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Do decentralized innovation systems promote agricultural technology adoption? Experimental evidence from Africa

Haki Pamuk [a], Erwin Bulte [a,b,*], Adewale A. Adekunle [c]

[a] Department of Economics, Tilburg University, Box 90153, 5000 LE Tilburg, Netherlands
[b] Development Economics Group, Wageningen University, Box 8130, 6700 EW Wageningen, Netherlands
[c] Forum for Agricultural Research in Africa (FARA), Ghana

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ABSTRACT

We use experimental data collected in 8 African countries to investigate whether a decentralized approach can promote the adoption of agricultural innovations. This participatory model is based on the creation of so-called 'innovation platforms' where local stakeholders meet and seek to identify problems and prioritize solutions. While we document evidence that the participatory model robustly promotes the adoption of crop management innovations across all research sites, we do not find significant effects for other domains of innovation. We also document considerable heterogeneity in terms of local priorities, and show that not all innovation platforms are equally successful. We present tentative evidence that the performance of these platforms depends on specific dimensions of ex ante social capital.

Introduction

Agricultural intensification and development is widely seen as a pre-condition for sustainable pro-poor growth in Africa (Haggblade et al., 2007; Christiaensen et al., 2010; Ligon and Sadoulet, 2007; WDR, 2007). An important component of many agricultural development strategies is the promotion of (the adoption of) innovations. Slow rates of innovation and adoption in African smallholder farming are a key factor explaining stagnating agricultural yields across the continent. The reasons for imperfect adoption are many, and include factors associated with the innovations themselves (which may not be suitable for risk-exposed smallholders or may imply demands on complementary inputs that are not always available), with the context (infrastructure, trading opportunities) and with the farming households (demographic factors, but also access to credit or attitudes towards risk). Important research in this field includes contributions by Feder et al. (1985), Liu (2013), Rogers (1995), Sunding and Zilberman (2001), and Suri (2011).

Another factor responsible for lagging adoption rates is the design of most extension programs, which by and large is based on the perspective that the diffusion of innovations resembles a 'linear process'. According to this perspective, key agricultural innovations are created by specialists (researchers), distributed by other specialists (extension workers), and adopted by producers (Leeuwis and van den Ban, 2004; Knickel et al., 2009). Such linear diffusion processes have been challenged by recent insights emphasizing social learning within (non-linear) networks (e.g., Bandiera and Rasul, 2006; Conley and Udry, 2010), and by academic work that identifies heterogeneity among smallholders so that 'blanket recommendations' are unlikely to be relevant for large swaths of the farming population (Duflo et al., 2008; Suri, 2011). These issues, combined with problems due to insufficient public funding and perverse incentive effects, have prompted policy makers and academics to probe alternative innovation and diffusion modalities. For example, capacity building and farmer empowerment have gained in importance in recent years, at the expense of more prescriptive approaches (WDR, 2007).

One recent attempt to revolutionize innovation and diffusion processes in rural Africa is the so-called Sub-Sahara African Challenge Program (SSA-CP; see below). Unlike conventional, top-down extension approaches, the SSA-CP articulates an "innovation system" perspective, integrating and building on knowledge and preferences from stakeholders across the production and distribution chain. Innovation systems are intended to be "participatory", and seek to engage not only research experts but also representatives from appropriate government bodies as well as producers, intermediaries, customers, and financial organizations. These stakeholders are brought together in so-called local "innovation platforms", enabling bottom-up searches for solutions to local bottlenecks. It is not evident whether the traditional, centralized model or the participatory model represents the most efficient and effective vehicle to promote agricultural development. While economies of scale in

* Corresponding author at: Development Economics Group, Wageningen University, Box 8130, 6700 EW Wageningen, Netherlands.
E-mail addresses: h.pamuk@uvt.nl (H. Pamuk), erwin.bulte@wur.nl (E. Bulte), c.aadekunle@fara-africa.org (A.A. Adekunle).

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innovation and transfer argue in favor of standardized, centralized approaches, the decentralized approach allows tapping into local knowledge about constraints, possibilities and priorities which may enhance local demand for innovations on offer.

In a companion paper we have analyzed and compared the poverty impacts of traditional extension approaches and the decentralized innovation system approach (Pamuk et al., 2012). Based on experimental data collected in selected villages in the DRC, Uganda and Rwanda, we found that the decentralized innovation systems approach outperforms the traditional linear extension model in terms of poverty alleviation. However, we also documented considerable heterogeneity in performance across localities, and were silent on the mechanism linking innovation systems to poverty impacts.

The main objective of this paper is to identify the impact of decentralized innovation systems on the adaption of different agricultural technologies, a potential mechanism linking innovation systems to poverty impacts. In addition, we explore whether the benefits of the "innovation system" approach are widely shared within rural communities, or whether local elites are able to capture most of them (i.e., we probe the issue of intra-platform heterogeneity). As before, we will base our analysis on experimental data collected during implementation of the SSA-CP (see below). However, unlike the earlier analysis we will not focus on one specific learning site – the poverty analysis was based on data from Central Africa only. Instead, we pull together data across all program sites in West, Central and Southern Africa. In addition, we will move beyond village-level variables (i.e. poverty rates), and focus on household-level adoption and dis-adoption data.

Our main results support and complement the findings in Pamuk et al. (2012). Specifically, we identify one rather robust impact of innovation platforms on farm management across project sites – potentially a channel via which poverty rates are reduced. In addition, while we document heterogeneity across platforms, reflecting that decentralized solutions reflect diversity in local priorities and challenges, we find no evidence of elite capture, or intra-village differences in impact. Finally, we are not able to document any impact for a subsample of the platforms, and provide tentative evidence that the impact of the innovation systems approach varies predictably according to local initial conditions.

This paper is organized as follows. In Program description: The SSA-CP we briefly summarize key elements of the Sub Sahara African Challenge Program, and the nature of its main intervention—the creation of innovation platforms in selected villages. Data and identification strategy summarizes our data and identification strategy. In Estimation results we present the results, paying most attention to the household-level impacts of innovation platforms in terms of farm management. Conclusions and discussion concludes.

Table 1
Sampling frame.

Survey	Unit of analyses	Intervention	Control	Total
Baseline	Households	1589	1572	3161
	Villages	159	165	324
Midline	Household	1484	1554	3038
	Villages	156	164	320

Table 2
Definitions of outcome variables and comparison of average level of outcome variables and households characteristics at IAR4D and control villages in baseline.

Variable	Definition	Comparison of outcome and household characteristics in baseline
Outcome variables		$\overline{Y}_{IAR4D} - \overline{Y}_{Control}$
Totsw	Total number of soil and water management technologies adopted (0–6)	0.0515 (0.0864) [2725]
Totsf	Total number of soil and fertility management technologies adopted (0–7)	0.257** (0.103) [3035]
Totcm	Total number of crop management technologies adopted (0–5)	0.0383 (0.126) [2863]
Totph	Total number of post harvest technologies adopted (0–6)	0.0821 (0.134) [2899]
Control variables-household characteristics		$\overline{X}_{IAR4D} - \overline{X}_{Control}$
Gender	Equals 1 if household head is male, 0 otherwise	−0.00843 (0.0381) [3109]
Age	Age of household head	−1.049 (0.706) [3144]
Education	Equals 1 if household head has over primary education, 0 otherwise	−0.0252 (0.0225) [2815]
Household size	Total number of members of household	−0.380 (0.480) [3132]
Agricultural experience	Years of agricultural experience of household head	−1.261 (0.851) [3104]

Robust standard errors clustered at village level in parentheses and numbers of observations are in brackets.
* $p < 0.1$.
*** $p < 0.01$.
** $p < 0.05$.

Program description: The SSA-CP

In 2004 the Challenge Program (SSA CP) introduced a new approach to promoting innovation and diffusion of innovations in African agriculture. This so-called Integrated Agricultural Research for Development (IAR4D) approach was based on an innovation systems perspective, and created coalitions of stakeholders to identify and address local bottlenecks to agricultural development. Through this approach, the program aims to promote agricultural innovations by utilizing indigenous knowledge of the farmers through a participatory framework and interaction between different stakeholders.

A central concept in this approach is the so-called innovation platform (IP), which are decentralized local innovations systems. IPs are vehicles to bring together stakeholders. Each IP serves a group of villages, and theoretically chooses representatives from different stakeholders via a participatory process. These representatives of farmers' associations, traders, researchers, extension workers, NGOs, and government policy makers regularly meet at these platforms, articulate their views, and negotiate joint strategies for action. In light of diversity in challenges across localities, one would expect different IPs to prioritize different problems and to formulate different strategies for action such as research and adoption of new agricultural technologies, crops, introduction of new natural resource management practices, institutions––IPs should be a springboard for participatory and bottom up processes. In addition, the IPs should engage the broader communities within which they are operational by raising awareness and the spreading of information via assigned IP members (FARA, 2008).

The Forum for Agricultural Research in Africa (FARA) coordinates the implementation of the SSA-CP. To provide "proof of concept", the IAR4D program was rolled out as a large experiment, whereby some communities received IPs (treatment communities)