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The power of video to trigger innovation: rice processing in central Benin

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Understanding how to stimulate innovation among farmers and processors is crucial for attaining sustainable agriculture. To explore how farmer-to-farmer learning videos and training workshops changed women's rice processing practices, we interviewed 200 women and 17 women's groups in 20 villages in central Benin, including four villages which had received no intervention at all. Video on improved rice parboiling (a process whereby paddy is pre-cooked by steam without touching the water) had reached three times more women (74%) than hands-on training workshops organized by local NGOs and contributed to more equitable knowledge sharing within communities. In the villages where the NGOs had shown the video, 24% of the women started to use the improved parboiler equipment individually and 56% collectively within their group, compared to none in the control villages. About 92% of the women who attended both video and workshops developed creative solutions based on the idea of pre-cooking paddy with steam, compared to 72% for those who learned only through video. Fewer women innovated after learning through workshops only (19%) and after being informed by their peers (15%). Video watching also made women pay attention to reducing the loss of steam and to use local resources innovatively to conserve energy. More than 90% of the women who watched the video improved the quality of their parboiled rice, for example, by removing dirt, washing rice several times and drying rice on tarpaulins. Workshops stimulated innovations less than video did. Farmer-to-farmer video has great potential to enhance sustainable agriculture by encouraging local innovations.

Keywords: behavioural change, innovation, learning, sustainable agriculture, training, video

Introduction

In neoclassical economics, innovation is seen as a response to changes in the relative abundance of factors and their costs. This assumes a causal link between economics and agricultural research and development and farmers' adoption (Rogers, 1995). This model has been criticized because it does not take into account the origin, nature and dynamics of innovation, particularly within the context of developing countries (Röling & Engel, 1992). Moreover, it gives insufficient attention to distribution and equity in innovation (Hall *et al.*, 2001).

The theory of innovation systems explains the role of various actors in innovation, the nature of their interactions and institutions that structure innovation (Spielman, 2005). Various authors (for instance Ekboir & Parellada, 2002; Hall *et al.*, 2001; Oyelaran-Oyeyinka, 2006; Van Mele *et al.*, 2005) have defined innovation systems in various ways, generally reaching a consensus on: practical

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knowledge, novelty, accumulation, creative use of knowledge, diversity of actors, complexity of the interactions between actors and the role of institutions.

The adoption of an innovation starts with a mental process in which a person acquires enough knowledge to decide to make a change (van den Ban *et al.*, 1994). Prochaska *et al.* (1992) suggest that behavioural change occurs in stages or steps that are neither unitary nor linear, but a cycle of adoption, maintenance, relapse and re-adoption over time. Innovations of interest to the poor are often neglected, unsupported or even undermined and repressed, when they are seen as affecting the status quo of power relationships at the local, national, or global levels (Berdegué, 2005).

To achieve sustainable agriculture, the capacity of rural people to innovate and engage with evolving markets in an equitable and environmentally friendly way has to be strengthened. During the transition period towards sustainable agriculture, farmers must experiment more, and so incur the costs of making mistakes as well as of acquiring new knowledge and information (Pretty, 2006). Farmers must first invest in learning (Bentley *et al.*, 2003; Röling & Wagemakers, 1998). Creating conducive learning opportunities is, therefore, a major condition to the move towards sustainable agriculture. Considering the weak rural institutions in West Africa, with the exception of the market trader with their sense for business and entrepreneurship (Röling *et al.*, 2004), particular attention needs to be paid to enhance learning opportunities for the marginalized poor, women and youth. Earlier experiences in Bangladesh showed that farmer-to-farmer learning videos on rice seed health triggered rural women to innovate and become rural entrepreneurs (Van Mele *et al.*, 2007). As videos are easily integrated with other rural learning approaches (Van Mele, 2008), the transaction cost for farmers to get exposed to a wide range of new ideas can be significantly reduced. Also, as most staff within advisory services are men and rural development interventions are often male-biased (see for instance Katungi *et al.*, 2008; Lahai *et al.*, 2000; Squire, 2003), video can help to overcome this gender bias.

The Africa Rice Center (WARDA) has developed a series of videos to support the many existing and emerging actors now contributing to rice development. In the rice parboiling video discussed in this paper, rural women in Benin present an improved, more energy-efficient way of parboiling (reduction of vapour loss, use of a more energy-efficient stove) to enhance the quality of rice. Because the poor may not be able to afford even relatively inexpensive innovations, such as metal pots for parboiling rice, we investigated to what extent the parboiling video could stimulate rural women to innovate with new knowledge and available resources. We compare the role of conventional training (workshops) versus video in triggering technical innovations in rice parboiling in central Benin. In this paper we consider a technical innovation to be a new way of parboiling rice by applying the basic principle of the improved technology (pre-cooking by steam). We conclude by discussing how farmer-to-farmer learning videos can trigger creativity and help rural people innovate for sustainable agriculture.

Conventional training

Following the creation in Benin of the Centre d'Action Régionale pour le Développement Rural (CARDER) in 1975, various extension approaches were implemented, including: (1) the integrated rural development approach; (2) the Training and Visit system (T&V); and (3) the local network of professional extension agents in the national extension system (Tossou, 1996). The T&V system was the principal agricultural extension approach in the country from 1985 to 1999, promoted by the World Bank and implemented by CARDER. This approach was based on producing large amounts of purely technical advice, using standardized, detailed and rigorously monitored schedules of contact farmer visits and staff training sessions. T&V drew heavily on the adoption and diffusion of innovation (Leeuwis, 2004). However, farmers were unsatisfied with the extension activities, because their real needs were not taken into account (Moumouni, 2005).

As in most African countries, agricultural extension services in Benin face numerous challenges and are under constant pressure to respond to farmers' needs and to show the impact of their activities. This pressure on extension services calls for changes in the traditional public extension systems, which are now seen as outdated,

top-down, paternalistic, inflexible, bureaucratic and inefficient, and therefore less able to cope with the dynamic demands of modern agriculture (Rivera & Zijp, 2002).

In this study, the conventional extension method was a two-day community workshop during which experts from four local NGOs (Castor, LDLD, Rabemar and Un Monde) showed women how to parboil rice with the improved equipment. Although the technology had been improved based on feedback from end-users and local artisans, the actual workshop resembles the traditional extension system which teaches farmers to adopt ready-made research outputs.

Farmer-to-farmer learning video

Participatory methods such as Participatory Learning and Action Research (PLAR) and Farmer Field Schools (FFS) focus on learning among farmers, testing and modifying technologies, and building social cohesion (e.g. Isubikalu, 2007). Nevertheless, scaling up of such participatory approaches remains a key challenge (Bentley, 2009; Van Mele *et al.*, 2005). To address this, Paul Van Mele started experimenting with farmer-to-farmer videos drawing on participatory methods. PLAR is an approach inspired in part by the FFS, with more emphasis on generating technology with farmers, specifically for smallholder rice farmers in Africa. A novel way of scaling up participatory methods is for farmers who have graduated from PLAR or FFS to share their learning and innovations with their peers through video.

WARDA developed an approach called zooming-in zooming-out (ZIZO) to guide organizations in producing low cost, high quality videos that are locally appropriate and regionally relevant (Van Mele, 2006). Zooming-in zooming-out starts with a broad stakeholder consultation to define regional learning needs. Then communities are approached to get a better understanding about their ideas, knowledge, innovations and the words they use to describe the topic. During this phase, farmers are ideally engaged in PLAR- or FFS-type activities (zooming-in). This allows them and the researchers to learn from each other while perfecting or modifying the technology to fit the local context. Videos are then produced with a few selected communities, communicating basic ideas as much as ready-made technologies. When showing the draft videos to other villages, new innovations may be identified and incorporated and unclear parts clarified (zooming-out).

In this paper, we assess the video 'Cashing in with parboiled rice', developed by WARDA, the National Research Institute in Benin (INRAB) and the NGOs Sasakawa Global 2000 (SG2000) and Songhaï Centre. (To watch this and other rice videos and to explore where you can obtain a copy, please visit http://www.warda.org/warda/guide-video.asp). The video was produced with rural women who had been testing and fine-tuning the improved parboiling equipment in Benin for three years. The video was originally produced in French and Fon, a local language. In addition to conventional training workshops, the four local NGOs (Castor, LDLD, Rabemar and Un Monde) organized video shows in 80 villages in central Benin with technical and financial support from WARDA and the international NGOs Veco-Benin and Helvetas.

Rice parboiling methods

Parboiling makes rice easier to process by hand, enhances its nutritional value and reduces its breakage rate at milling. Rice is parboiled in many Asian and African countries. In Benin, rice parboiling is exclusively an income generating activity for women and girls in rice producing villages.

Traditional methods of rice parboiling

In central Benin, parboiling is a major economic activity whereby women rely on several traditional methods. Paddy is soaked in either cold or hot water for 12 hours (in other regions soaking can be as long as 72 hours) in a large aluminium pot. The rice paddy is then drained and pre-cooked in the same pot in a small amount of water. So the paddy at the top may not be entirely steamed while the bottom is entirely cooked, resulting in a very heterogeneous product at milling. After pre-cooking, the paddy is dried in the sun for some days, usually on rocks or on the ground where the parboiled rice is often mixed with sand and stones.

Improved method of rice parboiling

The improved parboiling equipment consists of a large, metal pot with a perforated bottom that is placed on top of a large aluminium pot containing water (Figure 1). The equipment can be made by local artisans with available materials and skills. The principle behind this improved technology is that after soaking the paddy, it is transferred to the top container and pre-cooked with steam, without the paddy touching the water. This improved method formed the key content of the conventional training and the learning video, as summarized in Table 1.

Method

The study was conducted from November 2007 to May 2008 in five municipalities in Collines, central Benin, where the four local NGOs operate. The study covered 16 villages where the parboiling video had been shown in 2006 and where conventional training was done once from 2005 to 2007 (four villages per NGO). It also covered four villages where no intervention had taken place (one village per NGO).

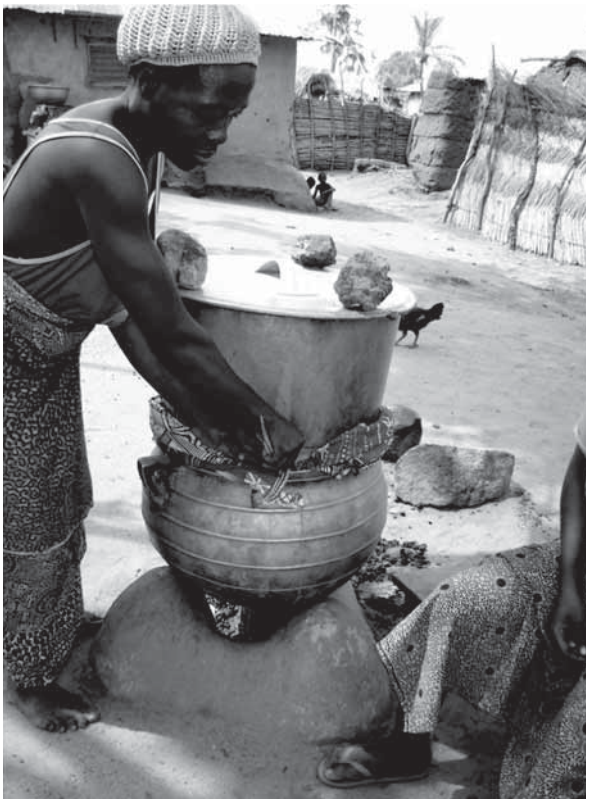

Figure 1 Women in Zongo village in Benin demonstrate how they use the improved parboiler. Cloth is wrapped around the junction between the vat and the pot to prevent steam from escaping. Stones keep the lid from lifting during the cooking. This parboiler is a prototype version. The final version has small locks to close the lid tightly.

We started by collecting qualitative data through focus group discussions (to get an idea about the role of parboiling at the village level), participant observation (to analyse how the women applied the learning from the video in practice), photography (to illustrate the technological innovations) and semi-structured interviews (e.g. to understand various social dimensions influencing parboiling as a rural enterprise).

Based on in-depth insights from the qualitative research phase, we formulated a structured questionnaire. We individually interviewed 200 women processors selected at random (10 women per village). We also interviewed all women's groups existing in these villages (17 women's groups in total) and NGO staff (three per NGO). Data from the structured interviews conducted in the 16 villages where video had been shown ($n = 160$) were analysed with the binomial logistic regression model.

Results

Most of the surveyed women were married (86%); between 25 and 40 years old (73%); and most of them were illiterate (70%). Only 22% had primary education while 5% could read and write their local language. The mean household size was 6.3 ± 2.3 members. The women's principal livelihood activity was agriculture (100%) and rice parboiling was the major secondary activity (90%). The video and workshop reached respectively 74% and 22% of women in villages where interventions had taken place.

Untrained women

In villages where the video was not shown, the improved parboiler was not used. From these control villages, only two women had seen the improved parboiler once during a conventional training held in another village. These two women did not use the improved equipment, but rather innovated based on its principle of pre-cooking

Table 1 Key steps and ideas for improved rice parboiling

Topic	*Key steps and ideas*
(1) Washing	• Properly wash paddy in a basin full of water (3 L for 1 kg of paddy). • Pour the cleaned paddy into a basket to drain the water.
(2) Soaking in hot water	• Pour the paddy into a pot with clean water and heat it up to 60 °C. • You can use your fingers to test the temperature. When the water gets so warm you can no longer dip your fingers into it, remove the cooking pan from the fire. • Let the paddy cool overnight.
(3) Washing	• Remove the paddy from the water. • Wash it with clean water and drain it in a basket.
(4) Pre-cooking with steam	• Pour the paddy into the parboiling vat previously placed on top of a pot containing about 10 L of water. To avoid cooking the rice, the water in this pot must not touch the bottom of the vat. • Boil the water. The steam passes through the holes in the vat and pre-cooks the rice. • Stop boiling when you observe that most of the husks on top are opened. This is usually in less than half an hour.
(5) Drying	• Dry the parboiled paddy in the sun on tarpaulins or on drying areas for less than two hours. Drying in the hot sun for too long can cause the grain to crack (as happens with clay or earthen pots that dry too fast). • Properly spread and continue drying in the shade on a tarpaulin. • Test the rice between your teeth to check if it is dry enough to mill. When dry enough, it gives a dry cracking sound.

rice by steam. Nevertheless, they had not shared this information with their peers.

Women adopt the equipment if given access to it

In the villages where the local NGOs had intervened and facilitated access to the improved parboiler, 58% of the women started to use the improved equipment, individually (24%) or in a group (56%).

Without individual access to equipment, women innovate

Of those women who did not have individual access to the technology, 67% creatively, applied both the ideas of pre-cooking paddy with steam and conserving steam during rice parboiling. The different innovations that women came up with are described in Tables 2 and 3.

Video stimulates more innovation than conventional training

Women were subsequently classified into five types: (1) those who learned from conventional training (workshops); (2) video only; (3) both video and conventional training; (4) friends and neighbours; or (5) those who had no information on improved parboiling. About 92% of the women who learned about improved rice parboiling through both video and workshops innovated based on the idea of pre-cooking paddy with steam, compared to 72% for those who learned only through videos (Table 4). Fewer women innovated after learning

Table 2 Technological innovations based on the principle of parboiling paddy with steam ($n = 160$)

Innovation 1	***Innovation 2***	***Innovation 3***	***Innovation 4***
Women adapted a perforated base to their pan to pre-cook the paddy with steam (Figure 2) (17.5%)	Women who cook local couscous with steam started to use the same equipment to parboil their rice (2.5%)	Women put wooden sticks in the pot and cover these with a bag before putting paddy for parboiling (Figure 3) (10.0%)	Women put yam fibres between wooden sticks and bag before putting the paddy (Figure 3) (1.2%)
Innovation 5	***Innovation 6***	***Innovation 7***	***Innovation 8***
Women put a bowl upside down into a pot with a little water and place a bag on top of the bowl before adding paddy (10.0%)	Women put paddy in a locally sold sieve, placed on top of pot with water (2.5%)	Women used a basket adapted to the pot so that the basket does not touch the water in the bottom of the pot (13.7%)	Women placed wire at the bottom of the pot containing a little water. A bag was put on the wire before rice was added (1.2%)

Table 3 Technological innovations made by women to seal the junction between pot and parboiling equipment for steam conservation ($n = 160$)*

Innovation 1	***Innovation 2***	***Innovation 3***	***Innovation 4***	***Innovation 5***
A mixture of cassava flour and water is applied at junction (11.9%)	A mixture of cooked maize flour with water or akassa (local meals) (26.2%)	A mixture of ash from firewood with water (3.1%)	A mixture of clay and water (6.2%)	The use of clothes to close junction (58.1%)

*Some women combined the use of clothes with cassava flour or other mixtures.

Figure 2 After having watched the video, women in Dokoundji village in Benin adapted a perforated base to their pan on which the rice paddy is put to be pre-cooked by steam generated by water in the pot. This technology is the same that women in Mondji village use to cook wassa-wassa, a local couscous.

through workshops only (19%) and after being informed by their peers (15%).

Apart from the technical innovations mentioned above, in villages where the video was shown, nearly all women changed rice handling practices (before and after the rice is parboiled). In control villages where no intervention had taken place less than 19% of the women properly handled their rice (Table 4). The quality of the parboiled rice was further improved by removing dirt from rice, washing rice several times and drying rice on tarpaulins. Training workshops and learning from their peers proved far less powerful in changing behaviours and strengthening innovation capacity.

Determinants of technological innovations

Using the answers to the structured questions of the 160 rural women surveyed, we used a logistic binomial regression model to assess which factors affected the development of technological innovations based on the idea of pre-cooking paddy

Figure 3 (a) After having watched the video, and without access to the improved technology, women in central Benin used sticks to ensure that the rice no longer touches the water during the steaming process. (b) In Dani village, after putting water and wooden sticks at the bottom of the pot, women put dried yam stalks. (c) Then, they put a jute bag on top of it before putting rice for parboiling.

with steam (Table 5). The factors included in the model are: video watching, marital status, age, number of dependents in the household, years of formal schooling, importance of rice parboiling activity, experience, religion, member in a farmers' organization, awareness of the importance of rice parboiling, self motivation, parboiling for profit, quantity of rice parboiled per year and the individual use of the improved rice parboiling equipment. Table 5 shows two significant variables, namely video watching ($p < 0.01$) and individual use of the improved equipment ($p < 0.05$).

Watching the learning video

The logistic model shows that women who had watched the learning video were more likely to innovate. The odds ratio is equal to 0.07. This means that women who did not watch the learning video were 93% less likely to innovate compared to those who had watched the learning video. Watching the video increased the probability of innovating. After watching the video, women understood the principle and need of pre-cooking rice paddy with steam. Those who did not have adequate capital to buy

Table 4 Percentage of women who changed their practices and who innovated with parboiling by steam and reducing vapour loss after different exposures ($n = 200$)

Category	*Conventional training only (n = 32)*	*Video only (n = 83)*	*Video and conventional training (n = 13)*	*Information from colleague (n = 34)*	*No information on the technology (n = 38)*
Remove dirt from rice	96.9	100.0	100.0	91.2	15.8
Wash rice two to three times	96.9	100.0	100.0	88.2	15.8
Innovate with parboiling by steam	18.7	72.3	92.3	14.7	0.0
Reduce vapour loss	21.9	86.7	92.3	14.7	0.0
Dry rice on tarpaulins	59.4	98.8	100.0	79.4	18.4
Remove shoes when turning the paddy over	40.6	96.4	100.0	70.6	0.0

Table 5 Influence of factors on women innovating with the principles of parboiling by steam ($n = 160$)

Variables	*Estimated parameters**	*Standard error**	*Probability**
Video watching	2.601	0.609	0.00[1]
Marital status	−0.079	0.286	0.783
Age	0.027	0.027	0.315
Number of dependents in the household	0.012	0.101	0.904
Years of formal schooling	−0.120	0.173	0.488
Importance of rice parboiling activity	−0.022	0.307	0.942
Experience	0.023	0.037	0.525
Religion	−0.016	0.210	0.940
Membership of a farmers' organization	0.493	0.426	0.247
Awareness of importance of rice parboiling	−0.378	1.194	0.751
Motivation of women	0.589	1.218	0.629
Parboiling for profit	−0.087	0.712	0.90
Quantity of rice parboiled per year	−0.244	0.127	0.054
Individual use of improved rice parboiler	−0.938	0.417	0.024[2]
Constant	−3.543	1.624	0.029
Chi-square = 43.875[1]			

*Logistic binomial regression model.
[1,2] significant at the 1% and 5% level, respectively.

the improved parboiler innovated based on its principles, but using local materials that were less costly than the metal pots. Besides the parboiler, in the video women also observed an improved stove that consumes less wood. Women later asked NGOs to train them to make improved stoves. Staff from the local NGOs reported that in the 80 villages where they had shown the video, 188 women were trained to make stoves, which were built in 16 villages with technical and financial support from the international NGOs.

Individual use of the improved equipment

The logistic model shows that women who lacked financial support to buy the improved parboiler innovated more. The estimated parameter is −0.938 and the odds ratio is 0.35 indicating that women who had the improved equipment at their disposal had 65% less tendency to innovate than women who did not.

Discussion

We have presented findings about how to strengthen innovation capacity in rural communities through the use of properly planned, low cost, high quality videos. Video proved a powerful medium for farmer-to-farmer extension and to expose rural communities to new ideas and practices. Finding ways to scale up farmer-to-farmer learning is becoming increasingly important in a rapidly evolving social, environmental and economic environment. To illustrate the urgency,

across Africa the consumption of rice is increasing at a rate of 4.5% per year, partly due to urbanization and changes in food habits (Seck *et al.*, 2008). Urban consumers have become accustomed to imported quality rice. However, the recent food crisis has shown the volatility of global markets and its undermining effect on food security and subsequent political stability of African nations (Seck *et al.*, 2008). As various traditional rice exporting countries in Asia can no longer guarantee to meet local demands, rural people across Africa will increasingly need to cater for urban demands, which imply higher food quality standards. Conventional training approaches are unlikely to be able to trigger change at the required speed and scale.

The adaptations by Benin women to improve rice processing after having watched video illustrate the power of video to quickly stimulate creativity among rural people, who are much more than passive technology consumers. Women have the ability to innovate with local resources, based on their endogenous and newly acquired knowledge. Once farmers know and understand the basic principle of a new technology (pre-cooking rice by steam) they are able to innovate based on the underlying principles and using locally available resources. They even observe secondary details (like the improved stoves) and seek out more information about them.

Farmer's innovations are often shaped by capital limitations and mainly rely on locally available resources, of which knowledge is a key one. Exposure to new ideas drives change. A recent inventory by the Forum for Agricultural Research in Africa (FARA) shows how the majority of the initiatives around rural Information and Communication Technologies (ICT) and the use of mobile telephony in agriculture is donor or at least externally driven. Besides, web and text-based information platforms are often in the English language. As the African farmer is faced with poor infrastructure, low literacy and limited colonial language use, such models of information delivery have proved to be largely ineffective (Gakuru *et al.*, 2009). Media, such as video, TV, rural telephony and radio, could have significant effects on rural development, but have remained undervalued in national and regional agricultural policies. Policies must provide an enabling environment to support sustainable agriculture based on locally available resources, local skills and knowledge (Pretty, 1998). To mobilize and enhance rural skills, policies that enable rural people to have better access to audio and video-based information services should at the same time support the involvement of rural people in content creation, as is done in the zooming-in zooming-out approach (Van Mele, 2006). To make this happen, opening up of the traditional research and extension systems to the value of local innovations is a necessary first step in this direction (Wettasinha *et al.*, 2008).

Our research has also illustrated that sustainable agriculture must take into account farmers' creativity to adapt basic principles of new technologies to local realities. To pre-cook rice with steam, women who could not afford the improved parboiler, came up with various innovative ways to prevent the rice from touching the water during this crucial stage of parboiling. Videos that show how farmers have implemented new ideas will encourage more farmers to experiment with new technology, whether these originate from research institutes, companies or fellow farmers.

Adoption and experimentation were influenced by the way women learned. The videos and workshops seemed to be mutually reinforcing. Videos stimulated innovations more than conventional training through workshops alone. Properly planned and well-made farmer-to-farmer learning videos proved most powerful in changing women's practices and capacities to innovate, as was the case in Bangladesh (Van Mele *et al.*, 2007).

Besides being more powerful, video was also able to reach many more people than conventional training (workshops). So far, partners in Senegal, The Gambia, Benin, Nigeria and Ethiopia have made local translations of the parboiling video in order to reach many women rice processors. By 2008, WARDA partners had translated the various rice videos into 20 African languages. The videos had strengthened capacities of more than 400 organizations and 130,000 farmers. This illustrates the importance of farmer-to-farmer videos in strengthening the increasingly fragmented organizational landscape in rural learning and innovation systems. Although many development interventions are male-biased, videos can give voice to rural women and help to overcome gender bias and blindness in rural development and in sustainable agricultural production in sub-Saharan Africa. Apart from strengthening

technical innovation capacity among rural people, women in particular, the parboiling video also triggered a range of organizational and actor linkage changes, which will be presented in a separate paper by the same authors. As the FARA report (Gakuru *et al.*, 2009, 21–22) concluded: 'Innovative farmer information systems are a blended learning process in which face-to-face interaction, learning by doing, learning through evaluation and experience, participatory research, etc. convert the generic information into location specific knowledge and then empower its members through horizontal transfer of knowledge.'

Conclusion

Local innovations better reflect the realities of rural people than do outsider techniques. Sustainable technologies should be taught along with the basic principles underlying them. Farmer-to-farmer learning video is an excellent way to illustrate these principles and to encourage rural people to create their own innovations.

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