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Unearthing the potential of participatory, and information and communication technologies' led extension and learning approaches in agricultural and environmental education in Uganda

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ABSTRACT
Uganda's public agricultural extension system experienced several reforms since colonial times. However, available literature indicates that a large number of smallholder farmers remain unreached by the extension systems. To address the above problem, there has been a call to unearth the role of participatory and Information and Communication Technologies (ICTs)-led extension and learning approaches for agricultural and environmental education, and development in the country. As such, a review study was conducted on the context and the potential of participatory and ICT-led extension and learning approaches to agricultural and environmental education. The reviews involved thematic and content analysis of variables of interest. From the review, we present a critical review of the historical and current state of agricultural extension reforms in Uganda. We also highlight the challenges and lessons on the status, context and potential of participatory and ICT-led extension and learning in agricultural and environmental education in Uganda. The review elaborates on recurring extension issues and describes the experiences on the role of ICTs to extension and emerging practices that are enhancing the delivery of timely information that suits the needs of farmers. Policy recommendations have been made to tap the potential of participatory, and ICT-led extension and learning approaches in order to enhance performance of agricultural extension systems in Uganda.

Keywords: Access, coverage, extension, inclusion, interaction, service delivery and quality, Uganda

RÉSUMÉ
Le système public de vulgarisation agricole en Ouganda a connu plusieurs réformes depuis la période coloniale. Cependant, la littérature disponible indique qu'un grand nombre de petits exploitants restent inaccessibles aux systèmes de vulgarisation. Pour résoudre le problème susmentionné, un appel a été lancé pour préciser le rôle des approches participatives et de vulgarisation et d'apprentissage fondées sur les technologies de l'information et de la communication (TIC) pour l'éducation et le développement agricole et environnemental dans le pays. À ce titre, une étude a été réalisée sur le contexte et le potentiel des approches de vulgarisation et d'apprentissage participatives et dirigées par

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les TIC en matière d'éducation agricole et environnementale. Les examens ont impliqué une analyse thématique et du contenu des variables d'intérêt. À partir de cet examen, nous présentons un examen critique de l'état actuel et historique des réformes de la vulgarisation agricole en Ouganda. Nous soulignons également les difficultés rencontrées et les enseignements tirés du statut, du contexte et du potentiel de la vulgarisation et de l'apprentissage participatifs et dirigés par les TIC dans le domaine de l'éducation relative à l'agriculture et à l'environnement en Ouganda. L'examen décrit en détail les problèmes de vulgarisation récurrents et décrit les expériences sur le rôle des TIC dans la vulgarisation et les pratiques émergentes qui améliorent la fourniture d'informations opportunes qui répondent aux besoins des agriculteurs. Des recommandations politiques ont été formulées pour exploiter le potentiel des approches de vulgarisation et d'apprentissage participatives et fondées sur les TIC afin d'améliorer les performances des systèmes de vulgarisation agricole en Ouganda.

Mots clés: Accès, couverture, extension, inclusion, interaction, prestation de services et qualité, Ouganda

INTRODUCTION

Over the past decades, agricultural advisory systems have globally changed, especially in regard to public extension, as farmers receive information from a wide range of participatory, and Information and communication technology (ICT) sources (Barber *et al.,* 2016). In Sub-Saharan Africa (SSA) and specifically in Uganda, reforms in extension services have tended to focus on organization involving the decentralization of the service delivery (Bashaasha *et al.,* 2011; Ministry of Agriculture Animal Industry and Fisheries, [MAAIF], 2016), with limited consideration on the potential differences and uniqueness of participatory and ICT-led extension and learning approaches in agricultural and environmental education (Anderson, 2007; Van Mele *et al.,* 2013). In this case, the term "participatory approaches" is used to describe a wide range of development and research approaches, methods and tools that can be used to improve the practice of development (FAO, 2014; Bentley *et al.,* 2015). Among the approaches that have been employed to enhance extension service delivery and farmer learning about agricultural and environmental management practices and technologies includes; farmer field schools (FFS), plant clinics, demonstrations, field days, exchange visits, and training and visit [T&V] (Anderson, 2007; Cai and Abbott, 2013; Karubanga *et al.,* 2016) and these have focused on various aspects of rural development. However, the design and application of these extension approaches in extension to enhance participation and learning among farmers have over the decades remained unclear.

There are anecdotal evidences that these approaches offer different and unique potential in providing equal opportunities for participation and learning among the rural farmers (FAO, 2014). There is thus, a need to substantiate on these claims. This review paper thus summarizes key issues, challenges and lessons on the context and potential of participatory, ICT-led extension and learning in agricultural and environmental education in Uganda. It also elaborates on recurring extension issues and describes the experiences on the role of ICT innovative approaches to extension and emerging practices that are enhancing the delivery of timely information that fits the needs of farmers. It is our hope that findings from these reviews will strengthen the national agricultural extension systems in Uganda and beyond.

METHODOLOGICAL APPROACH

A desk study was conducted to review the context and the potential of participatory and ICT-led extension and learning approaches to agricultural and environmental education. Data were obtained from the Internet, document analysis on extension reforms and published journal articles. The review has been guided by the qualitative approaches to gain a better and deeper understanding of the status and context of use of participatory, ICT-led extension and learning approaches in agricultural and environmental education in Uganda. To achieve the overall objective, the review was guided by four cardinal research questions: 1) What agricultural extension reforms have occurred in Uganda? 2) What approaches and methods to agricultural extension exist in Uganda? 3) Do ICTs play a cardinal role in agricultural and environmental extension? 4) What are the performance indicators of participatory and ICT-led extension and learning approaches? This paves way for new directions of provision of agricultural and environmental extension services in Uganda and possibly in other countries. Data analysis involved thematic and content analysis of variables of interest.

RESULTS AND DISCUSSION

The results presented in this paper represents a review of previous research work on participatory, and ICT-led extension and learning approaches in agricultural and environmental education in Uganda. This section gives the context of extension reforms and how the participatory and ICT-led extension approaches fit in the everchanging extension system, i.e., Agricultural extension system reforms.

Over the years, Uganda has implemented several extension approaches from which valuable lessons have been learned to inform the development of better extension approaches to improve agricultural extension service delivery (MAAIF, 2016). These approaches represent the evolutionary responses to the changing contexts and needs of stakeholders and beneficiaries. Karubanga *et al.* (2016) report that the agricultural extension system in Uganda has undergone drastic reforms in the past fifty years purposely to transform smallholder farming to be more productive, competitive and rewarding to provide decent living to farmers. It is argued that the reforms have involved shifts from the state controlled and enforcement approaches of the colonial times (Bashaasha *et al.,* 2011) to the balance between regulatory and educational approaches of the post-independence (Anderson, 2007), to intensification approaches such as the training and visit approach of the 1990s (Bashaasha *et al.,* 2011), to the recent neo-liberal approaches based on principles of decentralization and privatization such as the National Agricultural Advisory Services (NAADS) (FAO, 2014), to the current thinking of pluralistic extension delivery approach (MAAIF, 2016). However, Karubanga *et al.* (2016) report that the intuition is to point out that despite the well intentioned shifts in approaches, their impact on transforming smallholder farmers has been minimal especially with regard to enhancing participation and learning. Thus, merely changing designs of the delivery system without paying particular attention on the potential of participatory, and ICT-led extension approaches and tools for effective service delivery and learning tend to leave the entire extension system dysfunctional.

Overall, the various approaches have in the past failed to deliver meaningful changes in Uganda's agricultural sector. MAAIF (2016) reports that the lessons learnt show that this was partly because the reforms were piecemeal and characterized by institutional fragmentation and creation of parallel systems seeking to re-address some of the failures through establishing the potential of participatory, and ICT led extension and learning approaches; thus ensuring a well-

coordinated, regulated and harmonized pluralistic single-spine extension service delivery system with multiple providers addressing diverse clientele needs. In general, MAAIF (2016) reports that the problems in extension systems are due to a combination of several factors including: lack of relevant technology, failure by research and extension to understand and involve clientele in problem definition and solving, lack of incentives for extension agents, and weak linkages between extension, research, and farmers.

Overview of participatory approaches and methods to agricultural extension. Extension is a systematic process of exchanging ideas, knowledge and techniques leading to mutual changes in attitudes, practices, knowledge, values and behaviour aimed at improved production and productivity. These objectives can only be met with more participatory and interactive farmer learning approaches. Thus, the Ugandan Government put in place policies that promote decentralization, privatization, liberalization and developed a new plan for modernization of agriculture in the late 90s (Bashaasha *et al.,* 2011). Since then, a popular participatory approach called participation through organization has been stimulated. In this respect, participatory extension approaches are defined as a way of improving the effectiveness of rural extension efforts by government agencies, NGOs and other organisations engaged in rural development.

Available literature indicates that agricultural extension plays an important role in disseminating knowledge, technologies and agricultural information through appropriate extension approaches and tools (MAAIF, 2016; Karubanga *et al.,* 2017a). According to MAAIF (2016), it is reported that the delivery of agricultural extension in Uganda comprises of diverse extension approaches and tools including face-to-face training, farmer field schools (FFS), field demonstrations, agricultural shows and fairs, field days, exchange visits and mass media. However, these approaches and tools differ in their potential to foster participation and interactive learning. In particular, Karubanga *et al*. (2016) report that some of these approaches are not grounded in the basic communication and learning theories, and practices that are transformational. Similarly, FAO (2014) indicates that even the ostensibly learning oriented approaches like farmer field schools and on-farm field demonstrations have registered only limited evidence of inclusive participation and learning among farmers.

In particular, Cai and Abbott (2013) report that FFS, and training and visit (T&V) aims at providing farmers with first-hand information and on-spot tailored advice. These approaches however, are reported by Karubanga *et al.* (2016) as being too expensive in terms of human resource and facilitation needed to reach the many and often widely distributed smallholder farmers. This therefore calls for more understanding of cost effective extension approaches with potential of enhancing inclusive participation and interactive learning among farmers. According to Van Mele *et al.* (2013), effectiveness of extension system needs to involve and enhance access and learning by most disadvantaged people to allow more inclusive service delivery. However, Karubanga *et al.* (2016) found out that this requires the right use of potential participatory, and ICT-led extension and learning approaches especially in the current paradigm of learning and innovation. Karubanga *et al.* (2017a) affirm that this phenomenon is even more critical in developing countries, particularly Uganda where the majority (60%) of the population depend on farming and have limited access to expert knowledge because of weak or dysfunctional extension systems.

The role of ICTs in agricultural and environmental education. In Africa, the role of mass media in rural development has for long been recognized but their effectiveness and appropriateness vary because of differences

in the socio-cultural context (Van Mele *et al.,* 2013). For example, FAO (2014) reports that radios, TVs, videos and telephones have traditionally been employed as communication and learning tools to address extension related challenges allied to access and use of agricultural information but their effectiveness to date is contested. In addition to, FAO (2014) indicates that only about 18% of smallholder farmers in Uganda access information through conventional extension approaches; thus calling for more interactive ICT tools. ICTs that have been tested by various organizations to enhance effectiveness of extension delivery. Van Mele *et al.* (2013) and Karubanga *et al.* (2016) report that most international agencies are turning their aspirations to ICT media including radio and video because they are known to influence interactive farmer learning to enhance innovation. However, they do not clearly point out the technical capacities and institutional arrangements that guarantee sustainable and effective ICT mediated extension and learning. In this respect, Cai and Abbott (2013), and Karubanga *et al.* (2016) report that alternative approaches to extension service delivery not only need to take advantage of the increasingly available ICTs but to emphasize integration of these approaches and tools as they exhibit unique potential in fostering participation and interactive learning for change among farmers.

Despite the promise and potential of ICT in extension services, there are numerous challenges facing ICT as an extension strategy including complex and technical information, diversity of farmers, scaling up of ICT in extension services and financial challenges related to challenges of who pays for the service? The cardinal challenge, however, is how to integrate these ICTs in the conventional extension approaches given the diversity of socio-cultural contexts and infrastructural development.

In particular, Karubanga *et al.* (2016) report that video-mediated extension approach (VMEA) to extension was introduced in 2005 in Uganda by AfricaRice in collaboration with Sasakawa Global 2000 (SG 2000) increased farmer' access to agricultural knowledge and practices. According to FAO (2014), the video is reported as a novel, low-cost method that provides timely, on-the-spot and reliable information and advice to many farmers at once. Bentley *et al.* (2015) also report that the use of video enhances more interactive learning among farmers because of its appealing to audio and visual senses and stimulates joint reflection as farmers discuss what has been observed in the video. Karubanga *et al.* (2016) further report that the core element of any extension approaches is to influence participation and learning among farmers to change their practices and technologies more efficiently. This, however, requires well-structured external backstopping from extension agents.

Potential of participatory, and ICT-led extension and learning approaches. The recent Uganda's National Agricultural Advisory Services (NAADS) programme was meant to bridge farmers' linkages with the sources of information or knowledge. However, MAAIF (2016) indicates that even with the substantial financial investment in the NAADS, feed back reveals that over the last fifteen years, only 20% of the farmers had been reached by extension. Other studies (e.g., FAO, 2014) show how the NAADS failed to effectively deliver extension services to the smallholder farmers with regard to inclusive access to quality of service and enhancing geographical coverage as well as enhancing farmer empowerment in decision making through fostering learning. Relatedly, Karubanga *et al.* (2017b) revealed a noticeable geographic and thematic coverage of the services of five plant clinics operating from market places in Buikwe and Mukono districts of Uganda. They further report that the location

of plant clinics at markets did not allow equitable access and high farmer attendance particularly by women and distant farmers. Averagely, middle-aged male farmers (53%) were mainly favoured and overall attendance was relatively low.

In addition, FAO (2014) and Karubanga *et al.* (2017a) report that most women (around 70%) attribute their failure to participate and learn through participatory, and ICT-led extension approaches and tools mainly because of domestic and community commitments such as attending burials, wedding ceremonies, and community meetings. These findings imply that organizational, socio-economic and cultural factors are important if the potential of participatory, and ICT-led extension approaches and tools in agricultural and environmental education are to be maximized.

Conversely, Karubanga *et al.* (2016) reported that as a result of the high farmer to extension worker ratio in Sub-Saharan Africa, ensuring access to agricultural information by farmers is still problematic. For example, they cited that, in Uganda, one extension worker is expected to reach about 3189 farmers. It is argued that whereas this challenge cannot be addressed with effective approaches or tools only, FAO (2014) contends that ICTs can enhance equitable access to agricultural information and sustain interactive learning among farmers. However, the context in which such approaches and tools are employed is paramount to allow for participation of the ordinary people and putting them at the centre of their own learning and transformation as affirmed by Bentley *et al.* (2015). For example, Cai and Abbott, (2013) reported that, inherently, ICTs such as videos embrace group learning which provide a better means for enhancing participation and reaching greater numbers of farmers at once.

Contrariwise, the potential of participatory and ICT-led extension and learning approaches and tools require a comprehensive analysis of agricultural extension system performance components as these also have serious implications on sustainable use of the extension approaches and tools. Danielsen *et al.* (2012) reported that there are key components and related variables that are paramount for enhancing performance of extension approaches, in this case, plant health clinics (Table 1). Such analysis of performance components also apply in unlocking the potential of participatory and ICT-led extension and learning approaches in agricultural and environment education in Uganda. Danielsen *et al.* (2012) findings imply that the promoters and implementers of participatory and ICT-led extension and learning approaches and tools in agricultural and environmental education need to pay particular attention to these specific attributes to guarantee their effective and sustainable use in Uganda for farmer learning in attempts to ensure inclusive access to quality services and coverage of extension services.

CONCLUSION

This review paper indicates that failures of extension systems is not only a matter of the reforms, design and resource investment, it is also about how well the approaches and tools fit the context and more especially how they are designed and applied to enhance participation and enhance life-long learning among the farmers. It is concluded that evaluations of extension systems have not focused on how well the approaches and tools can be applied and how they are anchored in sound theory and practices of communication and learning for change.

Currently, agricultural and environmental education, and development emphasizes a shift from purely technical to extension and poverty alleviation. Thus, a considerable need for more understanding and widespread application of participatory and ICT-led extension and learning approaches and tools. However, more efforts should be directed to capacity building among actors in facilitating learning associated with

Table 1. Agricultural extension system performance components

Performance components	Key variables
Extension workforce	• Existing extension service providers (Local Government and NGOs) • Available extension staff • Level of training and necessary skills • Staff incentives and motivation • Staff selection criteria and experience
Service delivery	• Farmer trainings • Materials and equipment • Logistical support • Publicity/awareness creation • Monitoring and evaluation • Coordination and collaboration linkages • Communication and reporting procedures • Local technical backstopping
Access to information and learning	• Available information sources • Readiness to access and use • Adaptability to local content and context • Available informational databases • Relevance of information • Reliability and validity of information
Input supply and available technologies	• Readiness to access agro-input dealers • Availability of genuine agro-input dealers • Quality regulations mechanisms
Financing strategies	• Sources of funding (Farmer and Local Government (LG) contributions) • Available funds • Local funding policies/ level of self-funding • Accountability issues • Financial management committees
Policy support and leadership	• National/LG policy and governance framework • Local level support/ leadership • Farmer local rules, regulations and norms • Local coordination and reporting procedures • Procedures on access to production resources

Sources: Modified after Danielsen *et al.* (2012)

the use of participatory, and ICT led extension approaches in an innovation system – farmers, extension professionals, policy makers and researchers. The capacity building interventions should be preceded by capacity needs assessments, both individual and institutional. This also calls for systematic assessment and understanding of the technical and institutional factors that are likely to affect the potential and effective use of extension and learning approaches and tools in agricultural and environmental education in Uganda and elsewhere. The study demonstrates the value of performance assessments focusing on potential benefits to inform operational and strategic decision-making in the use of participatory and ICT-led extension and learning approaches to agricultural and environmental education.

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STATEMENT OF NO-CONFLICT OF INTEREST

The authors declare that there is no conflict of interest in this paper.

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