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How farmer videos trigger social learning to enhance innovation among smallholder rice farmers in Uganda

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Abstract: Information and Communication Technology (ICT) tools such as videos promoted to enhance farmer access to information to influence change in farming practices need to be situated in social learning processes. Farmers learn and innovate through social learning characterized by exchanges amongst farmers to contextualize knowledge and adapt technologies for relevance. This study assessed how a video-mediated extension approach (VMEA) triggers social learning to enhance innovation among rice farmers in Uganda using experiences of a Non-Government Organization, Sasakawa Global 2000 (SG 2000). A cross-sectional study was conducted among 100 farmers subjected to VMEA by SC 2000 in Kamwenge district. Semi-structured interviews, focus group discussions (FGDs), field observations and key informant interviews were used to collect the quantitative and qualitative data. Quantitative data were analyzed using Statistical Package for Social Sciences (SPSS) while thematic analysis was applied to the qualitative data. Results indicate that inherently, videos trigger conversational exchange between farmers including those

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PUBLIC INTEREST STATEMENT

Videos are among the ICT tools with high potential to enhance effectiveness of agricultural extension delivery especially in the Sub-Saharan region. The tool however has to be applied to enhance social learning, which is well known as the major mechanism for farmer learning and innovation. Evidence from this study indicates that in farmer learning process, videos positively influenced awareness creation, knowledge acquisition and retention, knowledge use, and sharing of experiences among farmers. If extension workers are to effectively use videos, they will have to acquire good facilitation skills for farmer learning and also be able to produce videos of farmer practices and innovations for dissemination. A more detailed competence assessment is essential for full integration of videos in extension service delivery.

who do not watch the videos. These interactions enable collective reflection, evaluation and validation of knowledge, which in turn motivate experimentation. In this study, videos significantly enhanced awareness, knowledge acquisition, uptake of technologies and innovation among rice farmers. However, the potential of videos in influencing farmer knowledge and behavioral change can be further exploited if the users can produce contextualized videos of farmer practices and innovations for dissemination. Among other things, effective use of videos in extension requires excellent skills in facilitating social learning processes; and video documentation of farmer practices and innovations to aid scaling up and deepening learning.

Subjects: Environment & Agriculture; Food Science & Technology; Social Sciences; Communication Studies; Information Science

Keywords: video-mediated extension approach; social learning; smallholder farmers; farmer innovation; rice; Uganda

1. Introduction

Farmers learn and innovate to improve on their practices for better living through social learning processes (Kibwika, 2007; MacGregor, 2007). Social learning is a participatory process whereby individuals interact, jointly reflect, and learn from each other (Bandura, 1997; Kiptot, 2007). The interaction and exchange that occur between farmers and knowledge experts is the basis for experimentation and adaptation of practices and technologies, and processes leading to innovation (Chowdhury, Van Mele, & Hauser, 2011; Danielsen, Karubanga, & Mulema, 2015; Kibwika, 2007). This phenomenon is even more critical in developing countries where the majority of the population depend on farming and have limited access to expert knowledge because of weak or dysfunctional extension systems. For example, in Uganda one extension worker is expected to serve about 3189 farmers (Danielsen et al., 2015) but farmers on their own continue to learn new ways to meet their changing needs and demands (Kibwika, 2007). Information and Communication Technologies (ICTs) including videos provide opportunities for improving access to information by farmers and other stakeholders in agriculture but their effectiveness in extension will depend on how well they enhance learning. Use of ICTs in delivery of extension services is a highly debatable issue at the moment. Proponents of ICTs sometimes give the impression that the magic to farmer access to information lies in ICT tools but such tools can only improve extension in as far as they are able to influence learning among farmers. It is therefore imperative that videos and other potential ICT tools are integrated in the social learning processes of the target communities (MacGregor, 2007).

ICTs are increasingly playing a significant role in the dissemination of knowledge and information in different spheres of life including agricultural related knowledge and information. Videos, radio, mobile phones and television are among the ICT tools that are gaining popularity in enhancing farmers' access to agricultural related knowledge and information (Van Mele, Wanvoeke, & Zossou, 2010a). Effective use of such tools lies in their capability to stimulate social learning (Karubanga, Kibwika, Okry, & Sseguya, 2016a). Videos in particular have a high potential to stimulate social learning because they combine visual and audio elements that facilitate internalization and contextualization of knowledge or information, which enable farmers to share and learn from experiences (Bentley, Van Mele, & Musimami, 2013; MacGregor, 2007; Van Mele, Wanvoeke, & Zossou, 2010b). If properly used, video as a communication tool is powerful in creating awareness, enhancing acquisition, and sharing of high-quality information with a large audience (Bentley, Van Mele, & Harun-ar-Rashid, 2013; Bentley, Van Mele, Harun-Ar-Rashid, & Krupnik, 2015). However, how videos can do this under specific farmer circumstances is the subject of investigation in this paper. The paper determines how videos used in dissemination of knowledge and practices of rice production in Uganda trigger social learning processes to enhance farmer innovations. In this context, innovations are defined as various modifications, adaptations and creative ways of learning by farmers intended to customize the learned knowledge and practices or technologies (Danielsen et al., 2015; Kibwika, 2007).

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Basing on the potential of videos, Africa Rice has since 2005 been recording farmers with innovative practices and/or knowledge and using the videos to disseminate and share experiences and knowledge (Bentley & Van Mele, 2011; Bentley et al., 2013; Zossou, Van Mele, Wanvoeke, & Lebailly, 2012). There is evidence in literature pointing to the view that videos influenced change of farmer behaviours and practices (Bentley, Van Mele, Zoundji, & Guindo, 2014; MacGregor, 2007; Tumwekwase, 2013) but how this happens is not explained. In 2007, Sasakawa Global 2000 (SG 2000), a Non-Government Organization (NGO) piloted use of videos to disseminate rice related information to smallholder farmers in 14 districts of Uganda. Kamwenge district in Western Uganda is one of the districts where use of videos is reported to have been successful after three years of implementation and that the learning has been sustained even without the NGO (Tumwekwase, 2013). Therefore, the study intended to explain how farmer videos triggered social learning to enhance innovation among smallholder rice farmers served by SG 2000 in Kamwenge district in Uganda.

1.1. Conceptual framework

Social learning is central to farmer learning and innovation. All approaches and methods aimed at change in farmer knowledge, attitudes and behaviors need to be situated within the social learning concept (Karubanga et al., 2016a). As illustrated in Figure 1, learning through videos in this case is conceptualized in the context of social learning processes and focusing on awareness creation; knowledge acquisition and retention; knowledge use through experimentation and adaptation; and localization of knowledge through sharing. Social learning theory is used to explain the farmer learning processes in video-mediated extension in Uganda using experiences of SG 2000. The visual power of the video arouses interest and attracts farmers to get exposed to information contained in the videos and thereby creating awareness. What farmers see and hear in the video is translated into knowledge that is acquired and retained for later use. On evaluation of the knowledge acquired against other available options, the farmers consider to apply what they consider relevant often with adaptations to suit their peculiar circumstances. Farmers experiment and make necessary adjustments and whether it works for them or not, they will have generated additional knowledge and experiences which are shared with others. Social learning is emphasized here because, first, the farmers live in a social environment characterized by interactions, sharing and co-influencing each other based on knowledge and experiences either introduced from outside or generated by themselves. In such processes, critical reflections are the basis for choice of what is experimented or used. The interactions, discussions and joint reflections that follow video shows enhance common

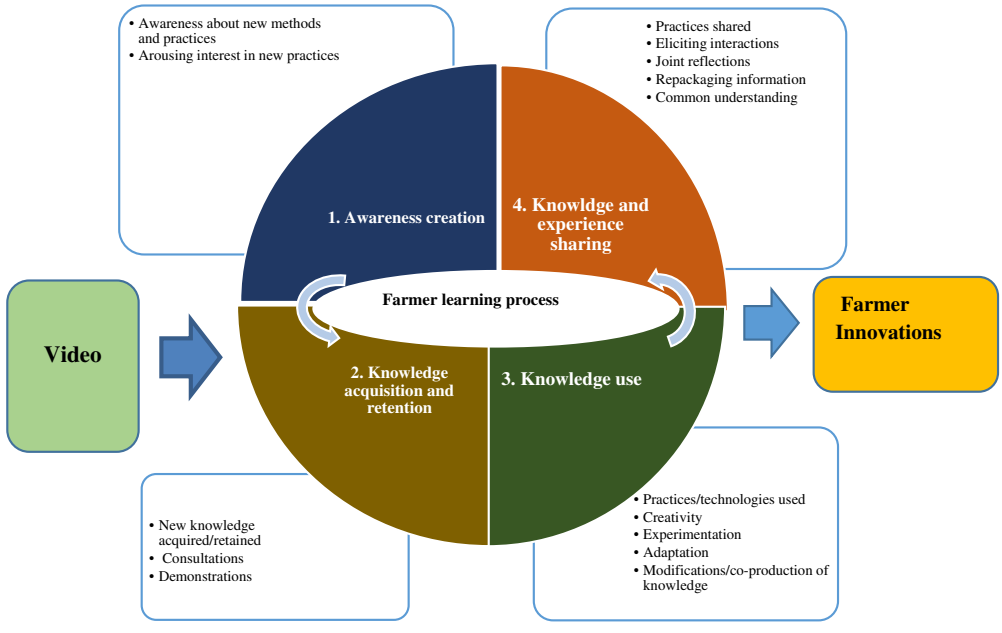

Figure 1. Farmer learning processes through videos.

understanding and repackaging of knowledge for localization and adaption to the specific needs and context of the farmers (Bandura, 1997; MacGregor, 2007).

A basic premise of social learning theory is that people learn not only through their own experiences but also by observing the actions of others and the results of those actions (Bandura, 1997; Glanz, Rimer, & Viswanath, 2008; MacGregor, 2007; Tilbury, 2007). The video exposes farmers and elicits interest and curiosity about new knowledge and practices (Bentley et al., 2015; Van Mele, 2011). Relatedly, farmers watch a video with intentions of learning new practices and technologies that can improve their farming practices. Thus, individuals that watch videos acquire, retain or remember what they saw even after a long period (Bentley et al., 2014; Tumwekwase, 2013), which is a key attribute for social learning (Bandura, 1997; MacGregor, 2007). However, the farmers' ultimate interest is not to acquire knowledge for the sake of it but to use it to improve their situations. After internalizing the knowledge acquired, farmers adapt and experiment what they have seen in the videos to suit their peculiar circumstances (Bentley et al., 2014; Shaw & Kristjanson, 2014).

Knowledge and experiential sharing involves forms of interactions, joint reflections and creativity leading to repackaging of information for common understanding (Cai & Abbott, 2013). It is the learning and adaptation and modifications through sharing own experiences that lead to innovation (Danielsen et al., 2015; Karubanga et al., 2016a). Videos are believed to stimulate social learning by stimulating information sharing among farmers (Asenso-Okyere & Mekonnen, 2012). Bentley et al. (2014) and Karubanga et al. (2016a) emphasize that effective farmer learning processes can only occur when farmers can engage with each other and later discuss and implement what has been observed. Viewing a video together is the basis for farmers to interact and clarify to each other what they have learnt and to lay a foundation for further interaction and sharing through experimentation. Scholars such as Zossou, Van Mele, Vodouhe, and Wanvoeke (2010) and Cai and Abbott (2013) claim that videos stimulate active communication and self-directed learning among participants – in this case farmers.

2. Methods

The cross-sectional study was conducted in eight purposively selected villages in Mahyoro sub-county in Kamwenge district, Uganda where videos were used by SG 2000 to disseminate rice related information for three years (2007–2010). The selected villages were those with records of farmers who participated in video shows during the intervention of video mediated extension by SG 2000. Multiple data collection tools were used in phases. The first phase involved six FGDs comprised of eight participants to gain insights in the experiences of farmers with regard to how videos influenced their awareness, knowledge acquisition, application and sharing of knowledge related to rice production. The FGDs also explored the learning that took place after the video shows as reflected by modifications and adaptations farmers made in their attempt to experiment the knowledge acquired. A total of 48 farmers (19 males and 29 females) who were purposively selected based on their experiences in rice production participated in the FGDs (Table 1). The FGD participants were selected with the assistance of Mahyoro Rice Farmers' Association (MARFA) chairperson. The outcomes of the FGDs were used to frame items for the individual semi-structured interviews to determine the influence of video on farmer learning process.

Table 1. Tools for data collection and number of respondents

Tool used for data collection	Number of respondents
FGDs (6)	48
Individual survey interviews	100
Home visits	6
Key informant interviews	16
Total	170

The second phase involved conducting the semi-structured individual interviews with the farmers to assess what they got more aware of, knowledge was acquired and retained, knowledge was used and shared with other people. The videos addressed twelve practices and technologies related to rice production. The semi-structured individual interviews gathered quantitative data on the farmers who were exposed to the twelve practices and technologies through videos, what they acquired and could remember, and what they applied and shared with others. Precisely:

- Awareness about the particular rice production practices and technologies was determined by the difference between number of practices and technologies the farmers were aware of after and before watching the video. Of the practices and technologies disseminated in the video, farmers indicated how many they were aware of before the video and how many they remembered watching in the video. This was for ease of measurement but not to ignore the fact that the videos could have enabled more awareness of even the practices and technologies they knew before.
- Knowledge acquisition and retention was measured by the details on relevance and application of the specific practices and technologies. The difference of what farmers knew after and before watching the videos was an indicator of the knowledge acquired and retained.
- Knowledge use was about what farmers applied in their own context (including the modifications made) influenced by what they learnt in the videos. In this case, what farmers were able to apply indicates the proportion of knowledge put into use compared to what they learnt from the video.
- Knowledge sharing was indicated by the acquired knowledge that was shared with others (farmers and extension workers) after watching the videos. This was determined by asking farmers, what particular rice production practices and technologies that were learnt and shared after watching the video based on relevance and applicability. The purpose was to determine whether video increased knowledge and experience sharing among farmers on particular rice production practices and technologies viewed in the video. The authors are aware that the videos could have enabled more sharing resulting from joint interactions, reflections and evaluations (verification) of even the practices and technologies the farmers knew before.

The semi-structured interviews involved all the 100 farmers who participated in watching the videos and whose records were available in the MARFA register. Out of these, 71 were men and 29 women (Table 1).

The third phase involved conducting the home visits to the farmers to ascertain through observations the practices and technologies that were being used. Six home visits were made as cases for observation. The homes were purposively selected from the FGD participants who exhibited more knowledge and experiences in rice practices and technologies. The observations focused on the practices and technologies farmers applied and the modifications and creative ways and adaptations (innovations) they employed to localize the acquired knowledge.

The fourth phase involved conducting the key informant interviews with 16 rice farmers to generate opinions on how the organization and other logistical issues such as timing and location of video shows affected the learning through videos as well as what they considered to be the success/failure factors for video-mediated extension. Sixteen key informants were also purposively selected during FGDs based on their location and sex.

Content analysis was applied to the qualitative data generated through FGDs, key informant interviews and observations. Data collected through semi-structured individual interviews were analyzed using Statistical Package for Social Sciences (SPSS) version 18.0. The paired samples *t*-test was performed to test for significance of differences in the practices and technologies the farmers were aware of; knowledge acquired and retained; and knowledge used and shared.

3. Results and discussion

3.1. Farmer learning through the videos

For each of the practices and technologies disseminated through videos, the learning that occurred was indicated by the change in awareness, knowledge, application of the knowledge, and knowledge and experiences sharing between farmers. Figure 2 presents the change in farmer learning (before and after) based on the twelve parameters disseminated through the videos.

Figure 2 above indicates that video enhanced awareness, knowledge acquisition and use about planting in lines, timely weed control, seed selection and use of tarpaulins for drying rice. These were perceived by farmers as key practices and technologies in enhancing both quantity and quality of rice produced. This implies that if knowledge and experience sharing among farmers is enhanced, rice production would definitely be fostered. More awareness creation enhanced more interest and curiosity in using particular practices and technologies where farmers had experiences and were able to share and apply it. This explains why more farmers planted in lines, controlled the weeds on time and selected their seed for planting. This could also be explained by the clarity and attractive nature of images which created a long lasting impact on the memory of viewers thus triggering continued use and sharing of knowledge on aspects that appear interesting and relevant as affirmed by Rogers (1995).

FGDs revealed that the limited use of technologies such as threshers could be attributed to increased knowledge and learning among farmers in terms of their availability, affordability and feasibility to use in attempts to experiment and adapt. In most cases, farmers are aware, learn and share more about the practices and technologies they think are relevant to them and they can use the limited available resources to implement what they have acquired as stated by Rogers (1995). For example, threshers besides being heavy and unavailable, they were perceived by farmers during FGDs as being expensive in terms of the costs involved in transporting and fueling. In addition, through joint discussions and reflections, farmers shared more information about using the wetlands as one of the possibilities to produce rice during drought. However, there was limited use of these wetlands because they were locally unavailable.

Overall, because of knowledge sharing, farmers go through an evaluation process whereby they assess the feasibility of particular practices and technologies before they are used. In the process they experiment through modification and adaptation to localize the acquired knowledge on practices and technologies. This confirms what Kibwika (2007), Van Mele et al. (2010a), and Shaw and Kristjanson (2014) said that farmers gain interest, learn, use and share more about what they can

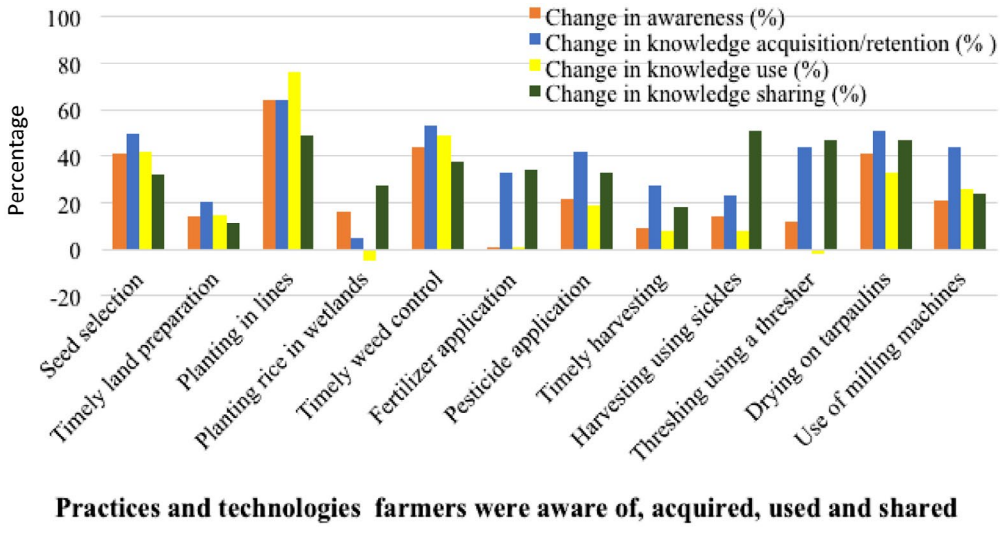

Figure 2. Farmer learning and application of practices and technologies disseminated through video.

experiment and adapt to fit their peculiar circumstances. In general, the results reveal that if knowledge sharing through video is well facilitated, it is likely that many farmers would be aware about the new practices (also see Karubanga et al., 2016a). Through sharing of knowledge and experiences farmers are likely to acquire and use more knowledge which they perceive to be relevant in solving their farming needs.

3.2. Influence of video on awareness creation, knowledge acquisition, retention, use and sharing

Table 2 presents the results of a paired samples *t*-test of significance on the extent to which videos influenced awareness; knowledge acquisition and retention; knowledge use; and sharing of what was learnt by farmers before and after the video shows.

3.2.1. Awareness creation

Conversations with farmers during FGDs revealed that rice farming in Mahyoro sub-county started in the late 1990s. Before then, farmers were mainly growing other crops such as cotton, maize, millet, beans, soya beans, cassava and groundnuts for both income and food. Whereas rice is a relatively new crop in the farming system of the area, farmers have accumulated knowledge and experience on rice production over time, which has in turn influenced changes in practices and technologies.

As part of the promotion of better rice production practices and technologies in the area, SG 2000 in collaboration with Mahyoro Rice Farmers Association (MARFA) used videos (2007–2010) developed in Benin to influence change in rice production practices and technologies (Key informant interview with MARFA chairperson). The videos shown by SG 2000 were developed in French and translated into English. Despite the language used in the video, in the FGDs, farmers acknowledged that the videos created awareness about new practices and technologies in rice production. Because of the growing importance of rice as a cash crop, farmers were curious and interested to learn about the new practices and technologies. Table 2 shows that the difference in knowledge as a result of awareness creation about new rice production practices and technologies through videos was highly significant among the participating farmers at 1% level of significance ($t = 7.468$, $p < 0.05$). This is attributed to the visual power of the videos – farmers would see the practices and technologies demonstrated and relate it to their context even though most of them could not fully understand the explanations in English (also see Bede Lauréano, 2016; Bentley & Van Mele, 2011; Van Mele, 2011; Waddington et al., 2014; Zossou et al., 2010). Most farmers (92%) who watched the videos for example appreciated the value of planting rice in rows. The videos are powerful in influencing learning especially among the less educated people because of the attractive and clear images (Bede Lauréano, 2016; David & Asamoah, 2011). Indeed, all farmers who watched the videos wished they had been more frequent than it actually was. For instance, most of the video participants (78%) said that video shows were rarely organized.

About 61% of the farmers perceived the frequency of video shows as being inadequate while 39% thought it was adequate. Those who thought the frequency was adequate based on the time they needed to internalize and experiment what they had learnt before learning new things. About half

Table 2. Awareness created, knowledge acquired and retained, used and shared

Attribute	Mean	*t*-test	Sig.	*df*	95% CI of the difference	
					Lower limit	Upper limit
Awareness creation	3	7.468	0.000***	99	2.42323	4.17677
Knowledge acquisition and retention	5	10.694	0.000***	99	4.21889	6.14111
Knowledge use	3	9.187	0.000***	99	2.21094	3.42906
Knowledge and experience sharing	5	13.076	0.000***	99	3.98681	5.41319

***$p < 0.01$.

of those who watched videos only once (49%) indicated they learnt something that they wished to implement to improve their own practices and technologies. This points to the view that the information in the videos was clear and relevant to most farmers as they grasped the information after watching the video only once. For the appropriate frequency, 76% of the farmers who participated in videos wished that the same videos could be shown at least twice a month. With regard to duration of a video show, farmers thought 2–3 h was adequate. This is about the maximum time farmers are able to concentrate and be able to retain the knowledge acquired. This is so especially if the video is presenting a variety of practices and technologies, however, they preferred that a particular video should present one practice/step and thereafter allow them to reflect and discuss what they have learnt in the context of their experiences. Besides, creating awareness, critical reflection before sharing of experiences, which is essential in social learning processes requires adequate time.

3.2.2. Knowledge acquisition and retention

Exposing farmers to new knowledge is only a step in the social learning process. Farmers need to further internalize and appreciate the knowledge acquired—something that is sometimes referred to as knowledge retention (Bandura, 1997; MacGregor, 2007). With regard to the practices and technologies that were conveyed in the videos, farmers acquired and retained averagely 5 out of 12 practices and technologies. However, this finding does not mean that all farmers acquired and retained the same practices and technologies because of their different interests. A paired samples *t*-test indicates that the knowledge that the farmers acquired and retained and could recall after 9 years was statistically significant at 1% level of significance ($t = 10.694$, $p < 0.05$). This indicates a high level of knowledge acquisition and retention facilitated by sharing with fellow farmers and consultations with extension workers. The clarity and the visual power of the videos enhance memory as a near real situation is simulated (also see Karubanga et al., 2016a). Farmers concurred that the steps were well demonstrated, allowing them an opportunity to clearly see, hear and understand what was being demonstrated. Although 89% of farmers did not have formal education and could not read or write, the videos enabled such a high level of knowledge acquisition and retention.

To enhance memory of the knowledge acquired, some farmers discussed and shared the information with others (52%) for purposes of clarifying the information to themselves, others (34%) chose to immediately apply what they had seen in the videos in their own context, others (12%) consulted extension workers (experts) for clarification or a second opinion, while some (2%) went to watch the videos more than once. Immediate application of what was learnt by farmers was due to lack of people they trusted to consult e.g. extension workers and yet about 89% of farmers could not write what they learnt for the future reference. Similarly, FGDs indicated that follow-up visits by extension workers would have enhanced successful application of the knowledge acquired as these provide more guidance and increase confidence of the farmers. Because of the limited access to extension workers, farmers who watched the videos wished to consult the SG 2000 staff immediately after the videos shows but the timing could hardly allow that and the videos ended late at night (10:00pm) (also see Karubanga, Kibwika, Okry, & Sseguya, 2016b). Though farmers acquire and retain the knowledge they consider important in addressing their production needs (Bentley et al., 2014; Tumwekwase, 2013), behavioural change in social learning processes is enhanced by sharing and copying from one another (Bandura, 1997; MacGregor, 2007).

3.2.3. Knowledge use

Not all that was learnt and retained by farmers was implemented. The farmers on average implemented 3 out of 12 practices and technologies they learnt about in the videos. Despite the low average of practices and technologies used, Paired samples *t*-test indicated a statistically significant influence of video on the use of knowledge acquired about the practices and technologies at 1% level of significance ($t = 9.187$, $p < 0.05$). Figure 3 shows the proportion of farmers who implemented the various practices and technologies they learnt about in the videos.

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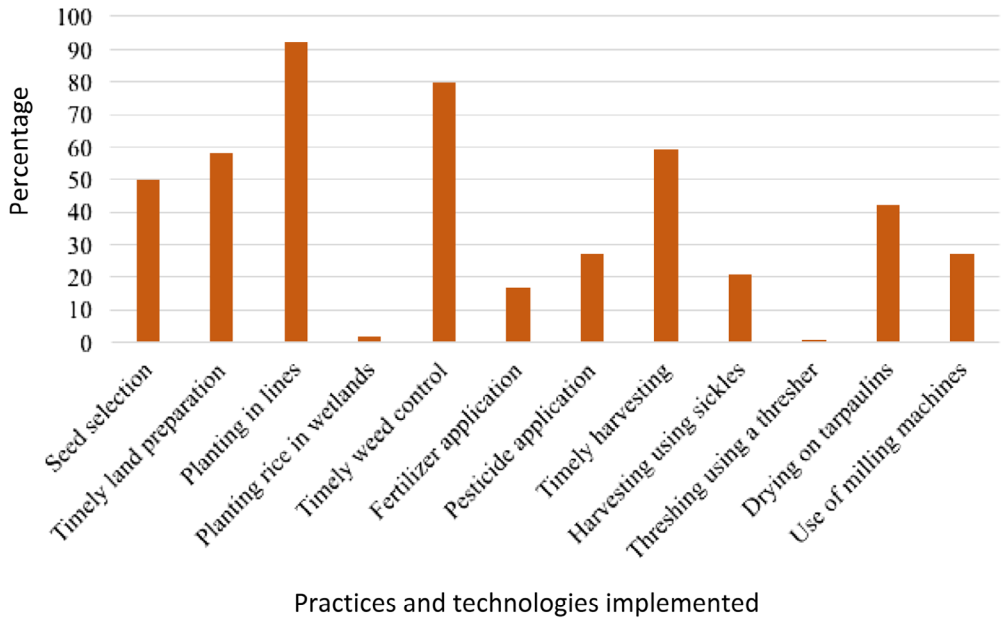
Figure 3. Proportion of farmers who implemented the practices and technologies.



The practices and technologies that were taken up by most farmers included planting in rows (92%), timely weed management (80%), timely harvesting (59%), timely land preparation (58%), and seed selection (50%). In the FGDs, farmers acknowledged that rice planted in rows made other operations e.g. weeding and fertilizer application easier and it also yielded more per unit area due to optimum plant population. Although farmers may have known about row planting before, it is the appropriateness of the technology for doing so that made farmers take up the practice more. To ensure timely weed control farmers used herbicides and completed it with hand weeding as opposed to hand weeding alone (field observations). Uptake of timely harvesting was enhanced by realization that if rice is not harvested on time, the post-harvest losses would be higher due to attack by birds and shattering and spillage due to over drying in the field. Because farmers depended on the rain fed agriculture, it was important that they prepare their land in time so as to plant early (FGDs with farmers). Reportedly, timely land preparation enabled farmers to benefit from better market prices since they were able to plant on time and harvest early when the prices are high (averagely USD 0.3 per kilogram of unmilled rice). Planting clean seed translates into good quality of rice produced. Exposing farmers to video allowed them learn more how they could select seed for planting. However, selecting seed by floatation and sorting using hands were respectively perceived as being costly and tiresome. Having been made more aware of quality aspects, about 42% of the farmers dried rice on tarpaulins as opposed to drying rice on bare ground, though the cost of tarpaulins was prohibitive.

The application of knowledge was enhanced by farmers sharing among themselves (96%) on particular knowledge which they deemed useful (85%) in addressing their production needs. They collectively evaluated the relevance and application of some of the practices and technologies in their own situation such as use of threshers. The videos depicted a desired situation which inspired the farmers to want to get to those levels of practices and technologies (also see Karubanga et al., 2016a; Van Mele, Bentley, Dacko, Yattara, & Acheampong, 2011; Van Mele, Bentley, Harun-ar-Rashid, Okry, & Mourik, 2016). It is important to note that social learning facilitates behavioural change especially where the learners are motivated to learn. Kibwika (2007) and MacGregor (2007) asserted that learners sometimes put in practice what they have learnt to show that they have learnt new ways of doing things. This confirms the assumption about social learning) that people tend to utilize the practices and technologies copied from others through their own creative ways towards gaining returns (MacGregor, 2007). One of the strong motivation for learning in this case was the commercial value of rice. Nearly all farmers interviewed grew rice mainly for cash. The demand for rice is rapidly

increasing due to increasing populations and food preference (Dandedjrohoun, Diagne, Biaou, NCho, & Midingoyi, 2012; Kijima, Otsuka, & Sserunkuuma, 2008) and so is the price of rice. The commercial value of rice was the basis for farmers to create mental images and imaginations and to adapt the learnt practices and technologies. Social learning theory affirms that learners need to be emotionally, intellectually and financially capable in order to model someone else's behaviour (MacGregor, 2007; Shaw & Kristjanson, 2014; Van Mele et al., 2011) which is portrayed in the videos. Videos therefore if fully integrated in social learning processes can enhance farmers' capability to learn and innovate (also see Cai & Abbott, 2013; Karubanga et al., 2016a).

3.2.4. Knowledge sharing

Sharing and copying from one another is the hallmark for behavioral change in social learning processes. The farmers on average shared 5 out of 12 practices and technologies with fellow farmers after watching the video. The new knowledge and experiences observed in the videos increased the sharing of knowledge among farmers. The difference between shared knowledge before and after watching videos was statistically significant at 1% level of significance ($t = 13.076$, $p < 0.05$). New knowledge alone is a stimulus for sharing among farmers as the process builds mutual acceptance and confidence to experiment. The videos presented real-life experiences from farmers which re-echoes the fact that the farmers learn best from fellow farmers (Bentley & Van Mele, 2011; Danielsen et al., 2015; Van Mele et al., 2010b), even in the virtual circumstances that the videos present (MacGregor, 2007). Through experimentation, farmers localized the acquired knowledge and generated additional knowledge, which they informally shared through songs and/or drama. Such knowledge can enrich the videos and enhance relevance (also see Karubanga et al., 2016a). Nearly the same proportions of farmers who considered the knowledge gained from videos to be useful (85%) also shared the knowledge acquired with other farmers (96%). Contrary to Kibwika (2007) where vanilla farmers hesitated sharing information because of the fear of competition, sharing of information among rice farmers was not constrained by competition for market.

The videos were shown at night (7:30pm–10:00pm) and this constrained participants to immediately share their knowledge and experiences on what they had learnt. The influence of learning from the videos would have been even more if there was time for farmers to discuss and exchange knowledge immediately after the video shows (also see Karubanga et al., 2016b). However, the videos ended late (10.00pm) and at this time, every one rushed to get to their homes. In this regard, a female farmer from Burembo village during the FGDs said that; "i*t would have been more beneficial if farmers discussed immediately after the video show—at that time the messages are still fresh in their mind and can easily relate what they saw and their own practices.*" Thus, the real learning, however, did not take place during the video shows but thereafter when farmers experimented through collective reflection on what they saw and evaluated it in their own context. This is typical for social learning processes (Danielsen et al., 2015; MacGregor, 2007). If video shows are followed up with activities that facilitate farmer interaction and exchange of knowledge, the effectiveness of videos in behavioral change can be greatly enhanced (also see Karubanga et al., 2016a).

The powerful images in the video incited participants to share what they saw starting with immediate family (85%) and group members (70%). This represents a broad network of sharing and learning from one another (also see Danielsen et al., 2015; Koppen, 2007; Mochizuki, 2007) unlike the conventional extension approach (Cai & Abbott, 2013). To ensure effective knowledge sharing and learning among actors, such forms of interactions need to exist (Danielsen et al., 2015; Karubanga et al., 2016a). More coherent interactions can create awareness and learning through strengthening social relations between the community members (ODonoghue, Lotz-Sistika, Asafo-Adjei, Kota, & Hanisi, 2007), especially the women and youth who are usually marginalized in accessing the information (Bentley et al., 2015; David & Asamoah, 2011).

Effectiveness of social learning results from a well facilitated interactive dialogue (Kibwika, 2007); but the findings also show that well framed knowledge in video format can trigger self-directed learning. The process is interactive and thus occurs on a platform for exchanging knowledge and

experiences (Kibwika, 2007). Conversations with farmers during FGDs revealed that knowledge sharing mainly occurred in their respective homes and during group meetings as they met to discuss group-based activities such as revolving funds. Others shared knowledge while at church/mosque/hospital. Through video, the learning therefore is not only limited to people who watch the videos, but it extends to other people through the various networks (also see Karubanga et al., 2016a).

3.3. Farmer innovations resulting from video-mediated learning

Through experimentation of what farmers learnt in the videos, they modified the technologies and practices to suit their peculiar production conditions. Some of the farmer innovations that emerged out of the video-mediated learning were related to seed sorting, planting, weeding, pest and disease management and harvesting as discussed below.

3.3.1. Seed selection and sorting

To get good yields, farmers have to start with good seed. The videos demonstrated the floatation and hand picking methods to sort the seed for planting. In the floatation method, farmers were required to add salt to the water (to increase the density) and then pour rice into the salt solution, which separates good seed from the bad one. The bad seed floats on water as good one sinks. Farmers in Kamwenge district thought that the two methods demonstrated were not appropriate. The floatation method was perceived to be very expensive because of the cost of the salt and the hand picking method was considered too tedious and time consuming. About the cost of salt, one of the female farmers from Karere village exclaimed;

> If for example, I have to plant 3 or 4 acres of rice, I would have to spend a lot of money on salt, which is unnecessary. Such methods could be affordable by rich farmers like those in the video looked to be! (Key informant interviews, 17 December 2015).

Having realized (from the videos) the importance of good seed, they started selecting seed for planting when the rice was still in the field. Field observations revealed that farmers carefully selected what they considered to be the best panicles which had matured uniformly and kept that for seed. This also ensured uniformity of variety planted unlike before. This resulted from the fact that, farmers did not trust the source of seed sold in the local shops and preferred to do careful selection of their own seed. This illustrates how the knowledge gained from the videos was creatively used to think about new practices which farmers were not doing before.

3.3.2. Planting

In the videos, farmers were exposed to two ways of planting rice in rows, namely using ox-driven planters and using a string to make furrows to plant rice. The use of oxen was not a common practice and so it was unavailable. The use of a string to make furrows was also considered tedious and required more labour. The important thing is that the video made farmers appreciate the value of planting rice in rows. Through their own creativity, farmers improvised a fork rake method, with fork-like pieces of metal mounted on a piece of wood. The forks are placed at the row spacing. When weight is applied on the piece of wood and dragged in the field as shown in Figure 4, it makes furrows where the rice seed is dropped and covered. In Figure 4, a child sitting on the piece of wood applied the needed weight to make the furrows (field observations).

After planting in rows, it was reported during FGDs that the subsequent operations like weeding, application of chemicals and harvesting became much easier. However, forked rake method had some challenges. For example, pulling the implement was also tedious but the advantage was that farmers were able to make several furrows at ago as compared to using a string and hand hoe. Because of its limitations, this method was therefore not appropriate for the elderly and the female farmers. In some instances, it was also difficult to penetrate 2–3 inches depth especially in heavy soils and thus may leave some rice seed exposed to birds. Some farmers applied about 20 kgs of sand/soil on the forked rake to make the appropriate furrow. To use this technology, farmers needed to have a fine seedbed. Thus, video stimulated farmers to develop creative and adaptive innovations

Figure 4. A child seated on a forked rake to apply weight for penetration into the ground to make furrows.

through social interactions and sharing (also see Karubanga et al., 2016a; Van Mele, 2011; Zossou et al., 2012).

3.3.3. Weeding

In the videos, two weeding methods were demonstrated, the use of manual weeders and use of herbicides. Farmers considered the manual weeders to be expensive, time consuming and tedious to push. They preferred use of herbicides, which was less labour intensive than manual weeders. The use of herbicides to control weeds in rice has spread very fast and at the time of the study, 80% of the respondents were using herbicides in combination with hand weeding. Through social learning processes, farmers jointly evaluated and shared experiences to inform their choice of practices and technologies to apply. There is, however, a risk that such social learning process could be dominated by the most influential people and could deny the shy and less vocal ones from effectively participating and contributing to the leaning processes. For example, in learning to apply herbicides, some illiterate farmer who applied a wrong herbicide lost her entire crop. She narrated during the key informant interview;

> I saw in the video how chemicals were used to control weeds in rice. I saw my neighbor spraying his rice field with the chemical to control weeds and without asking to get guidance on what chemicals to use, I bought a non-selective herbicide (Weed Master) and sprayed my rice too. To my disappointment, all my rice was scorched and dried. My mistake was that I did not ask to know the right chemical I should have applied (Female farmer, December 2015).

As farmers interact and learn from each other through their social networks, more technical support is needed for effective application of the acquired knowledge (Bentley et al., 2015; Kibwika, 2007). Such technical support helps to clarify issues and provide follow-up guidance to those who may not have fully grasped the knowledge and its application (also see Karubanga et al., 2016a).

3.3.4. Pest and disease management

Incidences of pests and diseases such as rice stalk borers and root rot were prevalent. Much as farmers appreciated the use of pesticides as being essential in controlling pests, only 27% of them applied the pesticides largely due to the cost of pesticides. All farmers interviewed identified birds as the most serious pest in rice production. However, to their disappointment, the videos never

presented any method for controlling bird damage in rice. Farmers used several methods to scare birds including making noise and use of scarecrows, but these were not very effective. Near Lake George, some farmers, trapped birds using fishing nets but this is not acceptable from an environment/ecological conservation point of view.

To control bird damage in rice, some farmers intercropped millet, maize and rice. The millet was planted two weeks earlier meaning that it matured a bit earlier to attract the birds and divert them from rice. Millet is also grown in the area as a food crop but rice had a higher commercial value than millet. . Also, to reduce the damage by rodents, some farmers planted sweet potatoes around the rice fields to attract and divert rats away from the rice. Whereas videos did not provide solutions to all the challenges in rice farming, farmers continued through their interactions to come up with new practices and technologies to address a variety of challenges. What the videos do in this case is to deepen the social learning that allows farmers to explore several potential solutions to the problems experienced including those not addressed by the videos.

3.3.5. Harvesting

The use of sickles to harvest rice demonstrated in the video was not generally taken up by farmers. Farmers argued during FGDs that they found the technology not appropriate because their rice varieties do not mature uniformly and yet a sickle would harvest everything including the immature rice. Further, using a sickle meant that they had to bend for long which was uncomfortable and caused back pains. They preferred to continue using knives to harvest rice. Similar to rice, they also use knives to harvest millet. At the time of the study, only 20% of the farmers interviewed used sickles to harvest rice. As some scholars (Danielsen et al., 2015; Zossou, Van Mele, Vodouhe, & Wanvoeke, 2009) argue, getting exposed to new ways through video does not mean that people should abandon old ones but use them as a basis for assessing the effectiveness of new ones for efficient adaptation.

4. Conclusion

Farmer video is among the ICT tools promoted to enhance the effectiveness and efficiency of agricultural extension systems especially in the Sub-Saharan Africa where access to knowledge and technology is a major constraint to agricultural development. The farmer videos are inherently anchored in social learning processes, which is the mechanism for effective farmer learning and change. It is a well-known fact that farmers learn best from fellow farmers (Van Mele et al., 2010a; Zossou et al., 2012) through social learning (Bandura, 1997; Karubanga et al., 2016a). The combination of the audio and visual elements in a video triggers a conversational exchange between the farmers who watch the video and even extending to those who do not watch the videos. In the conversations, farmers exchange what they have learnt and reflect together to evaluate the feasibility and relevance of the knowledge acquired and technologies observed (see Shaw & Kristjanson, 2014). Through such collective and critical reflections, farmers experiment and adapt the technologies and practices seen in the videos and even innovate to generate new knowledge and technologies or practices.

The study provides evidence that videos have a high potential to enhance awareness, knowledge acquisition and uptake of technologies. But even more important, the strength of social learning embedded in the video and its triggers on social exchange (also see Bandura, 1997; MacGregor, 2007) further enhances collective learning and innovation among farmers (Karubanga et al., 2016a). Videos are not promoted as substitutes to extension workers in the field but rather as a tool that enhances their effectiveness. Thus, effective use of video-mediated extension points to new competences required on the part of extension workers. First the extension workers will have to have excellent facilitation skills to support social learning processes and secondly be able to record videos of how farmers experiment and innovate to share with other farmers. They will have to learn how to apply the video as a tool for life-long learning rooted in social exchange (see Cai & Abbott, 2013). Proponents of video-mediated extension will also require a comprehensive assessment of competences required by the extension workers to support the social learning processes.

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Cover image
In the photo is G. Karubanga, the first author with farmers. Source: Authors.

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