kenya, we played one round with unequal (two levels) and one with equal endowment. We further controlled for group size and round-order effects. We find that contributions within the same round do not differ significantly depending on the rate of return, but players who faced a lower rate of return in the second round reduced their cooperation. Inequality of endowment did not decrease group-level contributions, but relatively poorer players contributed less both in relative and in absolute terms. We identify no group size effect, while relative cooperation levels persist between rounds. These findings can help derive recommendations for successful dissemination and management of collaborative innovations.

Keywords	Public Good Game; smallholder farmers; Africa; unequal endowment; rate of return; cooperation
JEL Code	**C71** Cooperative Games; **C93** Field Experiments; **Q12** Micro Analysis of Farm Firms, Farm Households, and Farm Input Markets

Introduction	*250 words*

In developing countries, the adoption of innovation is key to improving farm performance and thus building sustainable food systems that increase food security. However, innovation adoption is not a linear process, and is affected by complex and interrelated factors pertaining to the individual, the farm, the social, ecological and institutional context, and the characteristics of the innovation itself. If an innovation requires, or benefits from, collective management, then the ability to achieve sustainable cooperation is particularly relevant. We investigate what drives the willingness to cooperate of African small crop farmers by testing two treatments pertaining to the design of Public Good Games (PGG), namely endowment distribution and the rate of return. PGGs are a well-established typology of economic experiments whose participants face a dilemma between individual reward and the generation of a public good that benefits everyone in the same measure. They are used to elicit participants' willingness to cooperate or, equally, their care for the public good. If the decision is repeated and the participants are informed about the aggregated decisions of their

peers in the previous round, the outcome can also provide information about the evolution of cooperation, and whether this cooperation is sustainable. Our experiments can be categorised as 'artefactual field experiments' since they use a conventional protocol with a non-standard pool of subjects. Indeed, most of the literature using standard protocols relies on students from developed countries, while the experiments run in developing countries tend to be highly contextualised. We assess both individual and group-level behaviours.

Methodology	*248 words*

Within an international project, we ran lab-in-the-field experimental sessions among small-scale farmers. The sampling areas were purposively selected, and consisted either of a single village (Tanzania) or different villages in a district (Kenya, Tunisia). Where more than one village was involved, two-stage sampling was adopted, randomly selecting the villages and then farmers, with strata based on age, gender and farm size. Data collection took place between March and December 2021. Each session involved on average 20 farmers and included a two-round PGG, a lottery game to elicit risk attitudes, and a game to elicit time preferences. In line with experimental economic practices, the games were incentivised: participants received a show-up fee and a payoff whose amount depended on their and others' decisions. The payoffs were expressed in tokens, which were then converted at a rate ensuring the same average payoff at purchasing power parity across the countries. The final sample includes 1,486 farmers in 147 groups, of which 504 in Kenya, 482 in Tanzania, and 500 in Tunisia. In the PGG, participants were provided with an endowment they could keep for themselves, earning the corresponding payoff, or donate, partly on in full, to a common pool. The total group contribution to the common pool was increased by a multiplication factor and equally shared among the group regardless of individual contributions. Our variables of interest are individual and group-level contributions (in absolute terms and relative to the endowment), which are assumed to be influenced by the PGG design elements.

Results	*222 words*

First, contributions do not differ depending on the multiplication factor, but both in the Tanzanian and pooled samples we observe a significant decrease in individual contributions between rounds among the farmers facing the lower multiplication factor in the second round. This aligns with Bruttel and Friehe (2014),[1] who find that in repeated PGG, the players who have previously experienced high marginal returns contributed less once their return decreases. For group-level contributions, this dynamic is only significant in the pooled sample. Second, endowment inequality per se is significantly related to higher absolute and relative contributions at both individual and group level, which is in line with Gueye et al. (2020).[2] The farmers who were in an unequal setting in round 1 tend to reduce their contribution in round 2. The farmers with low endowment contribute less than those with high endowment in both absolute and relative terms, and decrease their relative contribution significantly in the second round, while increasing it in absolute terms. Third, we detect no significant group size effect. Fourth, the farmers who contributed a larger share of their endowment compared to their group in the first round, reduce their contribution in the second

[1] Bruttel, L. and Friehe, T. (2014). Can short-term incentives induce long-lasting cooperation? Results from a public-goods experiment. *Journal of Behavioral and Experimental Economics* 53: 120-130.
[2] Gueye, M., Querou, N. and Soubeyran, R. (2020). Social preferences and coordination: An experiment. *Journal of Economic Behavior and Organization* 173: 26-54.

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round, but they also contribute significantly more in the second round, both in absolute and relative terms. This result is in line with Bigoni and Suetens (2012).[3]

Discussion and Conclusion	***245 words***

By analysing the dynamics of individual- and group-level contributions under different treatments, we identified elements that may affect cooperation among African small-holders, allowing us to draw recommendations in terms of policies to promote the uptake of innovations that may require collective management through farmers' groups. Some of these elements affected the efficiency of cooperation, but not always in the expected direction. First, if the return to the public good declines compared to what farmers were used to, cooperation is likely to be negatively affected. Hence, we recommend against dissemination strategies promising unrealistically high returns: it is preferable to adopt a cautious approach and make the risks clear. Second, the presence of farmers endowed with different amounts of resources is unlikely to be a challenge. Involving rich farmers might rather increase the group's investment in innovations, and ensure the presence of potential early adopters (innovation champions), besides supporting relatively poorer farmers. Third, the involvement of larger groups is unlikely to be an obstacle to cooperation either, and can rather help spread risks (including those related to free-riding). Finally, cooperation is likely to deteriorate over time, especially among the groups which are initially less successful. To avoid the gap from widening progressively, constant support through organisational structures (cooperatives, NGOs) is needed. It is important to highlight that our PGGs were run in specific regions and consisted of only two rounds: further experiments involving more regions and with larger numbers of rounds are needed to confirm our findings.

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[3] Bigoni, M. and Suetens, S. (2012). Feedback and dynamics in public good experiments. *Journal of Economic Behavior and Organization* 82(1): 86-95.

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