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Lauréano Bede , Florent Okry & Simplice D. Vodouhe

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Video-mediated rural learning: effects of images and languages on farmers' learning in Benin Republic

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ABSTRACT

Training videos are extension tools that help to compensate for the low ratio of extensionists to farmers in most developing countries. This article reports on a study that aimed to understand the effects of images and languages used in a video on farmers' learning. The research involved 135 rice farmers in Benin Republic, and found that videos in the local language significantly improved assimilation and understanding. Repeated screenings increase farmers' learning, regardless of the language used, as videos allow learning from images. Farmers' associations and peer groups ensure better appropriation and dissemination of the knowledge gained from the videos by providing frameworks for discussion.

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Introduction

The lack of extension services is often cited as one of the causes of low agricultural productivity in Africa (CTA 2012). Agricultural extension is not only the transfer of technological packages developed by researchers, but also the sharing of experiences and effective techniques between local farming communities. Several extension methods and approaches have been used in previous decades. Common extension approaches include the general extension programme, the project approach, training and visit, and participatory rural appraisal (PRA) (Axinn 1988; Chambers 1994). Some of these approaches aim at providing first-hand information and advice tailored to the specific circumstances and needs of farmers (Karubanga et al. 2016). Despite the effectiveness of these methods, rural farmers do not have access to many good practices and knowledge to improve their skills and become better organised to take advantage of market opportunities.

In the rapidly changing African context, ICT provides considerable support to agricultural extensionists in their efforts to disseminate innovative practices. Televisions, radios, videos and telephones can greatly enhance access to information and stimulate learning among farmers (Bentley et al. 2014a). Videos complement traditional extension tools, especially when extensionists lack resources for demonstrations. Because of this, videos have been extensively used in many contexts in Africa (Van Mele, Wanvoeke, and Zossou 2010). Karubanga et al. (2016) show that in Uganda, videos complement very well the traditional methods of extension. Where there is no extension agent, videos can help to fill the gap (Bentley et al. 2014b). In Benin, Zossou et al. (2009) showed that videos are more effective training tools than face-to-face training approaches and may trigger innovations. With videos, extension agents said they were more confident to deal with experienced farmers (Okry, Van Mele, and Houinsou 2014).

CONTACT Florent Okry okryflorent@gmail.com

Videos combine audio and visual attributes. Access Agriculture, an international NGO promoting the use of videos in extension reported, from questionnaires in 2011-2012, that extension agents prefer farmer-to-farmer training videos in local languages spoken or understood by farmers. Meeting this request implies that videos initially produced in international languages (French and English) should be translated into local languages to better impact farmers' learning. This also implies that when the broadcasting language is unknown to farmers it can be a barrier to video-mediated learning. Bentley et al. (2014b) reported from a study in Benin that farmers also learn from the images in the video; "sometimes, the video can speak for itself". Images allow farmers to see how the information and ideas presented in the video are applied. Hence our initial assumption is that to some extent, visuals compensate for language in video-mediated learning. This study tests this assumption. It deepens previous studies, particularly Bentley et al. (2014b), by revealing the conditions under which farmers learn from images of a video presented to them in an unknown language. We thus investigate the level of assimilation and understanding of technical messages when farmers watch a video produced in a language unknown to them. Specifically, we:

(1) analyse the effect of the language used in the videos on assimilation and understanding of technical messages contained in the video.
(2) analyse the influence of repeated viewing on assimilation, understanding and video message-sharing by farmers.
(3) determine the social dynamics of knowledge dissemination in video-mediated rural learning.

Social learning

Social learning theory (Bandura 1977) helps to explain how and why people learn. It suggests that learning and new behaviour development can occur simply by observing the action of others. Bandura combined elements of behavioural theories and memory, and added a social element to explain learning. Social learning theory outlines that people can learn by observing others and some internal mental states are essential to this process. The theory states that behavioural change will not automatically occur just because something has been learned. The modelling process developed by Bandura includes four steps in order to determine if social learning is successful or not: attention, retention, reproduction, and motivation.

There is a diversity of stakeholders in rural areas and the links between them influence and/or change their practices. In multiple change and innovation processes, stakeholders have to learn and share perceptions, behaviours or practices. For Leeuwis (2004, 148), this learning may occur on various fronts.

Koutsouris and Papadopoulos (2003) argue that people are using the concept of "social learning" in several ways, but not necessarily ideally, and the widespread use of the concept "social learning" in extension provokes frustration due to its imprecision. It is useful to note here that the adjective "social" in "social learning" has several connotations (Leeuwis 2004, 161), and refers to the:

- topics that need to be learned about, such as other stakeholders' perspectives and interests, the social world, social arrangements.
- methods through which social learning may be stimulated; frequently the term "social learning" carries the methodological connotation of "learning in a group or platform";
- socio-political nature of the learning process: here the term "social" refers to the point that knowledge and perceptions tend to be socially constructed, which implies that learning cannot be looked upon as a neutral process.

This article considers these last two connotations in using social learning theory to better understand farmers' learning through videos.

Methodology

Study area

The study took place between September 2015 and February 2016, with data collection in the South-West of Benin Republic, specifically in 11 villages in the municipalities of Djakotomey, Lokossa and Dogbo. The villages were Agohoue-balimey, Gbotohoue, Kpoba and Nagonouhoue (in Djakotomey), Agonkanmey, Hlodo, Houin, Mambe, Toguemey and Totinga (in Lokossa), and Deve-homey (in Dogbo). The dominant local language (spoken by 73% of the population) in the study area is Adja. Other local languages spoken are Kotafon (22%), Fon (3%), and Yoruba (1%). These three municipalities supply more than 51% of the rice consumed in this region, and other dominant crops are maize, cassava, groundnut, cowpea and vegetables. The study villages were purposively selected based on the proportion of people who speak Adja, the importance of rice farming, and accessibility to the villages.

Video selection and experiment design

The video entitled "Urea deep placement", a topic of great interest to farmers (according to our exploratory study), was selected and downloaded from the website of Access Agriculture (www.accessagriculture.org). The video deals with urea losses in lowland rice farming. In the study area, urea is commonly broadcast in lowland rice fields. This causes a lot of loss of the urea by dissolution in water or by evaporation. The video presents an innovative and simple urea deep placement technique for irrigated or lowland rice production that minimises losses, reduces farmers' expenses and improves productivity.

"Urea deep placement" is a scripted training video developed using the zooming-in, zooming-out (ZIZO) method, which identifies problems that have a broad geographical relevance, then zooms in on solutions which are scientifically sound and have been used by real farmers, who show their innovations and explain them on the video (Van Mele 2006). The video was available in Adja, the local language of the study area. We also selected the English version, which serves as the unknown language to the farmers. English was chosen as the unknown language instead of French, which is the official language of Benin Republic. While the literacy rate is still low in rural Benin, some farmers could possibly know some French. The English version of the video is narrated by a native British speaker and former BBC journalist, which local farmers would not understand. We screened the video in the local language (Adja – well known) and English (unknown) for 135 farmers separated into six groups. Table 1 shows the experiment design.

Study participants were randomly selected from a list of rice farmers received from the local authorities of each village and updated during our exploratory tour. Two groups of farmers (labelled Adja and English) were created in each of the three study municipalities. To avoid communication among participants, as this could bias the results of the experiment, each group was drawn from one village. The number of screenings per group was also randomly decided by the research team. The two groups in Djakotomey municipality attended one screening, while the two groups in Dogbo

Table 1. Experimental setup.

	Djakotomey		Dogbo		Lokossa	
Group	G1	G2	G1	G2	G1	G2
(*n*)	(22)	(24)	(23)	(23)	(22)	(21)
Local language	Adja	Adja	Adja	Adja	Adja	Adja
Screening language	Adja	English	Adja	English	Adja	English
Number of screenings	01		02		03	

Notes: G = group; *n* = number of farmers.
Source: Survey, 2016.

municipality attended two. In Lokossa we organised three screenings. Where multiple screenings took place, these were organised at one-week intervals and assessment of knowledge gained was conducted one week after the last screening. Each group was designed to be 30 people, but many farmers were not available during the data collection period, and the six groups ended up being smaller (around 22 participants).

Data collection and analysis

Data collection was conducted in three steps.

(1) An exploratory survey (November 2015) allowed us to learn more about the rice growing practices and use of training videos in the study area. We selected the study villages based on the criteria presented above.
(2) We selected the video to use, designed the experiment and conducted a survey in December 2015 to pre-assess farmers' knowledge about the urea deep placement technique presented in the video. Only 1% of the farmers knew about the technique, and they had never practiced it.
(3) Screenings of the video were followed by a survey to assess knowledge gained. We used questionnaires to investigate aspects related to the socio-demographic characteristics of the sampled farmers and knowledge acquired. Farmer learning was assessed using three variables: *assimilation*, *understanding* and *sharing,* and we determined the number of retained messages, the number of understood messages, and the number of people with whom any knowledge gained from the video has been shared. Our hypothesis was that local language and repeated viewings provide better learning. Table 2 outlines the variables.

Data were analysed using the analysis of variance, the Student-Newman-Keuls test, and descriptive statistics.[1] The analysis of qualitative data (mostly related to knowledge sharing) was led by social learning theory (Bandura 1977). This theory explains that farmers' social networks influence their change of practices and attitudes toward a new technology or concept. They often interact with other social actors whose social pressure can influence their decision-making, such as the adoption of an innovation or agricultural technique and application. Farmers' contexts help to determine the success of video-mediated learning. Social dynamics and realities are important factors that help to understand how farmers learn and organise knowledge dissemination in their communities.

Table 2. Description and measurement of the variables.

Factor	Variable	Description and measurement [a]
Assimilation	Number of retained messages (NRM)	The eight main messages of the video were inventoried. The number of messages correctly identified by a farmer after watching the video corresponds to the number of retained messages. $0 \leq NRM \leq 8$
Understanding	Number of understood messages (NUM)	Farmers explained the content and importance or relevance of each message. The understood messages are those correctly explained. $0 \leq NUM \leq NRM$
Sharing (social learning)	Number of people with whom the gained knowledge has been shared (NP)	We ask the participants who viewed the video to list people with who they shared their gained knowledge, and we cross-checked with people listed. $NP \geq 0$

Notes: [a] "assimilation', "understanding' and "sharing' were assessed three weeks after the first viewing.

Findings

Effects of language used in a video and repeated viewing on farmer assimilation (retained messages)

First screening

The analysis of variances showed that farmers who watched the video once in Adja retained more technical messages (3.77, $\sigma = 1.02$) than those who watched the same video once in the unknown language (English) (2.17, $\sigma = 1.05$). The difference between these two groups is highly significant ($p = 0.01$) (Table 3(a)). This finding confirms that farmers learn more when a video is in their own language. The images alone allowed farmers who watched in an unknown language (Group 2) to retain about 60% of the messages retained by those who watched in their own language (Group 1). The local language is therefore the most suitable for assimilation but when local language versions are not available and no competent interpreter or extensionist is available, farmers can still use videos in an unknown language to achieve an average amount of learning, which is usually better than leaving farmers without any technical training.[2] Farmers can learn from the visuals. Do repeated viewings help bridge the gap observed regarding the assimilation between the two groups after the first screening?

Second screening

After two projections, farmers who watched the videos in the local language retained on average 4.48 ($\sigma = 1.08$) messages while those who watched the video twice in the unknown language retained on average 3.65 ($\sigma = 1.11$) messages. The difference between the two groups is highly significant (Table 3 (b)). This confirms our initial partial conclusion that the local language ensures better assimilation.

The level of assimilation obtained after a first screening in the local language (3.77, $\sigma = 1.02$) is similar to double screenings in the unknown language (3.65, $\sigma = 1.11$) (Table 3(a,b)). This implies that when the language of the video is unknown to farmers, at least two screenings should be organised to reach the same assimilation as when the video is in a local language.

The second screening improves assimilation in both groups 1 and 2 (Table 3(a,b)), and the gap of assimilation between Group 1 and Group 2 (after two screenings) is narrower than the gap between the two groups after one viewing (Table 3(a,b)).

These findings suggest that extension projects based on video-mediated learning should consider organising more than one viewing or give farmers the opportunity to watch the videos several times.

Table 3. Results of the experiment.

Group (*n*)	Municipality	Local language	Screening language	Retained messages	Test (*P*-value)	Understood messages	Test (*P*-value)	People involved in sharing	Test (*P*-value)
(a) First screening									
G1 (*n* = 22)	Djakotomey	Adja	Adja	3.77 ($\sigma = 1.02$) ^{b}	***	1.86 ($\sigma = 0.77$) ^{bc}	***	3.55 ($\sigma = 2.20$) ^{a}	ns
G2 (*n* = 24)	Djakotomey	Adja	English	2.17 ($\sigma = 1.05$) ^{c}		1.38 ($\sigma = 0.67$) ^{c}		2.42 ($\sigma = 3.38$) ^{a}	
(b) Second screening									
G1 (*n* = 23)	Dogbo	Adja	Adja	4.48 ($\sigma = 1.08$) ^{a}	***	2.91 ($\sigma = 1$) ^{a}	***	4.65 ($\sigma = 4.22$) ^{a}	ns
G2 (*n* = 23)	Dogbo	Adja	English	3.65 ($\sigma = 1.11$) ^{b}		2.04 ($\sigma = 0.77$) ^{b}		3.35 ($\sigma = 3.05$) ^{a}	
(c) Third screening									
G1 (*n* = 22)	Lokossa	Adja	Adja	3.68 ($\sigma = 1.25$) ^{b}	ns	2.55 ($\sigma = 1.1$) ^{ab}	***	4.55 ($\sigma = 3.71$) ^{a}	ns
G2 (*n* = 21)	Lokossa	Adja	English	3.14 ($\sigma = 1.42$) ^{b}		2.24 ($\sigma = 1.04$) ^{b}		4.62 ($\sigma = 3.29$) ^{a}	

Notes: Groups a, b, c, ab, bc identified from the Student-Newman-Keuls test; *** = highly significant at the 0.01 level; ns = not significant at 0.05.

This could be achieved by leaving copies of the videos in the community, as suggested by Bentley et al. (2014a).

Third screening

We found no significant difference among groups of farmers after three screenings (Table 3(c)). The assimilation in Group 1 is significantly lower than what is observed in Group 1 of the second projection. This could be explained by socio-demographic differences among surveyed populations, but further investigation is needed to delve into the mechanisms underlying this finding. The difference between the average number of messages retained by the Group 2 (unknown language) at the third projection (3.14, $\sigma = 1.42$) and that of Group 2 (unknown language) at the second projection (3.65, $\sigma = 1.11$) was not significant (Table 3(b,c)). Watching the video three times in the unknown language does not improve significantly the number of messages retained after two screenings, but it improves farmers' assimilation after one screening in the unknown language (3.14, $\sigma = 1.42$ against 2.17, $\sigma = 1.05$) (Table 3(a,c)). When local language versions are not available, a third viewing will add to farmer's understanding of technical messages but, as revealed by our findings, it does not add to message retention.

Effects of language used in a video and repeated viewing on farmer understanding (understood messages)

First screening

Farmers who watched the video once in Adja (Group 1) understood more technical messages (1.86, $\sigma = 0.77$) than those who watched the same video once in the unknown language (Group 2) (1.38, $\sigma = 0.67$). The difference between these two groups is highly significant (Table 3(a)). This finding confirms that screening in the local language enhances the understanding of the retained messages. However, the images alone enabled the farmers who watched the video in the unknown language to understand about 74% of messages understood by Group 1. We conclude that farmers learn better from videos in their local language. When local language versions are not available, screening in an unknown language may guarantee an appreciated level of understanding of messages as farmers learn through images.

Second screening

After two screenings, the farmers who watched the local language version understood on average 2.91 messages ($\sigma = 1$) while their peers who watched the video in English understood on average 2.04 ($\sigma = 0.77$) messages. The difference between the two groups is also highly significant (Table 3 (b)). Those who had the English screening understood 70.1% of messages understood by those who had the Adja screening. The average number of messages understood by farmers of Group 1 after a second screening (2.91, $\sigma = 1$) is significantly higher than the number of messages understood by Group 1 after the first projection (1.86, $\sigma = 0.77$) (Table 3(a,b)). The same observation was made with Group 2 (2.04, $\sigma = 0.77$ against 1.38, $\sigma = 0.67$) (Table 3(a,b)). It follows that repetition improves understanding in both groups. Moreover, understanding obtained with the second screening in the unknown language is significantly better than that obtained after the first screening in the local language. Videos in unknown languages probably spark discussion among peers which at the end raised farmers' understanding of the images. This is also in line with our observations during the viewing session in English.

Third screening

We found a significant difference between the two groups after three screenings (2.55, $\sigma = 1.1$) for local language against 2.24, $\sigma = 1.04$ for unknown language screening) (Table 3(c)). Those who watched the video in English understood on average 88% of the messages understood by their peers who watched it in Adja (Table 3(c)). The average number of messages understood after the

third screening in Adja decreased significantly compared to the average obtained during the second screening. The opposite trend was observed for screenings in English (Table 3(b,c)). It follows that when the broadcasting language is unknown to the farmers, the third screening sparks them to strive to better understand the main messages, probably through interactions that arise between participants. These interactions contribute to knowledge creation (Karubanga et al. 2016). Number of average messages understood after the third screening in English is higher than that obtained after a single screening in Adja (Table 3(a,c)). We conclude that when the broadcast language is unknown, it is good to do three screenings for better understanding.

Social learning through video screenings

Social learning as knowledge sharing after video viewings was analysed through the number of people with whom a farmer shared knowledge gained from the video. We found no significant difference between groups of farmers who watched the video in Adja and those who watched the same video in English. The video presents a technology that 99% of farmers are discovering for the first time. When the language used in the video is known, farmers' comprehension is based not only on images but also on the explanation and comments on good practices presented in the video. Understanding the language used in the video favours sharing of acquired knowledge with peers, especially those who did not attend the screening. It is easier for farmers to talk about what they have seen, heard in their language and learned.

We found that, when farmers do not know the language used in the video, social learning arises at first among farmers who attend the screening mostly to harmonise understandings of the images. The acquired knowledge is later on shared outside the projection room to the benefit of the community. We conclude that social learning is inherent to rural communities. In our case, social learning seeks to reduce the risk of misunderstanding that could lead to failure when applying the learned practices. Social learning appears therefore as a process that validates newly acquired knowledge.

Whatever the broadcast language, sharing was intensified with the repetition of the video screenings even if the observed differences are not statistically significant. The average number of people involved in messages sharing were 3.55 ($\sigma = 2.20$), 4.65 ($\sigma = 4.22$), and 4.55 ($\sigma = 3.71$) for the first, the second, and the third screenings in local language, respectively, and 2.42 ($\sigma = 3.38$), 3.35 ($\sigma = 3.05$) and 4.62 ($\sigma = 3.29$) for screenings in the unknown language (Table 3(a–c)). Each screening offers opportunities for discussion and knowledge sharing among farmers. We conclude that repeated viewings intensified social learning.

Table 4 shows that individuals belonging to farmers' associations shared knowledge gained from the video with 5.38 persons on average, while those who are not members of any association shared knowledge with 2.53 farmers on average (Table 4).

Because of the involvement of some actors belonging to several networks, the social learning went beyond what was done in the screenings and facilitates learning and decision-making. In this case, knowledge is built during interactions with peers. Gatherings organised by farmer associations offer farmers the opportunity to compare and discuss knowledge gained from the video.

In peers' groups, farmers discuss the relevance and suitability of the messages to their own farming context. Farmers' associations and peers' groups are therefore platforms for harmonisation

Table 4. People involved in social learning (knowledge sharing).

Farmers who:	Size	Number of people with whom newly gained knowledge has been shared
Belong to one or more organisation	63	339
Don't belong to any organisation	72	182
Total	135	521

of ideas that ensures better appropriation of knowledge gained. Furthermore, during interviews with the 49 women farmers of our sample, we learned that they are involved in social groups such as gatherings at market places, traditional solidarity groups, and women's groups. Because of their roles in farming, they are also in permanent contact with the work-gang with whom they could share knowledge and innovations. We assume that these networks offer women possibilities to more intensely share the knowledge gained through video-mediated learning.

Discussion

The highest level of assimilation and understanding of video messages was obtained when the language used in video is known to farmer. This confirms that farmers learn more when they attend screenings in their own language. Mackenzie and Walker (2013) conducted a study for the Global Campaign for Education on the importance of learning in mother tongue, concluding that is very difficult for learners to make out what is taught in an unknown language. UNESCO published four studies in 2008 on local language as key to effective learning. One of the main findings of these studies is that "Students participate more actively in the learning processes and feel more confident about learning when in local language" (Bühmann and Trudell 2008). As Zossou et al. (2016) explain, interactive rural learning approaches (such as farmer-to-farmer videos) need to be used more to make the technologies better known and improve the ability of the marginalised poor to adopt or innovate with local or limited resources. Our findings suggest that local languages used in farmer-to-farmer training videos can further promote the inclusion of farmers through social learning. Farmer-to-farmer training videos in local languages provide better access to information and knowledge because farmers are more concerned when seeing images and hearing explanations in their own languages. Improving access to knowledge is a great strategy for social inclusion so that knowledge or services offered by extension services consistently reach all populations.

We found after the first two screenings that repeated viewing allowed farmers to better assimilate and understand the information from the video, regardless of which language was used in the video. This means that well-selected images, when farmers can view them two or three times, help to fill the gap of assimilation and understanding created by a single screening in an unknown language. This nuances Mackenzie and Walker's (2013) conclusion on the need for education in the mother tongue.

In addition, we found that knowledge acquisition and sharing go beyond screening contexts. As Karubanga et al. (2016) state, knowledge acquisition and sharing are reinforced by interactions after exposure; and the audio-visual nature of video coupled with the entertainment element trigger viewers to reflect, share, and inspire experimentation and innovation (MacGregor 2007). Video-mediated extension approaches trigger farmer innovation (Zossou et al. 2009; Bentley et al. 2014a) and empower farmers to be self-directed learners who do not only apply knowledge acquired but also co-create knowledge and innovate (Karubanga et al. 2016). Social processes within farmers' social networks should be given due attention for a better understanding of the determinants of knowledge sharing among farmers. Expanding such learning alliances through farmers' networks could be a major responsibility for the extension worker to facilitate scaling out (Karubanga et al. 2016). Indeed, after the viewings, farmers discussed the information contained in the video with friends, family and other peers. For example, in Totinga, Deve and Hlodo, farmers' associations often opened their group meetings by discussing the importance and suitability of the urea deep placement technique. This was an opportunity for those who didn't watch the video to update their knowledge. Furthermore, with video, farmers are more confident to discuss their needs for additional knowledge with extensionists or researchers. For example, after the viewings, the leaders of rice farmers' association of Houin and the chairman of the Cooperative of the Irrigated Scheme of Deve requested more videos on topics such as pest management and bird scaring.

Conclusion

This study showed that farmers learn more from training videos in local languages, but that the language of the video does not significantly influence the intensity of knowledge sharing after three rounds of video screening. Local languages are therefore better for video-mediated learning. Nevertheless, when local language versions are not available, repeated screenings allow farmers to get the main information even if they may have misunderstood certain things. Images in quality farmer-to-farmer videos prove to be sufficient to ensure some learning. These insights apply to quality videos developed according to the ZIZO approach, and may not apply to other video formats. We suggest that future research assesses farmers' use of new knowledge and practices after viewings. More experimentation with videos on technologies of varying complexity would also be useful. Furthermore, farmers' associations and peers' groups are useful frameworks that favour the dissemination of knowledge gained in video-mediated learning. Farmers' social networks need to be more integrated in dissemination processes by extension workers to ensure better accessibility to innovation and knowledge.

Policymakers, research institutions, donors, agricultural extension specialists, and other development actors in rural areas should work more synergistically to develop or translate agricultural training videos in various local languages to improve their effectiveness as tools for extension and rural learning. For the time being, we recommend at least a double screening of training videos when local language versions are not available.

Notes

1. The Student-Newman-Keuls test or Newman-Keuls test is a common method of pairwise comparisons. It aims to identify the pattern of differences in an ANOVA results by evaluating all the pairs of means in order to decide which ones show a significant difference. It is a sequential test based on the "Studentized range" or Student's q (Abdi and Williams 2010).
2. Extensionists play an important role in video-mediated learning. For example, they have the competency to explain content when the video is in an unknown language to farmers.

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Notes on contributors

Lauréano Bede is a Research Assistant at the Department of Economy, Socio-Anthropology and Communication, Faculty of Agricultural Sciences, University of Abomey-Calavi, Benin Republic. His research interests lie in knowledge systems and knowledge dissemination in rural areas, extension approaches for enhancing farmers' learning, and innovations for improved livelihoods.

Florent Okry is an agricultural social scientist and Associate Professor at the School of Rural Sociology and Agricultural Extension at the National University of Agriculture, Benin Republic. He is also the Regional Representative West and Central Africa for Access Agriculture. He specialises in rural learning, innovation systems and extension.

Simplice D. Vodouhe is Professor at the Department of Economy, Socio-Anthropology and Communication, Faculty of Agricultural Sciences, University of Abomey-Calavi, Benin Republic. He specialises in agricultural extension.

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